GL01474

Country Profiles: 1992

Algeria
Colombia
Ecuador
Estonia
Indonesia
Iran
Iraq
Kazakhstan
Kuwait
Latvia
Libya
Lithuania
Mexico
Nigeria
Russia
Saudi Arabia
Venezuela
Yugoslavia

Algeria

COUNTRY PROFILE:

President: Ali Kafi
Prime Minister: Belaid Abdesselam
Population (1990): 25 million
Languages: Arabic, French, Berber dialects
Defense: Army: 120,000; Navy: 6,500; Air Force: 12,000
Religion: 99% Sunni Muslim
Location/Size: North Africa/918,497 sq. miles
Major Cities: Algiers, Oran, Constantine, Annaba
Major Import Products: Industrial equipment, intermediate goods, food, consumer goods

FINANCIAL PROFILE

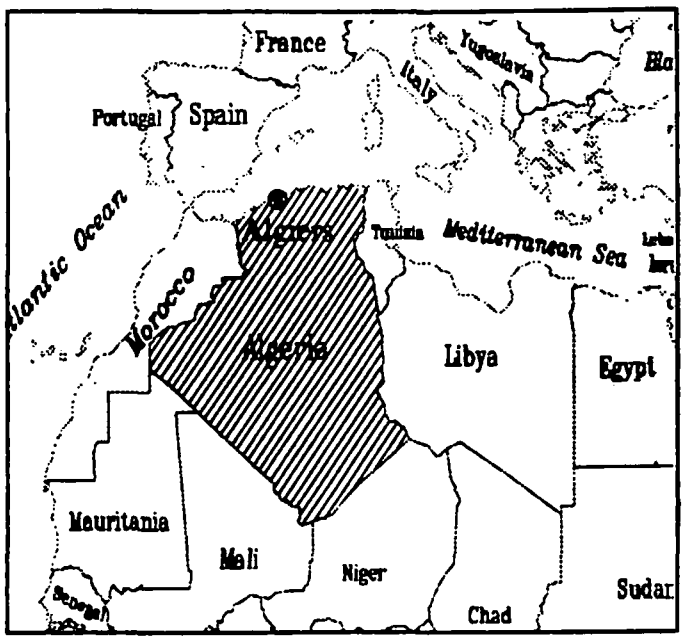
Monetary Reserves (Non-Gold, 9/91): 800 million dollars
Foreign Debt (1990E): 25 billion
GDP (1990): 45 billion dollars
Currency: Algerian Dinar (AD)
Exchange Rate (12/91): US$1 = AD 21.774
Current Account Balance (1990): 0.55 billion
Hydrocarbon Export Revenues (1990): 12.3 billion
Hydrocarbon Export Revenues/Total Export Revenues (1990): 97%

ENERGY PROFILE

Minister of Energy: Hassan Mefti
Proven Oil Reserves (1992): 9.2 billion barrels
Oil Production Capacity(1991): 1.38 million barrels/day (b/d)
Oil Production (1991E): 1.34 million b/d
Domestic Oil Consumption (1990E) 0.19 million b/d
Refining Capacity (1991): 0.465 million b/d
Major Refineries: Skikda, Arzew, El Harrach, Hassi Messaoud
Petroleum Exports (1991E): 1.1 million b/d
U.S. Net Oil Imports (1991): 0.253 million b/d
Natural Gas Reserves (1992): 114.7 trillion cubic feet (TCF)
Natural Gas Production (1990E): 1.77 TCF
Natural Gas Exports (1991E): 1.205 TCF. Of which: LNG - 689 BCF; Pipeline - 516 BCF.
Major Pipelines: Houd el-Hamra/Bejaia, In Amenas/La Skhirra, Haoud el-Hamra/Arzew, Beni Mansour/Algiers, Haoud el-Hamra/Skikda
Oil Terminals: Algiers, Annaba, Oran, Arzew, Skikda, Bejaia, La Skhirra
Major Oil and Gas Fields: Hassi R'Mel (gas), Hassi Messaoud (oil), Zarzaitine (oil), El Agreb (oil), Gassi Touil (oil).

OIL INDUSTRY PROFILE

Organization: Societe Nationale pour la Recherche, la Production, le Transport, la Transformation et la Commercialisation des Hydrocarbons (SONATRACH) - State-owned organization for exploration, transport and marketing of petroleum, natural gas and their products.
Major trading Partners: France, Italy, USA.



RECENT DEVELOPMENTS

Following the June 29,1992 assassination of Council of State leader Mohammed Boudiaf, a new president, Ali Kafi, was chosen by the Council. This event comes after months of violence and unrest in Algeria. To date, this unrest has not adversely affected the oil and gas sectors.

In mid-January, days before the second round of voting in the first multi-party elections in Algeria's history, former President Chadli Benjedid of the National Liberation Front (NLF) party resigned. The government was subsequently controlled by the army-backed Council of State in order to prevent the Islamic Salvation Front (ISF), the expected victor in the second round of voting, from creating a new government. In the first round of voting on December 26, 1991, the ISF had set itself apart from the other parties in Algeria as the likely winner in the democratically held elections.

The ISF was expected to take control of the government following the January 16, 1992 round of elections, until these elections were postponed following the takeover by the State Security Council. Prior to the military takeover, acting ISF leader Abdelkader Hachani had pledged that the new government would honor previous obligations and agreements.

HYDROCARBON INDUSTRY

Should the current unrest in Algeria cause a disruption in its oil and gas exports, world energy markets would be affected for two main reasons: 1) Refiners find valuable Algeria's high-quality light, sweet crude that yields clean products and low-sulfur fuel oil (LSFO); and 2) Algeria is a major supplier of LSFO to Italy and the U.S.

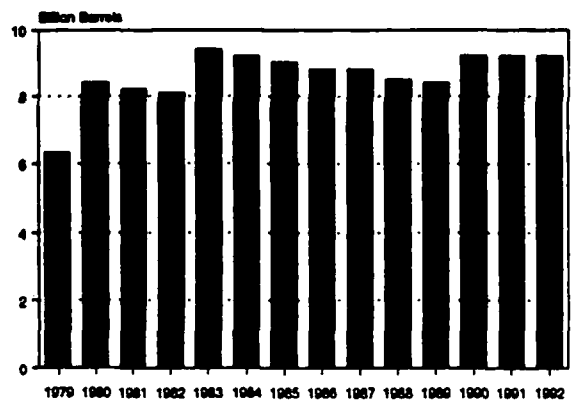
Rather than causing a major change in the price of crude, the impacts of such a disruption would be more likely to include:

- widening of price differentials between light, sweet crudes, such as North Sea Brent and U.S. WTI, to sourer Middle Eastern and Latin American crudes;
- relative rise of residual fuel oil prices in response to the LSFO scarcity and its premium over higher sulfur grades of residual fuel oil;
- Italy's loss of 20 percent of its natural gas imports;
- loss of LNG to France, Belgium and Spain.

Hydrocarbon Exports

Hydrocarbon revenues are vital to Algeria's economic stability, comprising over 95 percent of the country's export earnings. These revenues are Algeria's primary means to finance essential economic and social reforms, as well as to repay its substantial foreign debts. State energy company SONATRACH reported that hydrocarbon exports increased by 36 percent, to $12.3 billion, in 1990. Although export sales are increasing, the relative importance of crude oil to total energy sales is decreasing. In 1990, hydrocarbon export revenues were split approximately 1/3 each between crude oil, natural gas and LNG, and refined products.

Estimated Proved Crude Reserves



Oil Sector

Despite the decline of oil's share in overall hydrocarbon exports, Algeria's light, sweet crude is expected to be central to the country's development over the next ten years. Since the early 1970s, Algerian oil and liquids production has held steady at 1.0 to 1.3 million b/d. Nearly all of the 1.1 million b/d of exports during 1990 went to the U.S and OECD Europe. Algeria produced an estimated 1.3 million b/d (total liquids) during 1991, including: crude - 0.8 million b/d; NGLs - 0.41 million b/d; and condensates - 0.13 million b/d.

Sonatrach reported a major oil discovery in June 1991 - estimated at 240 million barrels - 1,000 miles southwest of Algiers.

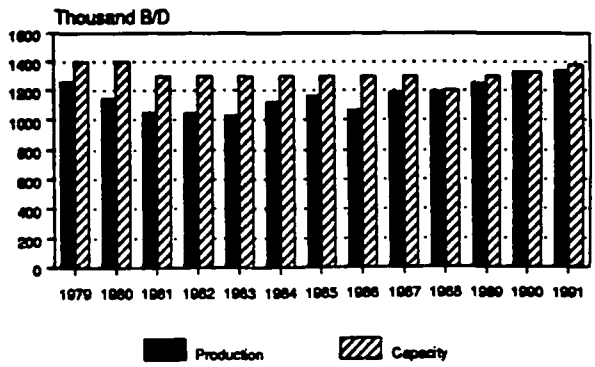
Algeria has modified its oil exploration legislation to attract foreign investors, despite opposition within its own parliament. It is thought that foreign companies might find in Algeria a wide range of desirable options short of a full production sharing arrangement.

Natural Gas Sector

Algeria's main focus is on development of its large natural gas reserves (114.7 TCF). The government is encouraging greater flexibility in pricing and marketing strategies to expand the market for Algerian hydrocarbon exports. The European market in particular is being targeted for increased penetration of Algerian natural gas.

To accomplish its goal of doubling natural gas export capacity, Algeria is planning several projects, including: 1) expanding the Trans-Mediterranean (Transmed) natural gas pipeline to Italy; 2) possibly constructing a new 12- to 15-billion-cubic-meter (420 to 530 billion

Total Liquids Production and Crude Oil Production Capacity

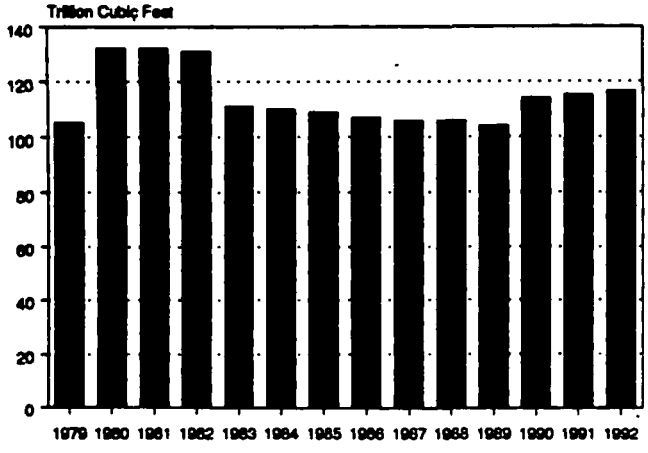


cubic feet) per-year capacity natural gas pipeline to Spain via Morocco and the Strait of Gibraltar; and 3) implementing a 5-year plan to double export capacity of LPG.

1. Italian public companies are expected to carry out most of the construction to expand the Transmed gas pipeline to meet the increased demand for gas in Italy and other central European countries. Italy plans to take at least 19 billion cubic meters (BCM) of natural gas per year from Sonatrach starting in 1994. Construction is expected to take three years.

2. Algeria, Morocco and Spain signed an accord on April 30, 1991 to proceed with a 1,265 km western gas pipeline linking the three countries. The pipeline would be completed by 1995 at a projected cost of $1.3 billion and may receive some financial support from the EC. OMEGAZ, a company jointly held by gas agencies of Algeria, Spain, Morocco, Germany, France and Portugal, has been established to conduct feasibility studies and develop the project. The pipeline would lessen Western Europe's dependence on North Sea gas supplies.

Estimated Proved Natural Gas Reserves



3. Algeria's 5-year plan to double LPG output includes: building extraction and other facilities in 10 fields between 1992 and 1997 (at about $100 to $200 million apiece); laying about 1,000 kilometers of pipeline and constructing the long-planned "jumbo" LPG Plant in Arzew.

- The 10 new facilities, for which two tenders have already been issued, are all located near existing oil or gas fields. The LNG unit at one of the two, Oued Noumer, is expected to treat 7 million cubic meters of gas a day.
- The 14 to 22-inch-diameter pipeline will link Alrar (east, at the Libyan border) and Hassi R'Mel (located inland, south of Algiers). The pipeline will then connect to an existing LPG pipeline that runs from Hassi Messaoud through Hassi R'Mel to Arzew. An existing natural gas pipeline links Alrar with Hassi R'Mel and Arzew (on the Mediterranean coast, east of Algiers).
- The construction of the Jumbo LPG plant at Arzew was originally tendered to a Japanese company in the early 1980s. The project was revived in 1989 as part of the plan to raise LPG capacity from 195,000 b/d in 1989 to 346,000 b/d by 1995. The plant is scheduled to come onstream in 1995.

Colombia

COUNTRY PROFILE

President: Cesar Gaviria Trujillo
Population (1990): 33 million
Location/Size: NW South America/440,831 sq. mi.
Language: Spanish
Religion: Roman Catholic (95%)
Major Cities: Bogota, Medellin, Cali
Import Products: Industrial inputs, capital goods consumer goods.

FINANCIAL PROFILE

Monetary Reserves (11/91, non-Gold): $5.988 billion
Total Foreign Debt (1991): $17.059 billion
Gross Domestic Product (1990E): $41.1 billion
Exchange Rate (1/92): US $1 = 712 pesos
Petroleum Revenue (1991): $1.0 billion

ENERGY PROFILE

Minister of Mines and Energy: Juan Camilo Restrepo
Proven Oil Reserves (1992): 1.9 billion barrels
Oil Production Capacity (1992): 475,000 b/d
Oil Production (1991): 425,000 b/d
Domestic Oil Consumption (1991E): 225,000 b/d
Refining Capacity (1992): 274,100 b/d
Gross Petroleum Exports (1991E): 230,000 b/d
Petroleum Exports to the U. S. (1991): 91,000 b/d
Natural Gas Reserves (1992): 4.1 TCF
Natural Gas Production (1991): 144 BCF
Coal Reserves (1991): 10.6 billion short tons
Major Ports: Covenas (Caribbean Coast)
Major Fields: Cano Limon, San Francisco, Provincia

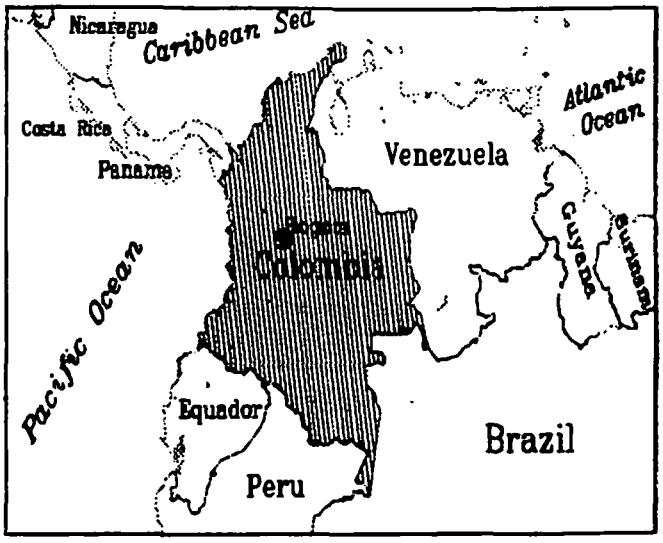
OIL INDUSTRY PROFILE

Organization: State-owned
Empresa Colombiana de Petroleos (ECOPETROL)
President of ECOPETROL: Andres Restrepo Londono
Major oil companies: Occidental, British Petroleum, Shell, Exxon, Texaco, Chevron, Total, and ELF
Major Customers: United States

RECENT OIL INDUSTRY DEVELOPMENTS

Discovery of large, high quality oil reserves in July 1991 at **Cusiana** has reshaped Colombia's future. This discovery will more than double oil reserves, has rejuvenated oil companies' interest, and should boost economic growth. Although some problems remain unresolved, such as guerrilla activities, oil workers' union demands, and the landowner rights issue, Colombia's hydrocarbon potential and the attractive terms for investment have renewed the confidence of foreign investors.

A major concern of oil companies has been the guerrilla attacks on critical infrastructure and kidnapping. Between 1986 and 1991 there were 195 attacks on oil facilities, resulting in lost revenue and infrastructure damage totaling



nearly $800 million. Hopes of a decrease in attacks came in the fall of 1991, with the arrest of drug-cartel members and with the decision by one of the principle guerrilla movements, M-19, to cease its attacks and become a political party. Other guerrilla groups, Quintin Lame and the People's Liberation Army (ELP), also chose to follow M-19's lead. These actions followed ratification of a new constitution intended to strengthen political participation and to secure more human rights protection. The two rebel groups that remain are the National Liberation Army (ELN) and the Simon Bolivar Guerrilla Front. Tenuous negotiations continue with the rebels to reach some accord, and to bring an end to the hostilities. There is fear that increased oil exploration and development will only offer more targets for attack. In the first three months of 1992, over a dozen attacks have been carried out.

To offset lost oil revenues, pay for repair of damage and increase security, the government imposed a "war tax" on production of 55 cents per barrel of oil in 1991. Landowners have claimed title to subsoil rights and want a royalty payment of 4% on earnings on mineral production. A state tribunal is responsible for resolving this claim, with a ruling expected by later in 1992.

The discovery by **British Petroleum** of large oil reserves comes at a critical time for Colombia. Declining oil reserves, combined with growing domestic demand, had raised doubts as to Colombia remaining an oil exporter through the 1990's. Revised forecasts, with Cusiana added, double oil production and triple oil exports. The potential size of oil reserves is still under study, with most estimates ranging from 3 to 5 billion barrels, and some as high as 10 billion barrels.

Cusiana is 120 miles northeast of Bogota in the eastern foothills region of the Llanos Basin. BP has a 40% share and leads the development, along with its partners Total (40%) and Triton (20%).

ECOPETROL has a 20% royalty share, and is expected to exercise its right to 50% of the concession, thus reducing BP and Total to 15.2% shares and Triton to a 9.6% share. Full production of 400,000 - 500,000 b/d is 3 to 5 years away, with output of 60,000 b/d considered possible by the end of 1992. BP plans to spend $200 million in 1992 on the development of Cusiana and other nearby areas. Over the next three years, total investment in Cusiana by ECOPETROL, BP, Total and Triton could total $1 billion.

LASMO announced a second discovery of oil on the Espinal block in the Upper Magdalena Basin, at **Venganza**, in early 1992. The first discovery was **Purification**. LASMO, two-thirds owner, and **Sun**, one-third owner, estimate the Espinal block may hold oil reserves of 2 billion barrels.

These recent discoveries have put new vigor in foreign investment activity, with 35 international oil companies currently involved in exploration and development endeavors inside Colombia. ECOPETROL has announced that $2 billion will be invested to explore 50 million acres through 95 joint ventures over the next five years. This represents only about 30% of the acreage available for exploration. ECOPETROL will seek international loans of $3 billion to finance its 5-year, $5.3 billion energy investment plans.

Oil Production

About half of Colombia's production is from the **Cravo Norte** fields in the eastern Llanos Basin near the Venezuelan border. Oil is transported from the fields to the Caribbean port of Covenas via the 480 mile, 240,000 b/d capacity Cano Limon pipeline. **Occidental de Colombia** operates the fields and shares ownership with **Repsol SA** on a 75/25 basis. **Shell** and ECOPETROL operate other fields in the region.

Colombia's other producing areas are: the lower, middle, and upper Magdalena River Valley regions -- with principle operators Occidental, Esso and Hocol; the southern and central Llanos Basin -- with principle operators Chevron, ELF and LASMO; and the Putumayo and Catatumbo areas in southern Colombia -- mainly operated by ECOPETROL and several smaller oil companies.

Oil Exploration and Development

Tuskar Resources, a Dublin-based company, discovered heavy crude in the southern Llanos Basin at Rubiales in 1991. Reserves are put at 390 million barrels, and production is expected to plateau around 75,000 b/d. Tuskar is seeking a partner to help complete work required by ECOPETROL, to avoid a suspension of operations.

Garnet Resources Corp. and ECOPETROL plan to bring on new production from southern Colombia's Putumayo region during 1992.

Hondo Oil has drilled three successful wells with a fourth planned, at the Opon association concession in the Middle Magdalena River Basin.

Triton leads a team developing the Tauramena concession, south of Cusiana. Triton has a 50% share, and partners BP and Total have 25% shares.

Occidental de Colombia has agreed to explore the 500,000-acre Samore Block in the Llanos Basin, 90 miles north of Cusiana and 40 miles west of Cano Limon. Occidental also signed an association contract to conduct geologic studies on 1.4 million acres in the Cauca Valley in western Colombia.

American International Petroleum is drilling test wells under an association contract in the Rio Planas region of the Llanos Basin, results so far have been encouraging.

Chevron signed a 6-year association contract to explore a 435,000 acre tract in the Sumapaz region, 50 miles southwest of Bogota.

Repsol SA and LASMO, in a 50/50 joint venture, will explore in the eastern Llanos Basin.

BP has rights to explore 5 million acres offshore.

Crude Oil Pipelines

Colombian oil fields are located mainly inland, making domestic consumption and export dependent on pipeline systems to deliver crude and products. The Magdalena/Llanos crude oil pipeline program includes the Cano Limon pipeline, the soon to be completed pipeline from Vasconia to Covenas, the recently expanded Central pipeline from the eastern plains to Vasconia, and a planned pipeline from the upper Magdalena Valley to Vasconia.

Completion of a 320-mile, 150,000 b/d pipeline from Vasconia, in the middle of the Magdalena Region, to the port of Covenas on the Caribbean, is scheduled for April 1992. This pipeline is an important step for the future development of the middle Magdalena region. It is being built by a consortium headed by Ecopetrol and Shell, with several other oil companies as partners.

The Central pipeline from Porvenir to Vasconia is undergoing a three stage expansion to raise capacity from 107,000 b/d to 200,000 b/d. There is also a 70,000 b/d pipeline from Tenay to Vasconia. The discovery and large potential of Cusiana could delay plans for the 425-mile pipeline to link the Upper Magdalena Valley region to Vasconia. Development of Cusiana will require the construction of a new pipeline, with construction cost estimated at $800 million, due to the distance and rough terrain to be crossed.

NATURAL GAS

New discoveries have improved the possibilities of carrying out plans to supply natural gas to cities to offset excessive use of electricity. Current consumption is about 400 million cubic feet per day, mainly in northern Colombia. A natural gas pipeline has been built to connect Ballenas on the Atlantic coast to Barrancabermeja in central Colombia. The Colombian government has deregulated the natural gas market, eliminating price subsidies and giving incentives for private investment. Colombia intends to spend $600 million over a 5-year period on a distribution network and imports. Prior to recent discoveries, natural gas reserves had been considered to small to justify construction of a marketing system. Now, Colombia's goal is to raise the share of natural gas from its current 7.6% of energy consumption to 27.5% by 2005, with projected savings in energy costs of $555 million.

Hocol SA (Shell) and **Triton** discovered natural gas in Rio Saldana, 120 miles southwest of Bogota. The Montanuelo well yield 12.4 mcf/d. **American International Petroleum** discovered natural gas 40 miles from Bogota, with reserves estimated at 8.35 BCF. Geologists estimate that total gas reserves in the **Puli Anticline** could reach 517 BCF. **Cusiana** is expected to yield marketable amounts of natural gas and other associated gases. Early output will be reinjected to ensure oil yield and to allow time for development of a distribution system. Meanwhile, importing natural gas from Venezuela has been discussed, but no plans are moving forward.

PETROLEUM REFINING

Colombia has four refineries, with a total distillation capacity of 274,100 b/d, but upgrading capacities are insufficient to meet demand for all products. The main refining center is Barrancabermeja with a capacity of 196,000 b/d. $100 million is being spent to add a catalytic cracker to the refinery, it which will boost gasoline production by 15,000 b/d. The only other major refinery is in Cartagena with a capacity of 70,700 b/d .

Colombia exports about 60,000 b/d of residual and distillate fuel oil -- mainly to the United States -- and imports gasoline. ECOPETROL has abandoned plans for a refinery at Puerto Trionfo, and now plans to build a 100,000 b/d refinery in the Casanare state near Cusiana by the mid-1990's.

PETROCHEMICALS

Colombia plans to invest $370 million over the next five years to expand its petrochemical capacity to meet domestic needs. In 1990 Colombia imported 70,000 metric tons (MT) of its 340,000 MT consumption. Colombia plans to raise capacity from 270,000 MT to 550,000 MT per year by 2000, with the largest growth coming in ethylene, increasing to 350,000 MT per year.

COAL

Colombia's 10.6 billion short tons (BST) of recoverable coal reserves are the largest in Latin America. In 1980, **Exxon** began development of Colombia's richest coal field, El Cerrejon. In 1989, Colombia produced 21 MST of coal, more than three times the amount produced in 1981. Colombia exported 11.8 MST of coal in 1989, mainly to Western Europe. Its goal is to supply 10 percent of the world coal market by 1999.

DOMESTIC ENERGY CONSUMPTION

Colombia's energy consumption pattern is very regionalized. Northern Colombia accounts for three-fourths of the county's natural gas consumption, while western Colombia is greatly dependent on electricity generated by hydroelectric plants, and with the country's propane use mostly limited to the area around Bogota. Consumption of oil products and coal is more evenly distributed. Firewood is still a main residential fuel, with one estimate placing consumption at 200,000 acres of forest yearly.

Ecuador

COUNTRY PROFILE:

President: Sixto Duran Ballen
Population (1990E): 10.8 million
Language: Spanish
Defense (1990): Army 50,000; Navy 4,800; Air Force 3,000
Religion: Roman Catholic
Location/ Size: Northwestern South America/109,483 Sq. mi.
Major Cities: Quito (Capital), Guayaquil
Major Imports: Industrial inputs, Capital goods.

ENERGY PROFILE:

Minister of Energy: Rafael Almeida
Proven Oil Reserves (1991): 1.55 billion barrels
Oil Production Capacity (1991): 300 thousand b/d
Oil Production (1991): 300 thousand b/d
Oil Production Quota (2Q/1992): 273 thousand b/d
Domestic Oil Consumption (1991): 60 thousand b/d
Refining Capacity (1991): 140 thousand b/d
Petroleum Exports (1991): 200 thousand b/d
U.S. Imports (1991): 63 thousand b/d
Natural Gas Reserves (1991): 3.9 TCF
Major Port: Guayaquil, Esmeraldas
Major Fields: Oil-Shushufindi, Sacha, Auca; Gas-Amistad.

FINANCIAL PROFILE:

Monetary Reserves (1991, Non Gold, US $ Mn): 936
Foreign Debt (1991 US $ Bn): 13.3
Gross Domestic Product (1991E US $ Bn): 11.6
Currency: Sucre
Exchange Rate (7/92): US $1 = 1433 Sucre
Current Account Balance (1991 US $ Bn): -0.47
Petroleum Export Revenues (1991E US $ Mn): 1.059
Oil Export Revenues /Total Export Revenues (1991): 37%.

OIL INDUSTRY PROFILE

Organization: Petroecuador, formerly CEPE, serves as the holding company for all state-owned petroleum operations. Restructured in August 1989, three subsidiaries of Petroecuador will manage exploration and production, refining, and marketing and distribution.

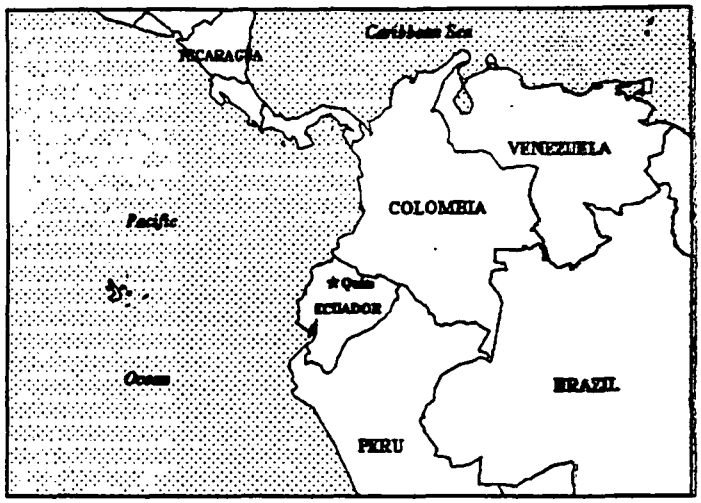
Major Oil Customers: United States, Japan.

RELATIONS WITH THE UNITED STATES:

Common participation in a number of international organizations and their extensive trade ties have resulted in close economic and political relations. The United States and Ecuador share mutual concern over international terrorist actions and the increasing narcotics traffic.

RECENT DEVELOPMENTS

On July 5, 1992, Sixto Duran Ballen was elected President of Ecuador, defeating Jaime Nebot Saadi by a comfortable margin. Mr. Duran's main concern will be to reduce state spending, which should help reduce Ecuador's 50 percent annual



inflation rate. His attention will also be focused on attracting foreign investment and privatizing state companies.

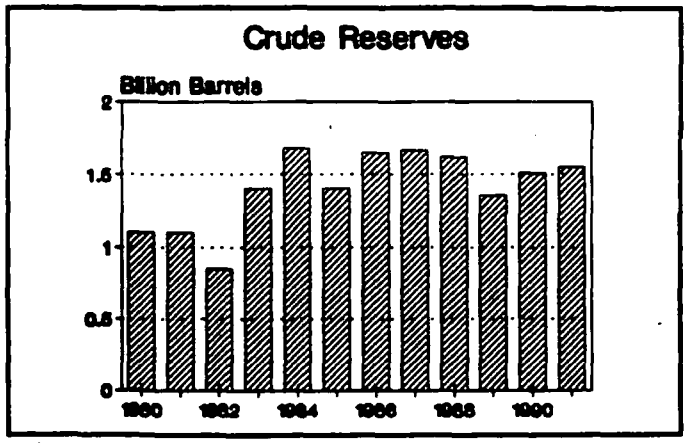
Some 4,000 Ecuadoran Indians marched into the capital of Quito in April, 1992 demanding that former president, Rodrigo Borja, turn over titles to their ancestral lands in the Amazon jungle. Several foreign oil companies have drilling rights to parts of Ecuador's eastern jungle region, but the Indians want the deeds to the undrilled areas of the rainforest. The reform was to be brought before the one-house legislature in June 1992. At the time of this writing, no conclusion was reached.

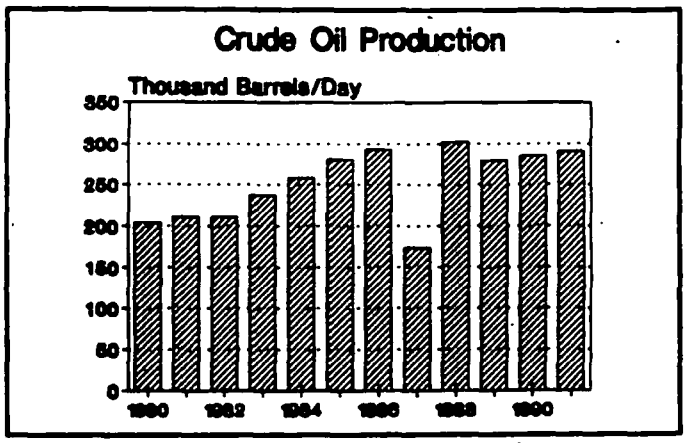
OIL INDUSTRY

In July 1992, Petroecuador, Ecuador's national oil company, discovered new oil reserves in the southeastern Amazon region with an estimated 250 million barrels of heavy crude oil. Production is expected to start in September.

On June 6, 1992, Texaco's 28-year contract with Ecuador expired. Petroecuador is preparing to take over complete ownership of production facilities as well as assets and obligations of the company. Ecuador expects an additional $40 million a year on the 33,000 barrels per day (b/d) exported by Texaco, which operated 15 oil fields and 22 production stations over 400,000 hectares (988,000 acres). At the end of 1991, Texaco operated the northeastern rainforest, which had 1.54 billion barrels in reserves and an average production of 222,800 b/d.

As the Texaco contract ended, former president, Rodrigo Borja, stated that oil production was stable and that the transfer from the US company to the Ecuadoran technicians was smooth. Borja





added that his government had taken five major steps to change the country's oil industry, including the creation of Petroecuador to manage the country's oil industry; the transfer of oil pipeline operations to Ecuadoran hands; the administration of the Petroecuador-Texaco consortium; the construction of a large oil pipeline network on the coast; and the transfer of Texaco's assets, rights and shares to Petroecuador.

Two new oil projects were introduced by Rorigo Borja in April 1992: 1) the expansion of the trans-Ecuadoran pipeline from 300,000 b/d capacity to 325,000 b/d and 2) a project to optimize the use of the Chuchufindi gas plant in the Amazon region, which would raise production from 230 tons a day to 500 tons a day.

Also involved in the oil industry is Atlantic Richfield Co., Arco, which struck oil in April 1992 in the Villano 2 well in Ecuador's eastern jungle region. The 11,800-foot well produced 2,500 b/d with an API gravity of 21. The field's reserves are estimated at 164 million barrels.

Two US companies, Maxus Energy Corporation (Dallas,TX) and CMS Energy Corporation (Dearborn, MI) signed oil agreements in April 1992 to develop and operate Ecuador's Block 16. Block 16 is located about 160 miles southeast of Quito in the Oriente region of eastern Ecuador. This agreement is a 20-year plan and estimated reserves total 216 million barrels.

Since 1985, Ecuador has signed about 12 exploration contracts with about 30 foreign private and state companies and has discovered reserves of over 500 million barrels. At the end of 1991, refinery capacity was roughly 142,000 b/d. A large portion, around 90,000 b/d, was located at Esmeraldas and was operated by Petroecuador.

The bulk of Ecuador's oil is produced in the Oriente Providence, the Amazon jungle region, and is transported via the Trans-Ecuador pipeline to the tanker-loading port of Esmeraldas. Oil exploration has been a priority in order to bolster Ecuador's lagging oil reserves. Oil revenues, down in 1986 due to lower oil prices, went lower in 1987 due to an earthquake that destroyed 25 miles of the Trans-Ecuador Pipeline. Following the earthquake, Ecuador's crude oil production level fell from nearly 300,000 b/d in 1986 to approximately 174,000 b/d in 1987, with an accompanying loss in oil revenues. During 1988 thru 1991, oil revenue recovered as oil production increased to nearly 300,000 b/d.

In 1991, Ecuador exported about 63,000 b/d, mostly crude oil, to the United States. Roughly one-third goes to the East coast, one-third to the West coast, and one-third to the Texas-Louisiana-New Mexico region.

Estonia

COUNTRY PROFILE

President: Lennart Meri
Prime Minister: Mart Laar
Government: Republic; declared independence from Soviet Union August 20, 1991; independence recognized by Soviet Union September 6, 1991
Population (1989): 1.6 million
Size/Location: 17,400 square miles in Eastern Europe, bordering the Baltic Sea on the West, the Gulf of Finland to the North, Russia to the East, and Latvia to the South
Ethnic Divisions (1989): Estonian (61.5%), Russian (30.3%), Ukrainian (3.1%), all other nationalities (5.1%)
Major Cities: Tallinn (capital), Tartu, Narva

ECONOMIC PROFILE

Gross National Product (est. 1992 @ purchasing power parity rate): $8.5 billion in $1990
Currency: Kroon
Commercial Exchange Rate (10/22/92): US$1 = 12 Kroon
Major Trading Partners: "Ruble zone" countries (down to 30 percent in 1992 compared to 95 percent in 1991), Germany, Poland, Scandinavia, United States.

ENERGY PROFILE

Energy Minister: Arvo Niitenberg
National Power Company: Eesti Energia
Proven Oil Reserves (1989E): none
Domestic Oil Consumption (1991): 50,000 b/d
Refinery Throughput (1991): none
Proven Gas Reserves(1989E): none
Natural Gas Consumption (1991): 5 million cubic feet
Coal Production (1991): none
Coal Consumption (1991): 600,000 short tons
Oil Shale Reserves (1991): 1.9 billion short tons (BST) usable
Oil Shale Production (1991): 23 million short tons (MST)
Peat Reserves (1991): 6.7 BST
Electricity Production (1991): 16 billion kilowatt hours (Bkwh)
Electricity Exports (1991): 7.9 Bkwh

OIL AND GAS INDUSTRY PROFILE

Major Oil Ports: None; Estonia receives products from Russia by rail. Tallinn is adding oil terminals to handle product imports
Major Gas Import Pipelines: Northern Lights pipeline from West Siberia
Major Oil Refineries: none

BACKGROUND

Estonia is the only Baltic republic with sizable fossil fuel resources, with oil shale, peat, and wood satisfying the majority of its primary energy demand. Estonia's oil shale is burned to generate all of the country's electricity. Electricity production is concentrated in two large thermal plants near Narva, with a total generating capacity of 3045 megawatts. This production enables Estonia to generate a surplus of power that is exported to Russia and Latvia. These plants are part of the North-Western Interconnected Power System linking the Baltics, Belarus, and Northwestern Russia. Estonia will discount its electricity imports to Latvia (in exchange for natural gas) as part of the effort by Baltic energy ministers to coordinate a mutual energy policy to meet expected fuel shortages this winter. In the future, however, severe environmental problems associated with mining and burning oil shale are expected to lead to decreases in these exports.

Estonia imports all of its coal, gas, and oil from Russia via rail. At present, Estonia lacks the infrastructure to import fuel from other sources. This lack of infrastructure, combined with the unreliability of Russian oil supplies, has prompted Estonia to sign contracts with West European investors to build oil import terminals, distribution, and service station networks. Russian natural gas supplies are more reliable, and Estonia also wants to increase the use of gas for environmental reasons. Natural gas accounted for 14% of primary energy consumption in 1990 (up from 8% in 1970), compared with 31% for oil and 74% for oil shale/peat (much of which is burned for power and exported, resulting in net negative consumption of primary electricity). Two pipelines currently link Estonia to West Siberian gas supplies. Estonia also has an extensive district heating network which is largely centralized and ideal for efficiency improvements. Like other republics of the former Soviet Union, Estonia is far more energy inefficient than other European countries.

Indonesia

COUNTRY PROFILE:

Head of State: Suharto
Population (1992): 183 Million
Languages: Bahasa Indonesia (official), Dutch, English
Defense : Army (215,000), Navy (43,000), Air Force (24,000)
Religion: Islam (88%), Christian (9%), Hindu, Buddhist
Location/ Size: Southeast Asia (a group of about 17,000 islands)/ 735,268 sq. mi. of land (the seven major islands are shown as shaded areas on the map).
Major Cities: Jakarta, Surabaya
Major Import Products: Raw materials & intermediates; capital goods; consumer goods.

FINANCIAL PROFILE:

Monetary Reserves (1991 Non Gold, US $): 9.26 billion
Foreign Debt (1991 US$): 76.3 billion
Gross Domestic Product (1991 US$): 107.3 billion
Currency: Rupiah
Exchange Rate (07/92): US $1 = 2028 Rupiahs
Current Account Balance (1991 US$): -3.6 billion
Petroleum Export Revenues (1991 US$): 7.39 billion

ENERGY PROFILE:

Minister of Mining and Energy: Ginandjar Kartasasmita
Proven Oil Reserves (1992E): 6.6 billion barrels
Oil Production Capacity (1991): 1.7 million b/d
Oil Production (1992): 1.53 million b/d
OPEC Oil Production Quota (1991): 1.4 million b/d
Domestic Oil Consumption (1992E): 0.7 million b/d
Refining Capacity (1991): 0.86 million b/d
Petroleum Exports (1991E): 0.97 million b/d
U.S. Net Oil Imports (1991): 0.106 million b/d
Natural Gas Reserves (1991): 91.5 TCF
LNG Exports (1990): 18.7 million tons
Major Terminals and Ports: Arun, Dumai, Pulau, Sambu
Major Fields: Duri, Minos.

OIL INDUSTRY PROFILE

Organization: (state owned) Pertamina
Major Oil Customers (1991): Japan, U.S., Australia

RECENT DEVELOPMENTS

To combat declines in oil reserves, production and exports, Indonesia has liberalized energy policies and contract terms to attract foreign investment. As stated at the Indonesian energy bilateral meeting with the U.S. on July 29, 1992, Indonesia's general policy on energy consists of three points: 1) to intensify the exploration of new potentials, 2) to diversify the use of energy sources, and 3) to conserve energy. Development and domestic utilization of natural gas is of considerable importance to Indonesia. On a net basis LNG revenue may match oil revenue in fiscal year 1990-91, and match gross revenues in the next five years. New energy policy strategy has maintained

oil production levels but economic growth has meant greater domestic demand and has led to increases in product imports.

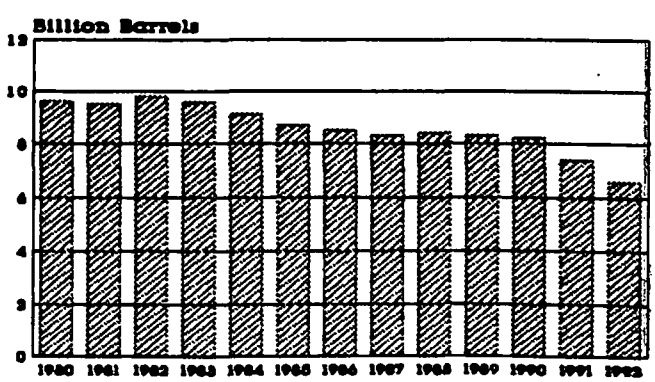
Revival of Investment

Indonesian oil fields are typically small and often require extensive use of secondary recovery techniques. This makes Indonesia dependent on a sustained flow of investment in oil exploration and development. To revive investment, Indonesia improved the terms of its production sharing contracts for foreign operators and opened secondary recovery areas for contract previously reserved for Pertamina. Indonesia's future plans are to open foreign investments in nine other oil and gas fields in the eastern provinces.

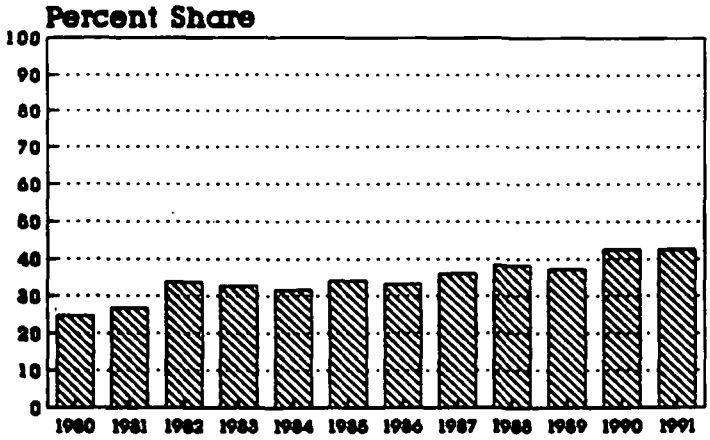
Expansion of Refinery Capacity

Indonesia plans to expand refinery capacity in order to reduce product imports and increase petroleum products exports. However, growth in

Estimated Proven Crude Reserves



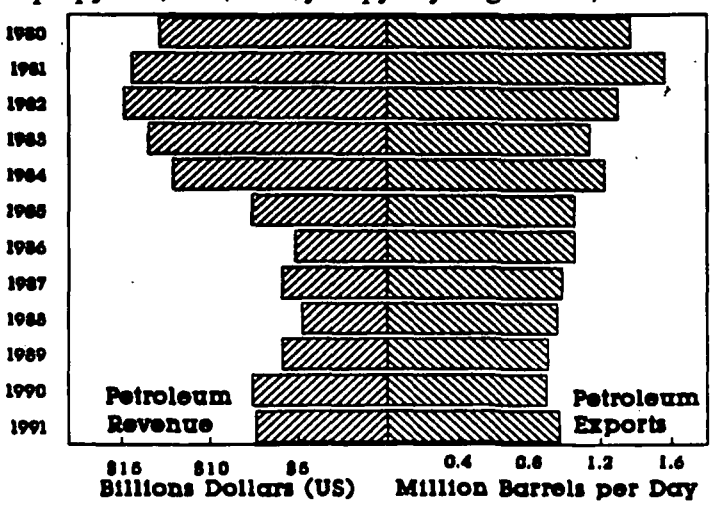
Consumption's Share of Production



domestic petroleum demand threatens those goals. To reduce petroleum demand, greater natural gas use is planned.

To promote refinery expansion a major change of energy policy was enacted by presidential decree, to allow foreign companies ownership of equity in oil sector assets. It is hoped that this policy change will revive several stalled refinery projects. The **125,000 barrels per day (b/d) refinery in West Java** appears on course for completion in 1993 and the **120,000 b/d Bintan Island refinery** (the first project under the new policy with foreign partners C. Itoh & British Petroleum) is planned for completion in 1994. Other projects under consideration that would add more refining capacity, still have to clear financial barriers and calm investors' concerns over long-term political stability.

Also under construction is a $2.25 billion olefin plant in the west Java town of Cilegon. When complete in late 1993, the plant will produce 550,000 tons/year (t/y)of ethylene; 300,000 t/y of propylene; 210,000 t/y of pyrolysis gasoline;



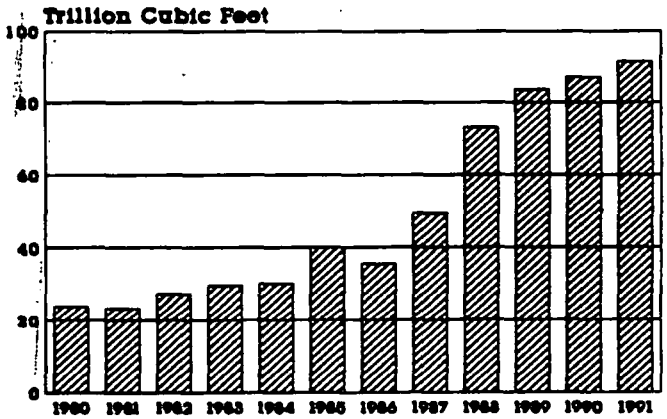
300,000 t/y of polyethylene; and 100,000 t/y of polypropylene. **Industry Minister Hararto** estimated imports savings of $1 billion a year from this project.

Natural Gas and LNG Exports

Large natural gas reserves, estimated as high as 150 TCF, have been discovered near Natuna Island in the South China Sea. A concession in this region, operated and half owned by Exxon, has 45 TCF of recoverable natural gas reserves. Exxon estimates development cost at $12-15 billion, with completion planned for 1998. Due to the high cost of development Pertamina wants to sell part of its share; some Japanese LNG importers are considered likely investors.

A gas distribution network design is being planned to supply natural gas for local energy needs. Plans are for natural gas to be used as a refinery fuel and in other domestic markets, exported to markets in Singapore and eventually supply the Arun LNG complex in Northern

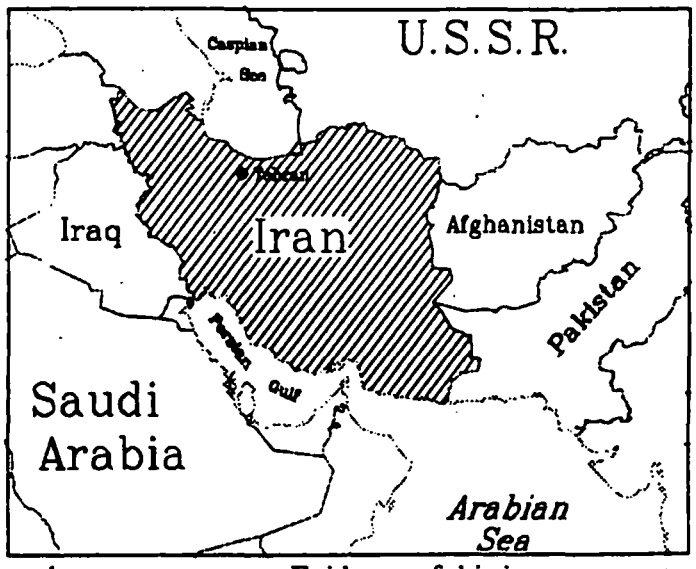
Estimated Proven Natural Gas Reserves



Sumatara. Waste gases, mostly carbon dioxide, will be used in enhanced oil recovery operations.

LNG exports were 18.7 million tons in 1990, almost 40 percent of the world's LNG market. Natural gas discoveries and development are important in providing adequate supply for potential expansion of LNG capacity. In March 1991, Pertamina awarded a $637 million contract to add a sixth liquefaction train of the LNG plant in Bontang to 2.3 million tons per year (MMT/Y). The contract is tied to a LNG supply contract with several Japanese utilities with completion planned for late 1994, and will raise total LNG capacity to 24 MMT/Y.

IRAN



COUNTRY PROFILE:

Head of State: Ali Akbar Hashemi Rafsanjani
Spiritual Leader: Ayatollah Ali Khamenei
Population (1992E): 60 million
Language: Farsi (Persian) 50%; Turkish 27%
Defense: Army (305,000); Revolutionary Guard Corps (150,000); Navy (14,500); Air Force (35,000)
Religion: Muslim (predominately Shi'a)
Location/ Size: Persian Gulf / 636,363 square miles
Major Cities: Tehran, Isfahan, Mashhad, Shiraz
Major Import Products: Industrial supplies (37%), machinery (30%), consumer goods (18%)
Major Trading Partners: Japan, Turkey, Germany

FINANCIAL PROFILE:

Gross Domestic Product (1992E US $ Bn): 87 (assumes international exchange rate)
Currency: Iranian Rial (IR)
Official Exchange Rate (3/92): US $ 1=IR 67.5
International Transactions Exchange Rate (August 1992E): US$1=IR600
Current Account Balance (1992E US $ Bn): -6.3
Petroleum Export Revenues (1992E US $ Bn): 15.4
Oil Exports as Percent of Merchandise Exports: 93%

ENERGY PROFILE:

Minister of Oil: Gholamreza Aghazadeh
Proven Oil Reserves (1992): 93 Billion barrels
Oil Production Capacity (1992E): 3.6 MMBD
Oil Production (1992E): 3.4 MMBD
Domestic Oil Consumption (1992E): 1.1 MMBD
Refinery Throughput (1991): 0.9 MMBD
Petroleum Exports (1992E): 2.4 MMBD
OPEC Production Quota (1992): 3.2 MMBD
Natural Gas Reserves (1992): 600 TCF
Oil Terminals: Kharg Island, Lavan Island, Sirri Island
Major Fields: Gachsaran, Agha Jari, Marun, Ahwaz Asmari, Ahwaz Bangestan

OIL INDUSTRY PROFILE:

Organization: National Iranian Oil Company (NIOC)
Major Customers: Western Europe, Japan, Brazil

RELATIONS WITH THE UNITED STATES:

Iran's spiritual leader, Ali Khamenei, said recently that Iran will not resume relations with the United States as long as it remains an "oppressive power." This statement reflects Khamenei's leadership of fundamentalist opposition to President Rafsanjani's relatively liberal policies. Despite such opposition, U.S.-Iranian relations have slowly improved over the past two years. Evidence of this improvement came in January 1991, when the U.S. began to allow selective purchases of Iranian oil, following a 3-year ban initially imposed in October 1987. In the months prior to this embargo, the U.S. had been a significant importer of Iranian oil.

RECENT DEVELOPMENTS:

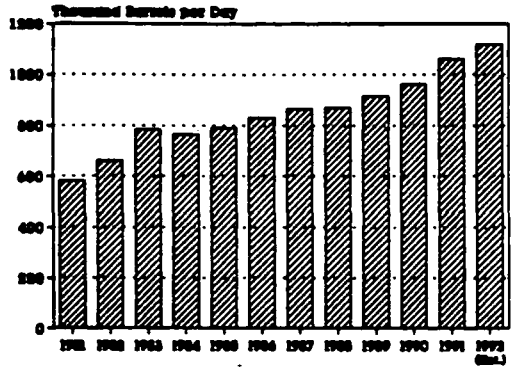
Iran faces immediate economic pressures, resulting both from the country's rapid population growth and the need to rebuild following the 8-year Iran-Iraq War. These economic pressures place a particularly heavy burden on the country's main source of revenues - the oil and gas industry. In order to maximize its oil export revenues, Iran has attempted to increase its own production, as well as to press for higher world oil prices. Iran also hopes to increase production from its huge natural gas reserves, both for export and domestic consumption. Substituting natural gas for oil consumption would also help free up more valuable oil for export.

Iran's need to rebuild its war-ravaged petroleum industry and to stimulate its economy has encouraged the country's recent move towards a more "pragmatic" foreign policy orientation. In the economic sphere, Iran has moved towards establishment of a market-based exchange rate, as well as towards allowing limited foreign participation in its upstream oil and gas operations.

Iran has also moved to assert itself in regional affairs, particularly among the newly independent former Soviet republics of Central Asia. In this regard, Iran has agreed with Azerbaijan and Ukraine to cooperate in construction of a 880-BCF-per-year-capacity gas pipeline from Iran,

through Russian and Azerbaijan, and on to Ukraine and possibly Europe. Iran has further offered to cooperate in exploring for oil and gas resources in the Caspian Sea with Azerbaijan, Russia, Kazakhstan, and Turkmenistan. Iran has also offered possible access for oil and gas exports from Central Asia to the Persian Gulf via pipelines through Iran.

Petroleum Consumption

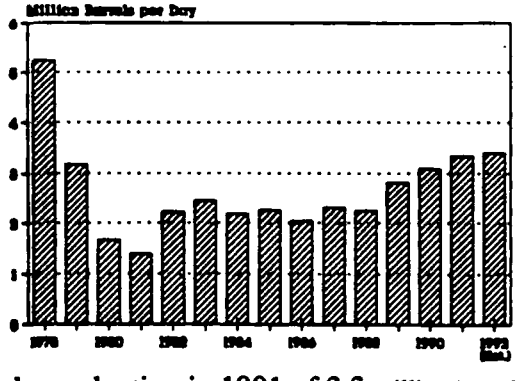


Finally, Iran has moved to reassert its power in the Persian Gulf region. In April 1992, Iran completed its occupation of a disputed island (Abu Musa) near the Strait of Hormuz. Abu Musa, along with two other islands - Lesser Tunb, and Greater Tunb - are also claimed by the United Arab Emirates.

OIL INDUSTRY

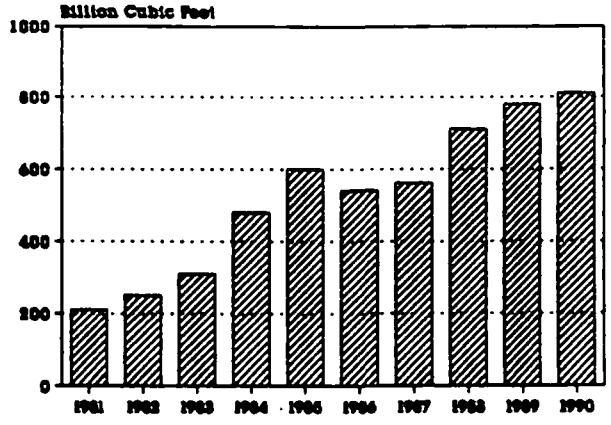
Iran has the fifth largest crude oil reserves in the world, estimated at nearly 93 billion barrels.

Crude Oil Production



Crude production in 1991 of 3.3 million barrels per day (MMBD) was about 13% of total OPEC production. Oil and gas revenues provided nearly 60% of government revenues in 1991. Iran's gas reserves of 600 TCF are the largest in the Middle East and the second largest in the world, representing around 13% of the world's total gas reserves. Natural gas resources are

Natural Gas Production



greatly underutilized, with only around 800 billion cubic feet being produced annually (over 700 years worth of production at this rate). The goal of a $1.4 billion gas development over the next 5 years is to free an additional 500,000-700,000 barrels per day (b/d) of crude oil for export.

After the war with Iraq, Iran began aggressive new programs designed to increase its recoverable oil reserves and to maintain and increase its production capacity. Secondary recovery techniques, involving the injection of associated and non-associated gas, have been applied to various oil fields - many of which suffered pressure loss due to lack of maintenance during the Iran-Iraq war. Current Iranian plans call for an expansion in oil production capacity from 3.6 MMBD currently to 5 MMBD by 1994 (actual production is anticipated at 4.5 MMBD, with 4.0 MMBD onshore and 0.5 MMBD offshore). In this regard, Iran plans to invest around $870 million in 1992 alone to modernize its petroleum industry. Of this amount, $620 million is earmarked for oil, and $250 million for petrochemicals. Overall, Iran has already spent $2.7 billion on rebuilding damage done to its petroleum industry during the war with Iraq. Iran claims it has plans to spend another $24 billion to complete this job.

In order to achieve its ambitious oil production goals, Iran has even resumed efforts at attracting foreign investors. Along these lines, Iran has pursued negotiations for development of offshore oil and gas fields with Japan, Europe and other international groups. Preliminary letters of intent or agreements have already been signed with France's Total (for the Sirri fields); Japan's Japex (for offshore fields in the Strait of Hormuz area);

and an Italian group (for a South Pars offshore gas and condensate project). Foreign investment - particularly onshore - is still politically sensitive, however, with a constitutional ban in place on foreign investment in the country's oil industry.

NIOC has also recently begun enhanced recovery programs at two aging fields - the Karanj/Paris and Nafteshah fields - currently producing 80,000 b/d and 15,000 b/d, respectively. NIOC's goal is to raise production at these fields to 250,000 b/d and 20,000 b/d, respectively.

Although Iran suffered heavy damage to its refineries during the war with Iraq, it has succeeded in getting its oil refinery industry back onto a normal footing in a relatively short time since the August 1988 ceasefire. In 1991, total refinery throughput reached 909,000 b/d (a record high), including over 300,000 b/d at Isfahan refinery, and over 200,000 b/d at the partially-rebuilt Abadan refinery. NIOC also plans to have the new 150,000 b/d Arak plant on line by mid-1993, while the 240,000 b/d-capacity Bandar Abbas refinery is scheduled to start production in 1994. Japan's Chiyoda and Italy's Snamprogetti are constructing the Bandar Abbas refinery. Other projects under discussion include a methanol plant on Kharg Island, a methyl tertiary butyl ether (MTBE) plant at Bandar Khomeini, and a linear alkyl benzene (LAB) plant in Isfahan.

Despite Iran's successes in restoring refining capacity, rapid growth in product demand has outstripped supply from domestic refineries. This growth in product demand has been caused mainly by rapid population growth and an upturn in industrial activity since the end of the war with Iran. This situation has forced NIOC to import significant amounts of product - 114,000 b/d in 1991 - in order to avert product shortages. Such shortages have helped fuel unrest over economic hardships brought about by two years of President Rafsanjani's economic reform program, as well as criticism of NIOC. This criticism resulted in a decision in March 1992 to relieve NIOC of responsibility for the country's refineries, which are now to operate as separate commercial units.

Iraq

COUNTRY PROFILE

Head of State: Saddam Hussein at-Takriti
Population(1990E): 19 million
Languages: Arabic, Kurdish
Defense (pre-1991): Army: 955,000; Air Force: 40,000; Navy: 5,000
Religion: 95% Muslim, more than half of whom are Shiites
Location/Size: Persian Gulf/168,040 square miles
Major Cities: Baghdad, Basra, Mosul, Kirkuk
Major Import Products (pre-embargo): Industrial supplies, capital goods, consumer goods

FINANCIAL PROFILE (Pre-Embargo)

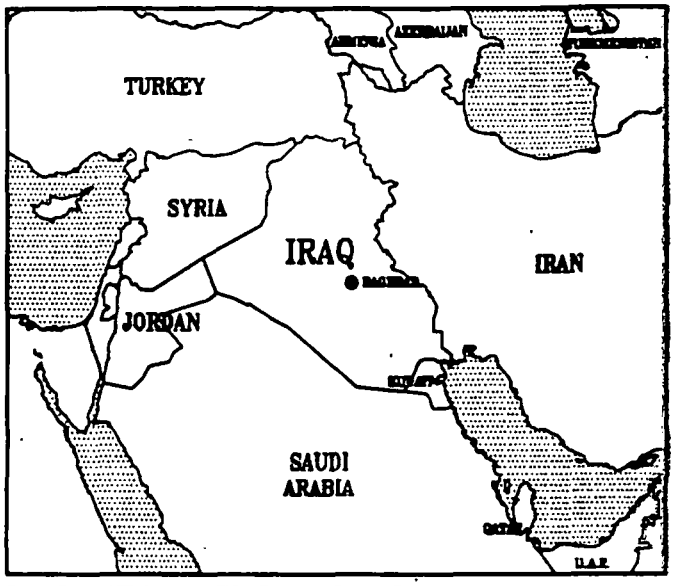
Monetary Reserves (Non Gold, 1987E): $0-2 billion
Foreign Debt (1989E): $65 billion
Gross Domestic Product (1988E): $41.3 billion
Currency: Iraqi Dinar (ID)
Exchange Rate (1/92): US$1 =ID 0.3109
Current Account Balance (1989): -$2.04 billion
Petroleum Export Revenues (1988E): $12 billion
Oil Export Revenues/Total Export Revenues: 94%

ENERGY PROFILE

Minister of Oil: Usama Abdel Razzaq Hithi
Proven Oil Reserves (1/1/92): 100 billion barrels
Oil Production Capacity (7/92E): 1.3-1.6 million barrels/day
Oil Production (7/92E): 400,000 barrels/day (b/d)
Oil Production Quota (5/92): 505,000 b/d
Domestic Oil Consumption (7/92E): 350,000 b/d
Refining Capacity (1992E): 550,000 b/d
Major Refineries: Baiji, Basra, Daura
Petroleum Exports (7/92E): 50,000 b/d
Exports to the United States (9/90-7/92): None
Natural Gas Reserves (1/1/92): 95 trillion cubic feet (TCF)
Natural Gas Production (6/92E): 240 million cubic feet/day
Pipeline Capacities: Iraq-Turkey, 1.0-1.2 million b/d; Iraq Pipeline-Saudi Arabia (IPSA II), 1.65 million b/d (closed to Iraq in 1990); Strategic Pipeline, 0.8-0.9 million b/d
Oil Terminals: Ceyhan, Turkey; Yanbu, Saudi Arabia (closed to Iraq); Mina al-Bakr
Major Fields: East Baghdad, Kirkuk, Rumaila, Zubair, Bai Hassan, Buzurgan

OIL INDUSTRY PROFILE

Organization: The Oil Ministry oversees the nationalized oil industry including: the Iraq National Oil Company (INOC), responsible for managing exploration and production; State Organization for Oil Marketing (SOMO); Iraq Oil Exploration Company (IOEC), responsible for oil equipment manufacturing; National Company for Distribution of Oil Products and Gas; Iraqi Oil Tankers Company; and the National Company for Oil Projects.
Major Customers (pre-embargo): Europe, United States, Japan

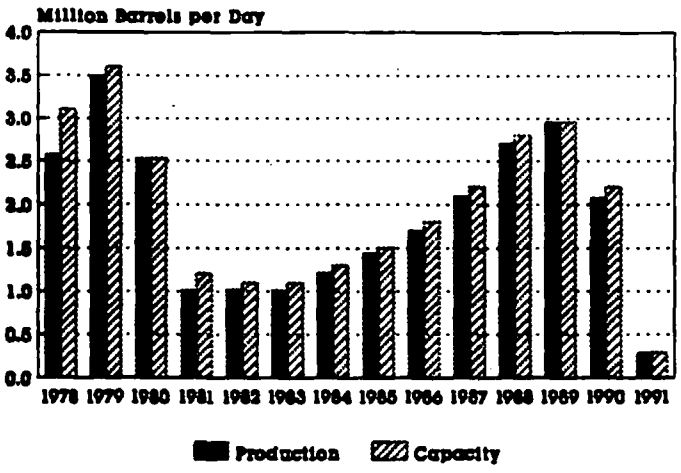


RECENT DEVELOPMENTS

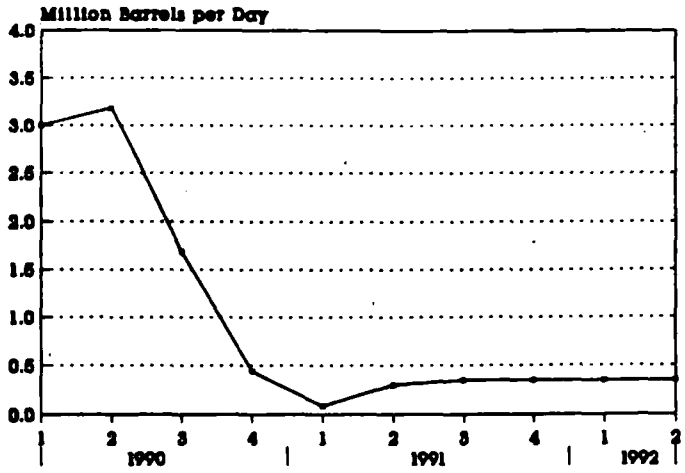
Iraq has been isolated both politically and economically since its invasion of Kuwait in August 1990. Iraq remains subject to United Nations (UN) sanctions and the threat of military action due to its failure to comply with the terms of the ceasefire resolution ending the Persian Gulf War. Two major points of contention are Iraq's failure to cooperate with UN inspection teams enforcing Iraq's agreement to destroy all weapons of mass destruction, and Iraq's treatment of the Shiites in the southern marshlands. In July 1992, Saddam Hussein told Iraqis not to expect an early lifting of sanctions.

Soon after Iraq invaded Kuwait, Iraq's overseas assets were frozen and all trade, except for humanitarian purposes, banned. In September 1991, the UN proposed a scheme that would allow Iraq to raise revenue for war reparations and humanitarian purchases by exporting up to $1.6 billion worth of oil over 6 months (about 450,000 b/d, assuming a price of $20/barrel). In several rounds of negotiation, Iraq has repeatedly rejected the plan. Iraq's basic objection is that the plan would violate its sovereignty, since it includes conditions on Iraq's use of oil terminals and sales of crude oil, and requires the monitoring of transport and drilling activity. Iraq has asked that exports be permitted through its Persian Gulf port at Mina al-Bakr (the UN plan specifies exports through Turkey to the Mediterranean terminal at Ceyhan), because of the transit fees it would have to pay Turkey as well as the line's vulnerability to attack by Kurdish rebels in northern Iraq. Iraq has also refused to accept a

Total Liquids Production and Capacity



Iraqi Oil Production



UN border agreement which would give Kuwait an area containing Iraqi naval facilities and several oil wells in the Rumaila field.

The military campaign to liberate Kuwait devastated Iraq's economy and infrastructure, with damage estimated in the range of $200 billion. Restoration efforts are proceeding with little known outside assistance due to the continued imposition and enforcement of UN sanctions. A high priority for Iraq is the restoration of its oil production and export capacity, since oil exports represent the primary future source of revenue for the economy. Iraqi dissidents estimate lost revenues and damage to oil installations have cost Iraq $35 billion since the Gulf crisis began in 1990. This estimate includes $5-10 billion in damage to pumping stations, pipelines, refineries, a petrochemical plant, export facilities, and several tankers.

RESTORATION OF OIL INDUSTRY

Progress in rebuilding Iraq's oil industry has been slowed by the lack of spare parts and access to foreign expertise and financing. Nevertheless, Iraq's claims to have restored a major portion of its oil producing, exporting, and refining capacity are largely substantiated by *Petroleum Intelligence Weekly* (*PIW*) reports (7/13/92 and 7/20/92). The following estimates are taken primarily from the *PIW* reports.

Production Capacity. In July 1992, Iraq's production capacity was estimated to total 1.3-1.6 million b/d, compared with 3.3 million b/d prior to the war (the estimate shown in the figure is lower because it represents an annual average for the year). Most of this capacity (0.8-1.0 million b/d) is reported to be in the northern fields near Kirkuk. The southern fields had been Iraq's primary producing region, but received more extensive damage in the war. Total capacity of these southern fields is estimated in the range of 0.5-0.6 million b/d, primarily from the Rumaila field. Iraq is expected to continue restoring its production capacity gradually once the embargo is lifted.

Export Capacity. Iraq claims it can export about 3 million b/d, but Saudi Arabia's objections to the use of the IPSA line and logistical constraints such as the lack of spare parts and limited storage facilities imply a lower total in the range of 1.5 million b/d (about 1 million b/d via the Iraq-Turkey Pipeline to Ceyhan on the Mediterranean and no more than 0.5 million b/d via Mina al-Bakr on the Persian Gulf). Current and pre-embargo export capacities are summarized as follows (million b/d):

	Pre-Embargo	Current
Yanbu (closed to Iraq)	1.65	1.65
Ceyhan	1.6	1.0-1.2
Mina al-Bakr	0.8	0.5

All four of the deep-water berths at Mina al-Bakr, Iraq's only operable Gulf port, reportedly have been repaired, while both Turkish and Iraqi officials claim the Iraq-Turkey Pipeline is capable of normal operations within their respective territories. Saudi Arabia, however, has stated it would not allow Iraqi exports to transit its territory via the IPSA pipeline to Yanbu on the Red Sea as long as Saddam Hussein remains in power. Another possible route for Iraqi exports - the line through Syria - has been closed since 1982 and is not likely to be reopened soon. Iraq's export route options are therefore limited to pipeline exports via Turkey, Persian Gulf exports via Mina al-Bakr, and continued small volumes via truck

to Jordan. Repairs to Iraq's reversible Strategic Pipeline linking the northern and southern fields and to a critical pump station at Haditha give Iraq the flexibility to export via either Turkey or the Gulf. Iraq has also recently mentioned the possibility of reviving plans for construction of a 1 million b/d pipeline to Jordan, which would provide an additional export route via Aqaba on the Red Sea.

Refining Capacity. Iraq has resumed operations at three main refineries, and has restored additional capacity at several smaller facilities whose production is not currently needed. Refineries at Daura (near Baghdad) and Baiji are reportedly operating at or near their pre-war levels. The Basra refinery received more extensive damage and is operating at about half its pre-war capacity. In June 1992, Iraq's oil minister claimed refining capacity was at 84 percent of its pre-war level. Iraq has also discussed longer-term plans to build additional refineries - one in Iraq and another in Sudan.

EXPLORATION AND DEVELOPMENT

Despite its current focus on repairing war damage, Iraq is already planning future exploration and development with the likely assistance of foreign companies and has established an output target of 6 million b/d by the end of the 1990's. Two French companies (Elf Aquitaine and Total) have begun negotiations with Iraq, and SOMO has established an office in Amman, Jordan for the purpose of attracting foreign companies. However, no commitments are likely until the uncertain political situation is resolved. In June 1992, Iraq signed a protocol with the former Soviet republic of Azerbaijan on cooperation in the sphere of oil and gas extraction. Iraq appears to be concentrating on the further exploration and development of four giant southern fields: Majnoun, West Qurna, Halfaya, and Nahr Umar.

ECONOMIC OUTLOOK

A report submitted to the UN by Iraq in January 1992 provides the official Iraqi assessment of the effect of the war and sanctions on the economy. Between 1989 and 1991, real GDP declined by more than 17 percent, personal income declined by 20 percent, and annual inflation averaged 140 percent. The balance of payments deficit for the last half of the 1980s was reported to be nearly $30 billion. In March 1992, Iraq's overseas assets were estimated by the *Middle East Economic Survey* to total $5 billion. Economic recovery is contingent on Iraq's ability to resume earning oil export revenue and to obtain access to its frozen assets and to foreign financial and technical assistance. This will not happen until the current political standoff is resolved.

POLITICAL BACKGROUND

The current internal political situation is difficult to gauge given Iraq's isolation, both from its Arab neighbors and most of the international community. Power rests with the President and a Revolutionary Command Council (RCC), comprised of nine members and chaired by Saddam Hussein. Considerable influence is wielded by the Iraq Regional Command of the Ba'ath Party, which is also headed by Saddam Hussein. Routine administration of the country is carried out by an appointed Council of Ministers. Legislative responsibility is shared between the RCC and the 250-member National Assembly, which is dominated by members of the ruling Ba'ath Party.

Internal political problems center on the rights of two groups: the Kurds in the north and the Shiites in the south. The first free elections for Iraqi Kurds, held in May 1992, produced no clear winners. So far, attempts at consolidating opposition groups have produced no visible results, despite general agreement among these groups that Saddam Hussein should be ousted.

Kazakhstan

COUNTRY PROFILE

President: Nursultan Nazarbayev
Prime Minister: Sergey Tereschenko
Population (1989): 16.5 million
Size/Location: 1.0 million square miles in Central Asia, bordering the Caspian Sea on the West, Russia to the North, China to the East, and Kyrgyzstan, Turkmenistan, and Uzbekistan to the South
Ethnic Divisions: Kazakh (39.7%), Russian (37.8%), German (5.8%), Ukrainian (5.4%), all other nationalities (11.3%)
Major Cities: Alma-Ata (capital), Karaganda, Chimkent, Dzhambul
Major Trading Partners: Other republics of the Commonwealth of Independent States (CIS), Holland, former Eastern Bloc, Finland, China

ECONOMIC PROFILE

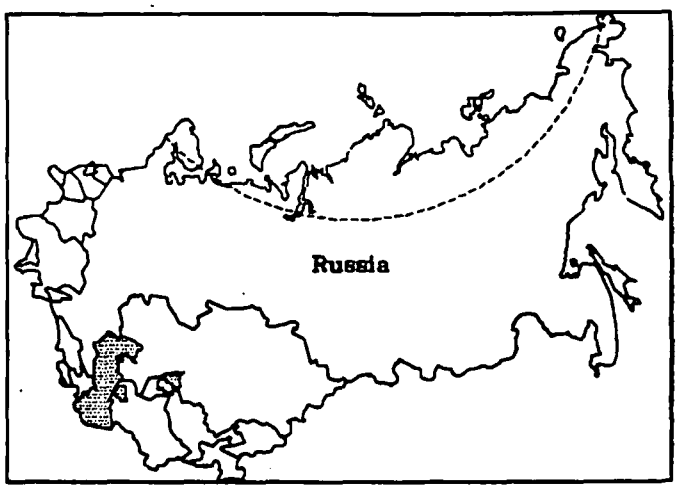
Gross National Product (1991): $135 billion (Note: assumes official 1991 exchange rate of 0.6 rubles/dollar)
Currency: Ruble
Commercial Exchange Rate (10/27/92): US$1 = 393 Rubles

ENERGY PROFILE

Minister of Fuel and Energy Resources: Kayir Baykenov
Proven Oil Reserves (1989E): 14 billion barrels
Oil Production (1992E): 600,000 barrels per day (b/d)
Domestic Oil Consumption (1991): 400,000 b/d
Refinery Throughput (1991): 360,000 b/d
Petroleum Exports (1991): 200,000 b/d
Proven Gas Reserves(1989E): 26 trillion cubic feet (Tcf)
Natural Gas Production (1992E): 0.4 Tcf
Natural Gas Consumption (1991): 0.5 Tcf
Natural Gas Imports (1991): 0.2 Tcf
Coal Production (1992E): 138 million short tons (MST)
Coal Consumption (1991): 94 MST

OIL AND GAS INDUSTRY PROFILE

Organization: Tengizneftegaz (Tengiz oil production association); Kazakhgazprom (State gas corporation); Kazakhstanugol' (State coal corporation, comprising both Karaganda and Ekibastuz production associations)
Major Customers: primarily Russia and Azerbaijan, but also Kyrgyzstan, Tadjikistan, Turkmenistan, Ukraine, Uzbekistan
Major Oil Fields: Mangyshlak fields (largest is Uzen), Tengiz (Aktyrau -formerly Gur'yev- Oblast), Korolev
Major Gas Fields: Karachaganak (Ural'sk Oblast)
Major Oil Ports: None; small tanker shipments to Baku and up Volga River to Volgograd from ports at Aktyrau and Aktau (formerly Shevchenko)
Oil Export Pipelines: Pipelines from Aktyrau to Russian cities of Orsk, Volgograd, and Samara (formerly Kuybyshev). Under construction - Caspian Pipeline Consortium line from Tengiz-Grozny has a completion date April 1993, continuing on to Novorossysk. Grozny-Novorossysk pipeline capacity is 1.5 million b/d
Gas Export Pipelines : Aktau-Aktyrau to Saratov in Russia
Major Oil Refineries (1991 throughput): Pavlodar (140,000 b/d), Chimkent (140,000 b/d), Aktyrau (80,000 b/d)



HISTORICAL BACKGROUND

The dry plains of southern Kazakhstan are inhabited by the nomadic Kazakhs. Russians arrived at the turn of the century in arable northern Kazakhstan, and greater numbers came in the 1950's with Khrushchev's Virgin and Idle lands programs. In addition, Stalin's resettlement programs moved entire ethnic groups out of European Russia into Kazakhstan, increasing its ethnic diversity. Kazakhs barely constitute a plurality now, with Europeans making up the plurality of the populace in the cities, industrial centers, and northern arable lands.

The Kazakh Republic was formed as an autonomous republic within the Soviet Federation on August 26, 1920, and reconstituted as an Union Republic on December 5, 1936. Kazakhstan declared its sovereignty on October 25, 1990, after 13 republics of the former Soviet Union had done so, but remains a member of the Commonwealth of Independent States, a loose confederation of 11 former republics of the Soviet Union.

Kazakhstan's importance as an independent republic arises because of its size, mineral wealth, and its possession of nuclear arms following the breakup of the Soviet Union. Kazakhstan is the second largest of the former Soviet republics in area, fourth largest in population, third largest in Net Material Product (NMP), and the third largest in both energy production and consumption.

Until its independence, Kazakhstan's economy was centrally directed and highly integrated with the other republics of the former Soviet Union. Foreign trade in particular was centrally directed by the former Soviet Union, with goods shipped primarily through Russia before being exported.

Most of Kazakhstan's economic and transportation infrastructure was planned without regard to its borders, with the result that Kazakhstan remains highly dependent upon trade with the other republics of the CIS.

ECONOMIC PROFILE

With independence, Kazakhstan has moved quickly to decentralize its economy and become more economically independent from Russia. Some key elements of economic reform are already in place, including:

Privatization - President Nazarbayev has moved quickly to implement privatization measures. All agricultural enterprises are to be privatized by the first quarter of 1993. In addition, Nazarbayev has issued decrees that will push small Kazakh industrial enterprises to be privatized, with a goal of privatizing up to 1/3 of all Kazakh enterprises within the next few years. The privatization measures have met with opposition from lower levels of the Kazakh government, especially from former communist leaders. Nazarbayev is in the process of replacing many local leaders with his own appointees.

Price Controls - State price controls on most goods were removed on January 6, 1992. However, some restrictions remain on communications, energy, food, housing, municipal services, and transportation. Coal, diesel fuel, gasoline, and retail natural gas price increases were limited to 300-500 percent, while crude oil, electricity, and natural gas price increases for producers were limited to 400-800 percent.

Currency - Kazakhstan continues to use the ruble. Kazakhstan plans to develop its own currency, and in preparation for this President Nazarbayev officially opened Kazakhstan's own gold fund in January 1992.

Economic Development - Kazakhstan has moved quickly to attract foreign investment by creating a political/legal/tax climate conducive to foreign aid. President Nazarbayev's regime appears to enjoy strong support, and he is committed to economic reform. On June 10, 1992, President Nazarbayev issued a decree creating a state foreign investment agency to be run by Deputy Prime Minister Kadir Baykanov. This agency will coordinate actions by state bureaucracies, draft legislation on foreign investment, conduct international tenders on mineral deposits, help evaluate competitive bids for resource development, and draft proposals for granting concessions. It will also formulate proposals for government guarantees for high-priority projects, and represent Kazakhstan in international loan and credit negotiations.

In May 1992, Kazakhstan adopted its law on "Underground Resources and Processing of Mineral Resources" to provide a legal framework for resource development. The law is broad in scope and is thought to be adequate but lacking in details, which are left for negotiations with individual investors.

Kazakhstan has been successful in attracting foreign capital, and has exploited foreign reluctance to invest in Russia. Kazakhstan claims 300 foreign joint ventures, with 20 reported joint energy ventures. Kazakhstan and Japan have set up a council for economic development, and plans include opening Japan's trade mission in Alma-Alta and launching a number of joint ventures.

OIL AND GAS INDUSTRY

In 1991, Kazakhstan was the former Soviet Union's second largest oil producer, third largest coal producer, sixth largest natural gas producer, and third largest overall energy producer and consumer. Kazakhstan's energy was developed primarily during the Soviet period beginning with the 1930's. Kazakhstan's oil and gas production is concentrated primarily in the Northwest, while its main consuming sectors are in the opposite end of the country. This has led to a large inter-republican trade in energy, with domestically produced oil and gas shipped northward while oil imports from Siberia and gas imports from Russia and Uzbekistan supply the rest of the country.

Kazakhstan's oil production has centered in the fields of the Mangyshlak peninsula bordering the Caspian Sea. The North Caspian Basin has recently been the center of much interest, culminating in the $20 billion joint venture with Chevron at the Tengiz field bordering the Caspian Sea. This field is estimated to contain between 3-10 billion barrels of oil, and eventually produce over 800,000 b/d. In July 1992, Kazakhstan joined the Caspian Pipeline Consortium with Russia, Azerbaijan, and Oman to construct a pipeline to transport Caspian Sea crude to world markets. Completion of the

Tengiz-Grozny segment is expected in April 1993. The French oil company Elf-Aquitaine has recently signed a deal to explore the Aktubinsk region of northwest Kazakhstan as well.

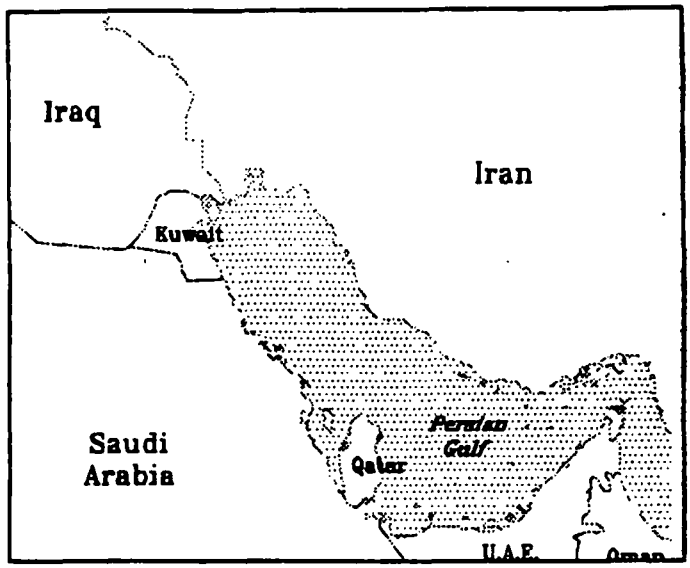
Kazakhstan has been successful in attracting foreign investment not only because of its stable legal/political environment, but also because its tax structure reportedly allows a high internal rate of return on energy investments of 30 percent, compared with 10 percent in Russia. The Omani government has been advising the Kazakhs on energy joint ventures, and is not only the project coordinator for the Caspian Pipeline Consortium, but has also been rewarded with its own exploration venture near Akyrau.

Gas production has been centered in the Karachaganak field in the Northwest, bordering the Orenburg field in Russia. British Gas and Agip recently won a $6-$7 billion contract to further develop the field, thought to contain 20 Tcf of reserves, with eventual production of over 0.7 Tcf/year - roughly equivalent to current Iranian production. Some associated gas is also produced in the Mangyshlak oil fields.

COAL INDUSTRY

Despite its oil and gas potential, Kazakhstan is very different from every other republic in the CIS in that coal, not oil or gas (the dominant fuel in the CIS), is the primary fuel used for energy consumption. Because of the abundance of coal, Kazakhstan is also a large coal exporter. The Karaganda basin in north-central Kazakhstan produces high quality coking coal which supplies the Ukrainian and Urals iron and steel industries. The Ekibastuz basin in the North is the third largest basin in the former Soviet Union, and produces brown (sub-bituminous) coal suitable for use in power stations in Urals power plants and Kazakhstan. This brown coal is produced from several huge strip-mining operations.

Kuwait



COUNTRY PROFILE

Head of State: Shaikh Jaber al-Ahmad al-Jaber as-Sabah
Population(3/92): 700,000 Kuwaiti citizens
Language: Arabic
Religions: Muslim (95%), of which approximately 70% are Sunnis
Defense: Army: 16,000; Air Force: 2,200; Navy: 2,100
Location/Size: Persian Gulf / 6,880 sq. mi.
Major Cities: Kuwait City, Salmiya, Hawalli
Imports: Industrial goods (24%), consumer goods (24%), transport equipment (19%), machinery (18%), food (13%)

FINANCIAL PROFILE

Gross Domestic Product (1992E): $12.4 billion
Currency: Kuwaiti Dinar (KD)
Exchange Rate (11/92): US $1 = KD 0.30
Current Account Balance (1992E): -$7.7 billion
Petroleum Export Revenues (1992E): $7 billion
Oil Revenues/ Total Revenues (1992): 90%

ENERGY PROFILE

Minister of Oil: Ali Ahmed al-Baghli
Proven Oil Reserves(1/1/92): 94 billion barrels
Oil Production Capacity (4Q92E): 1.3 MMBD
Oil Production (11/92): 1.5 MMBD*
Domestic Oil Consumption (8/92): 0.1 MMBD
Refining Capacity (10/92): 0.4 MMBD
Refineries: Mina Ahmadi, Mina Abdullah, Shuaiba
Petroleum Exports (1992E): 1.3 MMBD*
Natural Gas Reserves (1/1/92): 48 trillion cubic feet
Major Oil Fields: Burgan, Raudhatain, Sabriyah, Umm Gudair, Minagish, Magwa, Ahmadi
Major Ports: Shuwaikh, Shuaiba, Doha
* Includes Neutral Zone production

OIL INDUSTRY PROFILE

Organization: The *Supreme Petroleum Council* governs the nationalized oil industry. *Kuwait Petroleum Corporation* (KPC) is the parent company. Subsidiaries include: *Kuwait Oil Company* - exploration and production of oil and gas; *Kuwait National Petroleum Company* - refining and shipping; *Kuwait Petroleum International* - refining and product marketing; Petrochemical Industries Company - production and marketing of chemical products; *Kuwait Foreign Petroleum Exploration Company* - foreign exploration; and *Kuwait Oil Tanker Company* - tanker operations.
Major Trading Partners (1992): United States, Japan, Europe
Downstream Investment: British Petroleum (9.8% ownership), Hong Kong's Guoco Group Ltd. (24%), Britain's Midland Bank (10%), and Spain's Fesa-Enfersa (40%)

RECENT DEVELOPMENTS

In October 1992, Kuwait held its first postwar parliamentary election, with Kuwait's organized opposition groups winning an unexpectedly large majority of 35 seats. This is the first parliament to be formed since Kuwait's ruling Emir dissolved the legislature in 1986 for its harsh criticism of the government.

Shortly after the liberation of Kuwait in February 1991, reconstruction costs were estimated as high as $100 billion, with repairs expected to continue into the next century. Almost two years later, a revised version of the rebuilding process should cost only one fifth of the initial estimate. The fast pace of rebuilding, especially in the oil sector, has put production far ahead of the original schedule. With its oil industry heavily damaged by bombing and sabotage (including the setting afire of its oil wells by retreating Iraqi troops), Kuwait was forced to borrow on international financial markets to avoid liquidating its core investments. Current business opportunities in Kuwait focus on rebuilding the emirate's economic and physical infrastructure. With its own workforce depleted by the departure of large numbers of foreign nationals (who were deported during the occupation) and the voluntary exile of many Kuwaiti citizens, Kuwait has entered into numerous contract arrangements with companies around the world for assistance.

RELATIONS WITH THE UNITED STATES

The United States, having led the coalition which liberated Kuwait, is now taking the lead in rebuilding the country. The U.S. firm Bechtel Corp. was hired to oversee the reconstruction of

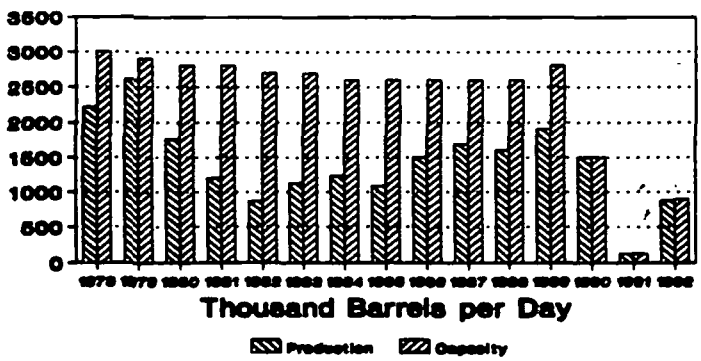
Kuwait's oil, gas and petrochemical facilities, and the U.S. companies of C.F. Braun and Foster Wheeler are responsible for the new design of the Mina al-Ahmadi and Mina Abdullah refineries. Also U.S. electrical equipment and supplies are being used in these refineries. Texaco's Getty Oil Co., which acts jointly with Kuwait Oil Co. and manages Kuwait's Neutral Zone production, is responsible for repairing wells and production centers.

Prior to the invasion by Iraq in August 1990, U.S. imports of crude oil and petroleum products from Kuwait had been increasing -- from an average 68,000 barrels/day (b/d) in 1986 to 157,000 b/d in 1989 (2 percent of net U.S. imports). In the first nine months of 1990, the United States imported an average 115,000 b/d from Kuwait. Imports were nonexistent in 1991 until September and October (34,000 b/d and 33,000 b/d, respectively) and averaged 66,000 b/d in August 1992.

STATUS OF REBUILDING EFFORTS

Since the liberation of Kuwait, 727 of the 940 oil wells have been brought back into production. Losses from the fires and leaks were estimated at 6 million b/d until the first well was extinguished on April 7, 1992. These losses were equivalent to $120 million/day in lost revenues. By August 1992, nine months after Iraqi-set oil well fires were put out, Kuwait had nearly tripled its oil revenues and cut its budget deficit by two-thirds since the end of the war.

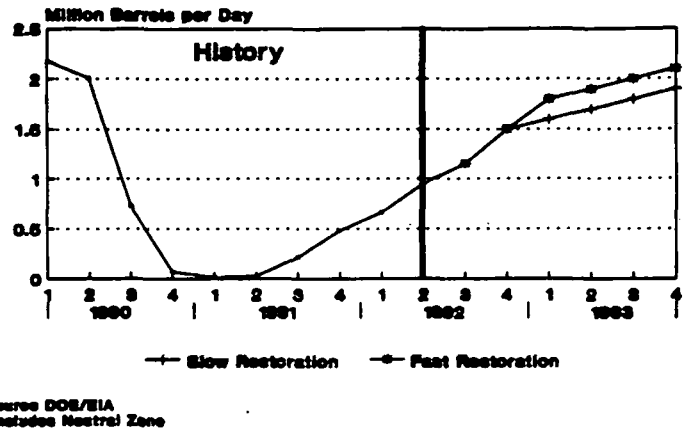
Total Liquids Production and Oil Production Capacity



According to estimates by Kuwait's oil minister, up to 3 percent of reserves may have been lost as a result of damage to the oil fields. This equates to 2.8 billion barrels, based on estimated reserves as of January 1992 .

Kuwaiti oil production, which had come to a complete halt following Iraqi sabotage and the conduct of Operation Desert Storm, resumed in June 1991. Throughout 1991 and into 1992, production increased steadily from an average of 450,000 b/d at the end of 1991 to 780,000 b/d by March 1992. Production is currently estimated at 1.5 million b/d. Kuwait's goal for the end of 1993 is 2.0 million b/d.

Kuwaiti Production*



Source: DOE/EIA
*Includes Neutral Zone

Product exports have been slower to recover due to extensive refinery damage. The Mina Ahmadi refinery, the oldest of the three major refineries, is currently processing 185,000 b/d, all for domestic product demand. The other two major refineries -- Mina Abdullah and Shuaiba -- received more extensive damage. Refinery capacity in Mina Abdullah is currently 230,000 b/d, which is mostly for export. Shuaiba refinery, which was the hardest hit by the Iraqi damage, will not be processsing any crude oil before November of 1993, when it is scheduled to refine 130,000 b/d. The three refineries are expected to reach their full capacity levels by 1995 after repairs and updates are completed.

The occupation, war, reconstruction, and loss of oil revenues have been costly for Kuwait. Since Iraq's invasion, Kuwait is reported to have sold about $40 billion in assets. Of the $16 billion Kuwait had pledged to pay for Desert Shield and Desert Storm, it had paid all but $2.8 billion by September 1991. In July 1992, the government approved a $24 billion plan to buy out bad debts, which have been carried for a decade by Kuwaiti banks following the collapse of the Manakh stock market in 1982. In December 1991, Kuwait signed a $5.5 billion loan agreement, its first borrowing on such a large scale. The 5-year

reconstruction loan, coordinated by J. P. Morgan and Company, is being provided by a syndicate of 81 institutions, including many European and Japanese banks. The loan is complemented by export credit packages (with the United States, Britain, Japan, and Canada) totalling $5.5 billion.

Oil Industry

Kuwait has been a major world oil producer since World War II, and has used its oil revenues to develop an advanced welfare system and provide jobs for over a half-million people. In the late 1960's, Kuwait bought 100 percent equity in the Kuwait Oil Company (KOC). In 1980-1981, it completely reorganized its oil sector by forming a new holding company, the Kuwait Petroleum Corporation (KPC) to consolidate the upstream operations of KOC and the downstream operations of the Kuwait National Petroleum Company. Since that time, it has been expanding facilities for distribution, marketing and retail of its refined products. In 1983, it established a London-based subsidiary (Kuwait Petroleum International, KPI) to manage newly acquired distribution outlets, mainly in Europe.

The emirate plans to reestablish itself as a major producer as it recovers from the war with Iraq. Assuming war-damage to reserves is no more serious than assessed, Kuwait's reserves will last for another two centuries at the pre-invasion production rate. Kuwait therefore has a strong motivation to hold and expand its market share. Future expansions are expected to be slower than before the war, however, due to financial limitations.

KPI refines and markets its products in Europe under the brand name of "Q8", with 5,000 filling stations in Italy, Sweden, Great Britain, and the Benelux countries. In 1991, KPC formed a new company (Kuwait Oil Thailand) to construct 100 filling stations in Thailand. Thailand currently has 17 filling stations operating. Thus, Kuwait's oil industry has developed into a totally integrated sector, controlling operations from wellhead to pumping station.

KPC has regained 90 percent of its traditional customers in East Asia, Japan, India and Brazil, plus new "major" customers in the United States. Kuwait also supplies about 30,000 to 40,000 b/d of crude oil to the Chinese Petroleum Corporation (CPC) and 60,000 b/d of crude supplies to the South Korean firm of Yukong.

Downstream Investments

Kuwait's once aggressive overseas investment policy, originally intended to supplement the country's oil revenues and to protect the country from oil price fluctuations, cushioned the financial impact of Iraq's occupation. Kuwait's world-wide investment portfolio before the Gulf War was estimated between $100-120 billion. Kuwait's current overseas investments are estimated at $30 billion. Kuwait has had to draw on nearly $40 billion to cover war-related costs, and the value of some its investments, particularly real estate, has fallen as a result of general market conditions.

Latvia

COUNTRY PROFILE

Prime Minister: Ivars Godmanis
Government: Republic; declared independence from Soviet Union August 21, 1991; independence recognized by Soviet Union September 6, 1991
Population (1989): 2.7 million
Size/Location: 24,900 square miles in Eastern Europe, bordering the Baltic Sea to the West, Estonia to the North, Russia to the East, and Belarus to the Southeast
Ethnic Divisions (1989): Latvian (52%); Russian (34%); Belarussian (4.5%); Ukrainian (3.5%); other nationalities (6%)
Major Cities: Riga (capital), Daugavapils, Liepaja, Ventspils

ECONOMIC PROFILE

Gross National Product (est. 1992 @ purchasing power parity rates): $15.2 billion in $1990
Currency: Latvian Ruble (Rublis)
Commercial Exchange Rate (10/22/92): US$1 = 160 Rublis
Major Trading Partners: "Ruble zone" countries, Germany, Poland, Scandinavia, United States

ENERGY PROFILE

Industry and Energy Minister: Ivars Millers
National Power Company: Latvenergo
National Petroleum Company: Latvijas Nafta
National Gas Company: Latvijas gaze
Proven Oil Reserves (1989E): none
Domestic Oil Consumption (1991): 70,000 b/d
Refinery Throughput (1991): none
Proven Gas Reserves(1989E): none
Natural Gas Consumption (1991): 100 billion cubic feet
Coal Production (1991): none
Coal Consumption (1991): 700,000 short tons
Electricity Production (1991): 5.6 billion kilowatt hours (Bkwh)
Electricity Imports (1991): 3.7 Bkwh

OIL AND GAS INDUSTRY PROFILE

Major Oil Ports: Ventspils, the second largest export point for oil from the Commonwealth of Independent States (CIS), has a capacity of 800,000 b/d and is ice-free. Exports in 1991 were 386,000 b/d. Products are received mostly by rail from Russia, Lithuania, and Belarus
Crude Oil Import Pipelines: Druzhba (Friendship) pipeline from Russia via Novopolotsk (Belarus) to Ventspils
Major Gas Import Pipelines : Northern Lights pipeline from West Siberia (Russia) to Riga and storage reservoir at Incukalns
Major Oil Refineries: none

BACKGROUND

Latvia has no fossil fuel resources and contains only small amounts of peat and firewood. Latvia's major indigenous source of primary energy is the cascade of three hydroelectric plants on the Daugava River totalling about 1500 megawatts. All other energy must be imported, largely from Estonia, Lithuania, Poland, and Russia. Latvia is the only Baltic country to be a net importer of electricity. Latvia hopes to offset expected declines in electricity exports from other Baltic republics by increasing its own power production. Latvian energy requirements could also be cut by using its district heating system more efficiently and by closing many of its highly inefficient, energy consuming factories. Like other republics of the former Soviet Union, Latvia is far more energy inefficient than other European countries.

Latvia contains the second largest export point for Russian oil (the port at Ventspils), and Latvian transit fees for the port have been an important source of hard currency earnings. However, Russia has shifted much of its exports to its own ports for strategic and financial reasons, and Ventspils is not as vital as before. Latvia is planning to use Ventspils and the port at Riga to import products and reduce the dependency on Russian products; these imports are part of the coordination effort between Baltic energy ministers to coordinate a mutual energy policy to meet expected fuel shortages this winter. Latvia has also invited foreign investors to develop a distribution and service station network.

Natural gas is becoming increasingly important to Latvia, and the country is negotiating a joint venture with Gazprom (Russia) to expand and operate Latvia's underground gas storage facility at Incukalns. Natural gas accounted for 28% of primary energy consumption in 1990 (up from 9% in 1970), second only to oil (40% in 1990, down from 63% in 1970).

LIBYA

COUNTRY PROFILE

Head of State: Muammar Gadhafi
Population (1990): 4.54 million
Location/Size: North Africa/685,524 Sq Mi
Major Cities: Tripoli, Benghazi
Major Import Products: Machinery, 32%; Military supplies, 20%; Food, 12%

FINANCIAL PROFILE

Monetary Reserves (Non Gold, 1991): $5.7 billion
Foreign Debt: Negligible
Gross Domestic Product (1990): $32.7 billion
Currency: Libyan Dinar
Exchange Rate (1/92): US $ 1 = 0.275 Dinar
Petroleum Export Revenues (1990E): $10.1 billion
Petroleum Revenue/Total Revenue (1990): 98.5%

ENERGY PROFILE

Secretary of Petroleum: Abdullah Salim al Badri
Proven Oil Reserves (1992): 22.8 billion barrels
Oil Production Capacity (1992): 1.6 million b/d
Oil Production (1991): 1.5 million b/d
Crude Production Quota (2Q/92): 1.395 million b/d
Domestic Oil Consumption (1991E): 155,000 b/d
Domestic Refining Capacity (1992): 350,000 b/d
Foreign Refining Capacity (1992): 199,000 b/d
Petroleum Exports (1991E): 1.3 million b/d
Natural Gas Reserves (1992): 43 TCF
Natural Gas Production (1991): 547 BCF

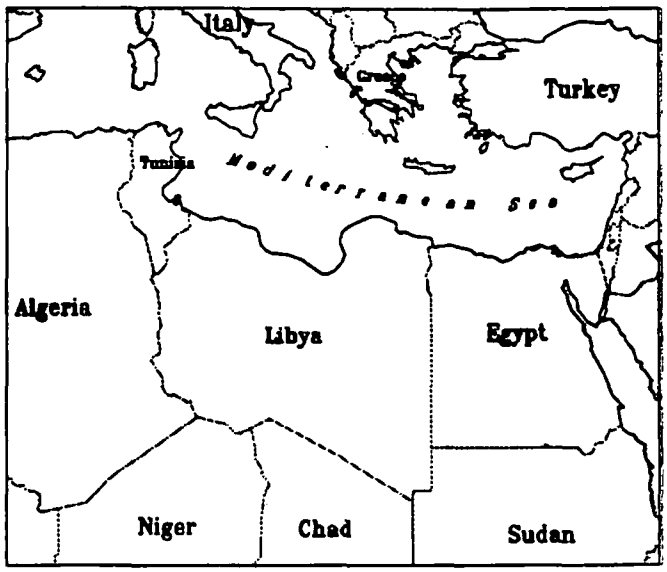
OIL INDUSTRY PROFILE

Organization: *Libyan National Oil Company* (LNOC)- Manages the state-owned oil industry
Major customers: Italy, Germany, other Europe, the CIS and the former Eastern Bloc countries

RECENT DEVELOPMENTS

Libya's relations with the United States have been strained recently over the issue of the 1989 bombing of Pan Am flight 103 over Lockerbie, Scotland that killed 270 people. To date, Libya has not released the two men accused of being responsible for the bombing, or four others implicated in the bombing of a French airliner over Nigeria in 1989.

On April 15, 1992, the United Nations implemented economic sanctions on Libya. These sanctions include the grounding of all air traffic to and from Libya, severing of diplomatic relations, and the halt of all arms sales to the country. Gadhafi appealed to the World Court to override the sanctions but was denied.



U. N. sanctions do not include any restrictions on Libyan oil. If enacted, oil sanctions would be potentially devastating to the Libyan economy, since oil export revenues represent nearly all of Libya's export earnings. Oil sanctions could also be hard on the countries that rely heavily on Libyan oil, mainly Italy. Italy imports over 450,000 b/d from Libya, almost one-third of its petroleum imports and about 35% of Libya's petroleum exports. However, given the current political environment, there is little probability that oil sanctions will be agreed upon in the near future.

OIL INDUSTRY OVERVIEW

The Libyan oil industry was nationalized in 1973, and the Libyan National Oil Corporation (LNOC) was created to oversee oil activities. LNOC controls oil production of the six major Libyan oil systems. The six production systems are operated by; Arabian Gulf Oil Company (Agoco), Waha, Sirte, Zueitina, Agip and Veba. Brega International was dissolved in 1991 and LNOC now directly administers the marketing of petroleum. Oilinvest is in charge of LNOC's international holdings.

Petroleum revenues represent nearly all of Libya's export revenues and about 30% of its GDP. Due to its dependence on petroleum earnings Libya favors efforts to defend world oil prices. At the OPEC meeting in February 1992, Libya agreed to a crude production quota of 1.395 million barrels per day, a 10% reduction from its previous quota.

Libya's economic condition has suffered since the 1986 oil price decline, with the Persian Gulf crisis providing a temporary boost in oil revenues. Lower petroleum export earnings have reduced

domestic spending, eroded the value of oil as payment for trade debt, increased restrictions on imports, and slowed Libya's efforts to expand downstream investments. To counter lower domestic spending in the oil sector, Libya has pursued foreign investors to provide capital and to overcome its shortage of qualified personnel.

Libya's market strategy is to expand downstream market share and to lobby other OPEC members to defend crude oil prices over higher production quotas. The strategy reflects Libya's relatively limited ability to increase oil production and its need to maximize the return on its oil reserves.

Reserves and Production

The bulk of Libya's output comes from wells operated by **Agoco, Waha, Sirte,** and **Zueitina**. They represent about 80% of the total production while the European companies that still operate in the country (**Agip, Veba, Wintershall** and **Elf Aquitaine**) account for the remaining 20%.

12 oilfields in Libya have reserves of 1 billion barrels or more, and two others have reserves of 500 million to 1 billion barrels. The offshore **Bouri** field, discovered in 1976, is the biggest find in Libya since the Bu Attifel and Baki fields were discovered in 1968. The offshore frontier is the most promising for Libya since there are large areas that have not been fully explored. Onshore areas have been thoroughly explored and the likelihood of a new major find is small.

The official Libyan government estimate of proven crude reserves, 45 billion barrels, is significantly higher than independent estimates of 22.8 billion barrels. Industry sources believe that LNOC's enhanced oil recovery (EOR) program could raise the volume of recoverable reserves by 7 billion barrels, only about one-third of the government's estimate. EOR techniques could add an additional 13 years to the current 42-year life expectancy of reserves, using a crude oil production rate of 1.5 MMBD.

Exploration and Development

The major component of Libya's expansion plan is the development of the **Bouri** field, the largest producing oil field in the Mediterranean Sea. Italy's **Agip** is the developer of the field which is estimated to have 5 billion barrels of crude, of which 600 million are considered to be recoverable. First phase of development cost $2 billion, with an initial production of 75,000 b/d in June 1990. Current production from the field is about 150,000 b/d. Agip's second stage expansion plans include the addition of new wells, more platforms, and a pipeline to the shore. A major problem with achieving maximum production in the field is its relatively high gas-to-oil ratio (GOR). Horizontal drilling has been tested at Bouri to alleviate this problem. With this large amount of associated gas, this field is proving to be the country's greatest potential for natural gas production.

Agoco is planning to boost output at its **Sarir** field in the eastern part of Libya through water injection at the 7 billion barrel reservoir.

Domestic Refining

Libya's refining industry has expanded considerably since the early 1970's, when it operated a single 10,000 b/d refinery at **Marsa Al Burayqah**. In 1977, the 120,000 b/d **Az Zawiyah** refinery came on stream, and in 1984 the 220,000 b/d **Ra's Lanuf** refinery began operation. In 1985 a small unit at **Tobruk** was completed, and in 1986 a topping plant was added at **As Sarir**. Currently, Libya's total refining capacity is near 350,000 b/d.

A large percentage of the output at the Ra's Lanuf refinery supplies nearby oil-fired electric power plants along the coast, and provides feedstock to the local petrochemical plants. Az Zawiyah's product output meets about 70% of domestic demand in the Tripoli area, while part of the jet fuel, gas oil and naphtha production is aimed at foreign markets. The refinery also produces about 30,000 tons per year of lube oil that meets all of Libya's domestic needs.

A 220,000 b/d refinery at **Misratah** has been under consideration for a number of years, but plans have yet to proceed.

Petrochemicals

Phase I of the **Marsa al Burayqah** fertilizer complex began production in 1978, with all units completed in 1981. The complex produces ammonia, urea and methanol. The second phase, completed in 1985, doubled the capacities of each plant. Despite the fact that the complex is operating only at about 35% of its nominal capacity, production of urea and ammonia far exceed the domestic demand for such products.

The **Ra's Lunaf** complex came on stream in 1987 with a 330,000 tons/year capacity ethylene unit that uses naphtha from the nearby refinery as feedstock, a propylene unit and a butene unit. In 1989 a group of four companies led by the Yugoslavian company **Energoinvest** signed a $130 million contract for the construction of the four units that will make up the second phase of the Ra's Lanuf complex. These four units include

a butadiene recovery unit, an MTBE unit, a butane-1 unit and an aromatics unit. Construction is expected to be completed by late 1992.

Among the projects being considered, the biggest is a fertilizer complex at Sirte. It was reported in 1989 that the project would be smaller than the originally planned $1 billion complex. No tenders have yet been awarded.

FOREIGN INVESTMENTS

Oilinvest directs all of Libya's overseas oil refining and marketing investments. It currently sells about 300,000 b/d of crude oil and products and owns refineries and/or marketing interests in Italy, Switzerland, Greece, Spain, Hungary, and Czechoslovakia.

In early 1992, Oilinvest purchased 180 service stations for almost $50 million from the Italian firm **Cameli Petroli**. Libya now owns over 2,100 gasoline outlets in Italy.

Also in early 1992, Oilinvest took control of the Hamburg-based German oil products retailer **Hamburg Eggert Mineraloilhandels (HEM)**. Oilinvest's control of HEM will give it a direct outlet for products produced at the 70,000 b/d **Holborn Europa** refinery it operates in Hamburg. Oilinvest is currently working on plans to expand in Egypt and attempting to expand into France.

Libya has been working with Egypt on a plan to build a string of service stations that will carry Libyan petroleum products, including high octane gasoline, on the coastal highway between the cities of Alexandria and Salum in Egypt. Plans call for a 560 kilometer (336 mile) product pipeline to be built from Tobruk, Libya to Alexandria, Egypt.

NATURAL GAS

LNOC's Gas Projects Department is responsible for all gas exploration, development, production, processing and marketing operations. Most of Libya's gas is associated, and therefore production is largely governed by crude oil output. **LNOC** and **Agip** are assessing the feasibility of developing the natural gas structures at the offshore Bouri field in northwest Libya.

A $3.5 billion development plan is currently being drawn up. If determined to be economical, natural gas will be exported to Italy via a 583 kilometer (350 mile), 580 million cubic feet per day pipeline under the Mediterranean. More than 20 oil and gas finds have already been made in the vicinity of the Bouri Field.

Agoco awarded **MAN Guthofnungshuette** of Germany a $96 million contract to build a gas treatment plant at the **Sarir** oil field in early 1990. Work entails the building of six compressor stations and a gas treatment and purification plant for the supply of 75 million cubic feet per day of treated gas to the Great Man-Made River power station some 90 kilometers away. The work is scheduled to be completed in 1992.

Sirte awarded a contract to the Italian firm **Bonatti** for the construction of a gas gathering and treatment plant with a 75 million cubic feet per day capacity. It will draw gas from the **Al-Sumud** field near Marsa al Burayqah.

OTHER INVESTMENTS

Libya's major non-oil effort is the construction of the Great Man-Made River (GMR). Phase I of the GMR was completed in 1991 and includes an 1,100 kilometer (660 mile) pipeline that is four meters in diameter. The pipeline will interconnect the water wells in the Fezzan region in central Libya and carry the water to Tripoli at a rate of 71 million cubic feet per day (cu f/d). The whole project is expected to take 25 years to complete at a cost of over $27 billion. Once completed the five phase project is expected to carry 200 million cu f/d from the reservoirs under the deserts in central Libya to the coast, 70 million cu f/day to the north western system and 130 cu f/d to the north eastern region.

Lithuania

COUNTRY PROFILE

President: Algirdas Brazauskas (Acting)
Prime Minister: Bronislovas Lubys
Government: Republic; declared independence from Soviet Union March 11, 1990; independence recognized by Soviet Union September 6, 1991
Population (1989): 3.7 million
Size/Location: 25,200 square miles in Eastern Europe, bordering the Baltic Sea to the West, Latvia to the North, Belarus to the East, and Russia (Kaliningrad) and Poland to the Southwest
Ethnic Divisions (1989): Lithuanian (79.6%); Russian (9.4%); Polish (7%); all other nationalities (4%)
Major Cities: Vilnius (capital), Kaunas, Klaipeda, Panevezys, Siauliai

ECONOMIC PROFILE

Gross National Product (est. 1992 @ purchasing power parity rate): $15.1 billion in $1990
Currency: Talonas
Commercial Exchange Rate (10/22/92): US$1 = 246 Talonas
Major Trading Partners: (First half of 1992) Russia (47%), Ukraine (12%), Belarus (11%), Latvia (5%), Germany, Sweden, Poland, United States

ENERGY PROFILE

Energy Minister: Leonas Asmantas
National Energy Enterprise: Litovenergo
National Power Company: Lithuanian Electricity Board
State Enterprise - Gargzdai Oil Deposit Exploration: Gargzdai Oil Geology
Proven Oil Reserves (1989E): 150 million barrels
Oil/Gas Production (1991): negligible
Domestic Oil Consumption (1991): 110,000 b/d
Refinery Throughput (1991): 230,000 b/d
Proven Gas Reserves(1989E): negligible
Natural Gas Consumption (1991): 200 billion cubic feet
Coal Production (1991): none
Coal Consumption (1991): 600,000 short tons
Electricity Production (1991): 28.4 billion kilowatt hours
Electricity Exports (1991): 8.9 billion kilowatt hours

OIL AND GAS INDUSTRY PROFILE

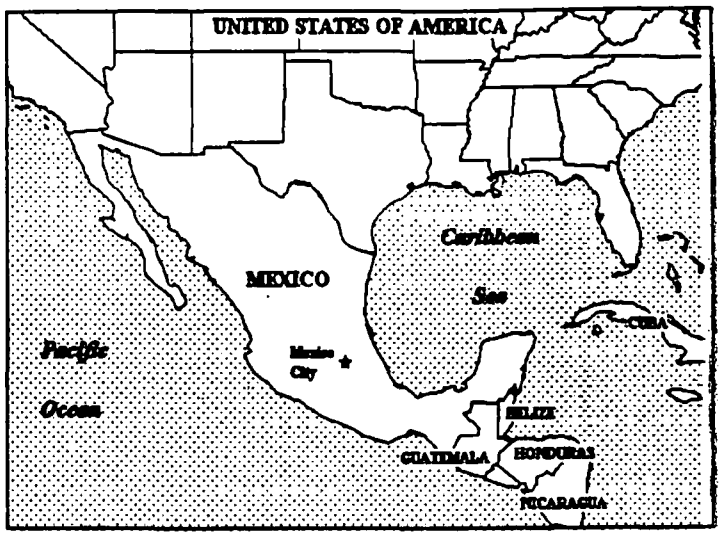
Major Oil Ports: Klaipeda. 1991 exports were 150,000 b/d refined products; ice-free port.
Major Gas Import Pipelines : West Siberia (Russia) to Vilnius
Major Oil Refineries: Mazeikiai (throughput in 1991 was 230,000 b/d; capacity is currently 260,000-280,000 b/d)

BACKGROUND

Lithuania has few oil, gas, or hydropower resources. As a result, it must import almost all of its primary energy from Russia, the other former Soviet republics, and Poland. Primary energy consumption is led by oil (45% in 1990, down from 66% in 1970), and natural gas (37% in 1990, up from 17% in 1970). On the other hand, Lithuania contains the only refinery in the Baltics and the second largest port in the region at Klaipeda, and generates a surplus of electricity for export from its nuclear and thermal power plants. The twin 1500-megawatt nuclear reactors at Ignalina are the largest in the world. However, the safety and reliability of the reactors at Ignalina, which are similar in design to those at Chernobyl, are cause for concern.

Lithuanian energy security is also a problem as oil supply shortages have disrupted Mazeikiai's operations. Lithuania's negotiations with Russia on security of energy supplies will include Russian access and transit fees charged for the port of Klaipeda. Lithuania is planning to build an oil import terminal to reduce its dependence on Russian oil, and could refine imported crude oil and re-export products for hard currency. Lithuania is planning to use Klaipeda to import products and reduce the dependency on Russian products; these imports are part of the coordination effort between Baltic energy ministers to coordinate a mutual energy policy to meet expected fuel shortages this winter. Compounding the problem of shortages its that like other republics of the former Soviet Union, Lithuania is far more energy inefficient than other European countries. Lithuania has also invited foreign investors to develop a distribution and service station network.

Mexico



COUNTRY PROFILE

Head of State: President Carlos Salinas de Gortari
Population(1990E): 86.1 million
Location/Size: N. America/764,000 square miles
Major Cities: Mexico City, Guadalajara, Monterrey
Major Import Products: Raw materials and intermediate goods (78%), capital goods (21.3%)

FINANCIAL PROFILE

Monetary Reserves (Non-Gold 6/91): $14 billion
Foreign Debt (1990): $98 billion
Gross Domestic Product (1990): $238 billion
Exchange Rate (9/91): US $ 1 = 3050 Pesos
Current Account Balance (1990): -$5.26 billion
Petroleum Export Revenues (1990): $10 billion
Oil Revenues / Total Revenues (1990): 37.7%

ENERGY PROFILE

Proven Oil Reserves (1991): 52 billion barrels
Oil Production Capacity (1991): 3.2 MMBD
Oil Production (1991E): 3.17 MMBD
Domestic Oil Consumption (1990E): 1.7 MMBD
Refining Capacity (mid-1991): 1.5 MMBD
Petroleum Exports (1991E): 1.4 MMBD
Natural Gas Reserves(1991): 73 TCF
Natural Gas Production (1990): 1.33 TCF
Petroleum Product Imports (1991E): 0.12 MMBD

OIL INDUSTRY PROFILE

Organization: Petroleos Mexicanos (PEMEX)
PEMEX Director: Francisco Rojas
Major Customers (1990): United States (56%), Spain (17%), Japan (11%), and France (4%)
Downstream Investment: A five percent share in Repsol - the state oil company of Spain.

RELATIONS WITH THE UNITED STATES

Mexico and the United States have maintained good relations since 1938. During the 1980's, Mexico ranked as one of the United States' top five oil suppliers. From 1980 till 1989, oil imports from Mexico averaged from 8 to 19 percent of U.S. net imports; representing from 42 to 52 percent of Mexico's total petroleum exports each year. During 1990, U.S. **crude oil imports** from Mexico averaged 689,000 b/d, and **products imports** averaged 66,000 b/d, while **U.S. product exports** to Mexico averaged 89,000 b/d. Mexico was one of the first countries to respond to President Bush's call for higher production to offset the loss due to the Persian Gulf crisis.

RECENT EVENTS

PEMEX, the state-owned oil company, has made remarkable progress in revitalizing Mexico's oil industry under President Salinas and **Francisco Rojas**, the Director of PEMEX. The removal of the corrupt union leaders controlling PEMEX, in early 1989, was the first critical step and cleared the way for market-oriented reforms. Rojas has restructured PEMEX, improved its fiscal condition, changed the focus to profits, and encouraged PEMEX to behave more like its private-industry counterparts. To lower costs and improve profitability, the work force was reduced from 213,000 to 150,000, operations streamlined, renewed emphasis placed on upstream invesment, and more sophisticated marketing techniques put into use.

The improved financial health of PEMEX and Mexico's natural resource wealth were keys in acquiring greater access to capital markets. In addition, attempts by PEMEX to loosen the barriers to foreign investment in Mexico's oil industry have allowed access to much needed technical expertise. Although Mexico's constitution does not allow foreign companies to hold equity in domestic oil resources, use of innovative financing arrangements have produced deals with foreign firms.

PEMEX's goals are to increase petroleum exports, develop Mexico's natural gas resources, lower domestic oil demand, increase profitability, and "depetrolize" the economy. Although PEMEX generates just 8% of Mexico's GDP, it accounts for about one-third of tax revenues and an equal portion of foreign exchange.

PEMEX ORGANIZATION

PEMEX was reorganized to decentralize bureaucracy, establish profit and cost centers, and to make management more effective and accountable in controlling operations. Three geographic regions were defined; northern (Poza Rica), central (Villahermosa), and maritime (Ciudad Carmen). Each region has 6 functional areas; exploration, production, drilling and maintenance, technical services, administration, and planning.

PMI (PEMEX's marketing arm), headed by **Pedro Haus**, administers the sale of petroleum. PMI began using futures contracts for products in 1989, and has accounted for 220,000 b/d of product traded so far in 1991. With PMI's successful use of product futures, the possibility of using crude futures is being evaluated. As part of a strategy designed to

modernize commercial policy and improve its market flexibility and scheduling, PMI has tested the use of spot crude sales and begun to charter tankers to service customers without the ability to lift cargos. PMI was credited with saving PEMEX $60 million in 1990.

Financial Developments

PEMEX's 1991 capital budget was $2.4 billion, 20 percent above 1990 spending. PEMEX has put together an aggressive 5-year capital spending budget of $20 billion. To finance this investment, PEMEX plans to raise $8 billion in the capital markets of Europe and the United States, arrange loans through the export/import banks of interested nations, and contract for services with payments made in product.

Using part of the extra revenue from the Persian Gulf war, PEMEX retired domestic debt of $850 million, and more than halved its external debt to $5.6 billion. Debt reduction, lower operating cost, and new tax structures – which let PEMEX more clearly show profits – have strengthened PEMEX's financial position and eased the acquisition of funds in capital markets. In September 1991, PEMEX raised $150 million through a seven-year Eurobond issue. PEMEX had previously raised an equal sum through a three-year bond issue in October 1990.

In early 1991, Mexico and the U.S. ExImbank agreed to a $5.6 billion, 5-year loan package ($1.3 billion in 1991) to be spent on exploration and production projects with U.S. companies. This amount represents over half of the export/import bank loans PEMEX had planned. In late 1991, opposition to the use of foreign contractors delayed the issue of more tenders, and could undermine U.S. involvement. The opposition is over the use of foreign contractors while Mexican firms are without work. New tenders are not expected until 1992.

Prior to the opposition, two contracts with U.S. companies had been arranged. In April 1991, **Triton Energy** signed a $14.8 million turnkey contract to drill in the Gulf of Campeche. The second was a contract with **Smith International** for drilling services and equipment.

Exploration and Production

Mexico has proven oil reserves of 56 billion barrels and estimates of probable reserves ranging from 250 to 700 billion barrels. No outside certification of reserves has been done since 1977. The mid-1980's policy, to allow crude production to decline to match domestic needs, reduced investment in exploration and field development and impeded the growth of crude production. Salinas reversed that policy, and directed PEMEX to increase exploration and production spending.

106 exploration/development wells were completed in 1990, down 13.8 percent from the previous year, but there was much evidence of a new surge in exploration. Wells spudded rose 61 percent in 1990 to 132, and footage drilled was up 75 percent to 1,726,916 feet. Areas with the most activity included Campeche Sound (31 wells), Villahermosa District (22 wells), and the Reynosa District (11 wells). In 1990, 14 of 43 exploratory wells drilled were successful – 10 oil and 4 gas. Two gushers were in Campeche Sound; Zaap-1 flowed 10,800 b/d, and Alux-1 flowed 5,623 b/d.

Crude production rose by 33,000 b/d in 1990 to 2.55 MMBD, and is expected to average 2.69 MMBD in 1991. Production of other liquids was 428,000 b/d in 1990 and should average near 450,000 b/d in 1991. Natural gas production was 1,333 billion cubic feet (BCF) in 1990 and is expected to be 1,350 BCF in 1991.

Offshore crude production is becoming a larger portion of petroleum output (all liquids), up to 60 percent in 1990 from 56 percent in 1985. The quality of crude is getting heavier also – 48 percent of total liquid production in 1990 was heavy, up from 43 percent in 1985. Onshore production, mainly light oils marketed as Isthmus Blend, is concentrated in the southeastern regions of Chiapas and Tabasco. Campeche Sound region accounted for 70 percent of Mexico's 1990 total liquid production. With onshore production declining, the immediate hope for increased production is offshore, which accounted for 80 percent of the recent increases.

The **Cantarell Project** in the Gulf of Campeche is an important undertaking by PEMEX. The project's goal is to maintain Maya crude production above one million barrels per day. The super-giant Cantarell geological complex has estimated recoverable reserves of 10 billion barrels, with 1990 production reaching 1.15 MMBD. Plans are to improve oil recovery by reducing back pressure with the installation of a new collection system and the drilling of 30 additional wells. Gas separation units will be installed on production platforms and connected to gathering centers. The Cantarell Project is estimated to cost in excess of $800 million.

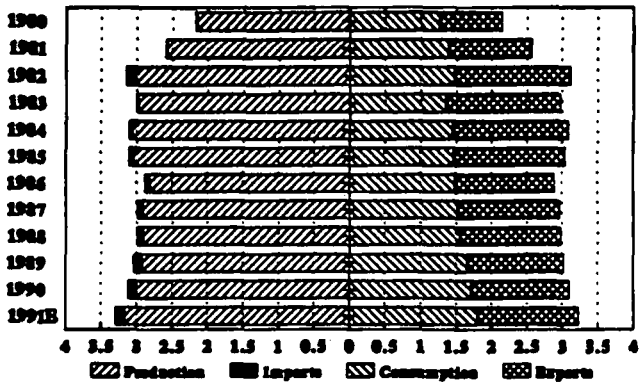
In 1991, ninety-two onshore and thirty-six offshore wells are expected to have been completed. Exploratory drilling has had a 40 percent success rate, which leads PEMEX to ask where is the "risk" in risk contracts, and to the viewpoint that PEMEX can purchase any required technical expertise without having to sell equity. Concerns have been expressed, some from inside PEMEX, that equity financing will be necessary to continue to increase production, in order to maintain exports, as domestic consumption grows. The risk politically for Salinas is substantial, as oil is seen in Mexico as a symbol of independence from the United States.

Consumption and Imports

Domestic consumption is rising by 7 to 10 percent a year, in 1990 averaging about 1.7 MMBD. Petroleum accounts for approximately 70 percent of Mexico's energy consumption. Gasoline is the fastest growing part of petroleum demand. Due to environmental and economic reasons driving restrictions were

imposed in Mexico City that prohibit the use of a car one day a week. PEMEX has also revised policy to allow the import of only unleaded gasoline with a maximum Reid vapor pressure of 9.5. Mexico's gasoline imports from the United States averaged 46,000 b/d during the first 10 months of 1991, more than twice the 20,000 b/d average for 1990.

Mexico's Oil Balance
(Million Barrels per Day)



In 1990 Mexico imported $850 million worth of petroleum products. Mexico recently signed a four-year contract to import 100 million cubic feet per day (mcf/d) of natural gas from Texaco, Conoco, Global Natural Resources, and Citizens, each with a one year deal. Extra spot purchases could boost gas imports to 240 mcf/d – the maximum capacity of the pipeline being used. Natural gas imports are expected to average 116 mcf/d in 1991, or three times the 1990 imports of 42.5 mcf/d. Greater use of natural gas is necessary to replace oil in and around Mexico City to reduce pollution. Pemex also plans to use more domestic natural gas production in Mexico City. Currently industrial users are the major natural gas market.

Oil Refining

Rojas has established new goals for refinery operation, placing emphasis on profitability. The old criteria was to meet domestic demand with little regard for costs, the new goal is to meet domestic needs at the lowest cost and market products at the highest price – regardless of the implications for imports or exports. At present PEMEX operates 6 refineries with a total distillation capacity near 1.5 MMBD. During 1991, three refineries – Poza Rica, Azcapotzalco (inside Mexico City), and Reynosa – a combined capacity of 150,000 b/d, were closed due to acute pollution problems. To offset the effects of these closures and to further ease pollution problems, a $750 million project is underway to expand and upgrade the Tula (near Mexico City) and Salina Cruz (Pacific coast) refineries. The project will add catalytic crackers, desulfurization and reformer units – boosting gasoline production capacity by 30,000 b/d. Two contracts for the Tula refining complex were reported in late 1991. Pemex awarded Bufete Industrial Construction a contract to add a 40,000 b/d cracker, with M.W. Kellogg, – a U.S. company which owns a 25 percent share of Bufete, to provide technical assistance. The second award was to the U.S. firms HRI and Texaco, which signed a contract to provide technical assistance for a 50,000 b/d sulphur removal unit.

$7 billion of PEMEX's 5-year, $20 billion capital budget, is for the construction and expansion of refineries, storage and transportation. Studies are under way that will determine which other refineries to expand and the types of capacity to add. A new 300,000 b/d refinery is planned, at a site not yet selected, with a cost of $2.5 billion and construction expected to take 4 years.

Petrochemicals

Petrochemical activities were consolidated into a single sub-directorate in 1990, headed by Raul Robles Sequra. As of January 1991, PEMEX had petrochemical production capacity of 20.1 million tons per year. In 1990, 17.65 million tons of petrochemicals were produced. Revenue from petrochemical sales was $1.3 billion, 12.5 percent of PEMEX revenue. Petrochemical production has rebounded from a dip in the late 1980's, as a result of insufficient investment. New investment of $5-7 billion, over the next 4 years, to modernize and construct new plants is believed necessary to keep Mexico competitive in the global market. Should the investment not be made, it is projected Mexico would need $9 billion of petrochemical imports by 1995. Because of its relatively low profile the petrochemical sector has served as a testing ground for new management strategies and techniques for foreign investment. If proven successful, corporate restructuring, along with the use of foreign financing and technology may be used as a role model for other parts of Pemex.

Under Mexican law only PEMEX can produce "basic" petrochemicals. Since 1986 the number of basic petrochemicals has declined from 60 to just 19, MTBEs being the most recent revision. "Secondary" petrochemicals are also defined, among which foreign ownership is restricted to 40 percent, unless a special trust is granted. The number of secondary petrochemicals has also declined dramatically, from 700 to 66. Red tape involved in obtaining a special trust has been reduced as well. Any petrochemical not defined "basic" or "secondary" is open to full foreign ownership.

$1 billion of PEMEX's 5-year capital pending plans is targeted to increase petrochemical production capacity. Twelve petrochemical projects are now being planned. Of these seven are plants to produce MTBE, which is crucial in reducing reliance on leaded gasoline. One of these plants will be built in an arrangement with ENI of Italy. Pemex will supply heavy crude to ENI and in return it will use the revenue to build a $350 million, 500,000 ton per year MTBE plant using ENI technology.

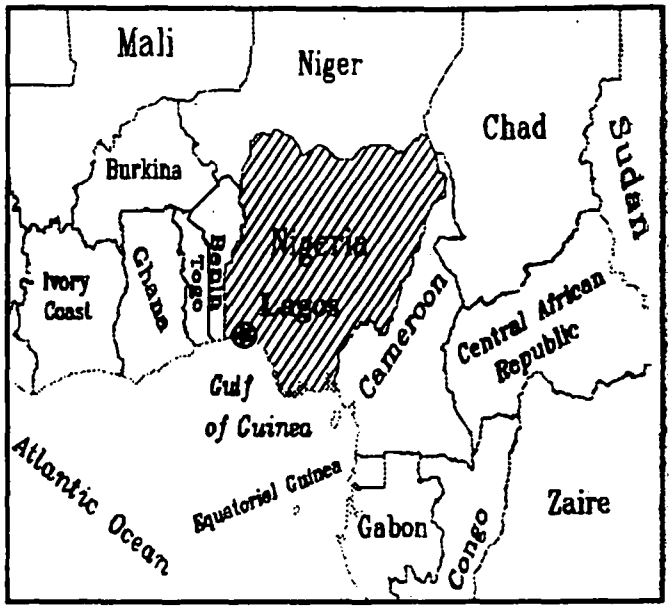
Nigeria

COUNTRY PROFILE

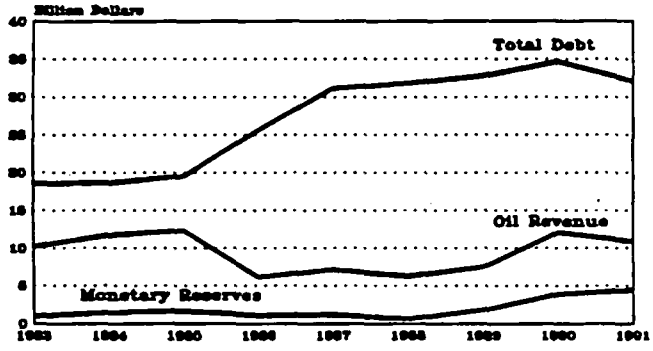
Head of State: General Ibrahim Babaginda
Population (1989): 105 million
Languages: English, Hausa, Ibo, Yoruba
Defense: Army (80,000); Navy (5,000); Air Force (9,500)
Religion: Muslim (47%), Christian (34%)
Location/ Size: West Africa/ 356,700 Sq. mi.
Major Cities: Lagos, Ibadan, Ogbomosho, Kano,
Import Products: Industrial goods, machinery, food

FINANCIAL PROFILE

Monetary Reserves (12/91, Non Gold): $4.4 billion
Foreign Debt (1991): $32 billion
Gross Domestic Product (1990): $26.6 billion
Currency: Naira
Exchange Rate (12/91): US $1 = 9.862 Naira
Current Account Balance (1991): $1.09 billion
Petroleum Export Revenues (1991E): $10.9 billion
Oil Export Revenue/Total Export Revenue(1991): 96%



Financial Trends



ENERGY PROFILE

Minister of Petroleum Resources: Chu Okongwu
Proven Oil Reserves (1992): 17.9 billion barrels
Production Capacity (1992): 2.0 million b/d
Oil Production (1991, all liquids): 1.95 million b/d
Crude Production Quota (2Q1992): 1.751 million b/d
Domestic Oil Consumption (1991E): 300,000 b/d
Refining Capacity (1992): 430,000 b/d
Petroleum Exports (1991E): 1.5 million b/d
Oil Exports to the United States (1991): 702,000 b/d
Natural Gas Reserves (1992): 104.7 trillion cubic feet
Marketed Gas Production (1991): 113 billion cubic feet
Major Ports: Lagos, Port Harcourt, Calabar, and Sapale
Major Fields: Forcados, Meren, Okan, Obagi, Oben

OIL INDUSTRY PROFILE

Organization: The Nigerian National Petroleum Co. (NNPC) manages the state-owned oil industry.
NNPC Chairman: Imo Itsueli
Major Oil Companies: Shell, Chevron, Mobil, Agip ELF, Ashland and British Petroleum.
Major Oil Customers: United States, Spain, France, and West Germany.

OIL INDUSTRY OVERVIEW

Nigeria is Africa's largest petroleum producer. The good yields and low sulphur content of Nigerian crudes are very attractive to refiners. Oil was discovered in the 1950's, oil exports began in 1958, and Nigeria joined OPEC in 1971. Since 1973, revenue earned from petroleum has provided around 90% of Nigeria's total export earnings and about 70% of federal government revenues.

The Babangida government, in power since August 1985, has been successful in promoting investment in oil exploration, expansion of production capacity, and development of natural gas resources. Nigeria has taken an aggressive role in encouraging investment through the introduction of more competitive methods to sell oil concessions and incentives for companies to invest. Nigeria's goals are to increase oil reserves to 20 billion barrels, raise production capacity to 2.5 million barrels per day (MMBD) by 1995, expand downstream operations, utilize natural gas resources, and diversify sources of income.

In late 1991, NNPC was reorganized into five divisions: **National Petroleum Investment & Management Services** (NAPIMS); **Corporate Upstream Development**; **Refining and Petrochemicals**; **Commercial and Investment**; and **Corporate Services**.

RECENT OIL DEVELOPMENTS

Nigeria is trying hard to ensure its position as one of the most active countries in oil investment. In acknowledgement of the higher costs incurred to find and develop new reserves, NNPC raised the minimum margin of return on investments that increase oil production capacity, from $2.00/bbl to $2.50/bbl. Incentives for offshore exploration and development have also been improved. In negotiating final agreements with winners of deepwater offshore blocks, NNPC has indicated that its rates on taxes and royalties will be reduced from 85% to 50%. Companies working offshore include Conoco, Mobil, Shell, Agip, ELF, Ashland, and a joint venture between Statoil and BP. Production of 500,000 b/d offshore is possible by early next century.

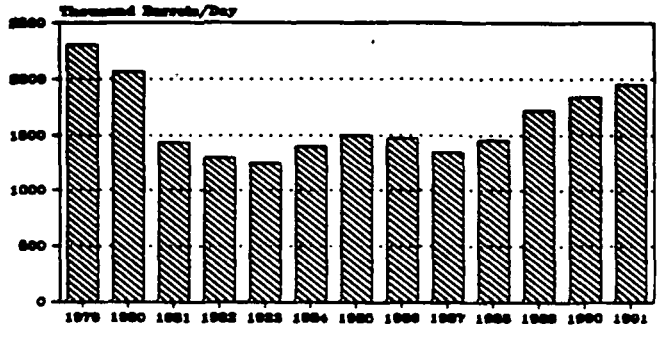
NNPC plans to end its use of joint venture contracts and convert to production-sharing agreements. This change will relieve NNPC of its capital-funding requirements. In 1990, to fund its capital requirements, NNPC sold a 20 percent share of its main oil concessions (NNPC-Shell) for $2 billion. Shell bought 10 percent, increasing its total share to 30 percent; while Agip and ELF both purchased 5 percent shares.

Oil Production and Exports

The bulk of Nigerian production comes from three joint ventures: **NNPC-Shell, Elf, Agip** -- 1,000,000 b/d; **NNPC-Chevron** -- 300,000 b/d; and **NNPC-Mobil** -- 300,000 b/d. Most production is from small reservoirs, located in the Niger delta region, and the Benue and Benin basins, in southeastern Nigeria.

Exports to the OECD account for most of Nigeria's exports. In 1991, Nigerian oil exports averaged 728,000 b/d to Western Europe, and 702,000 b/d to the United States.

Total Production
(All Liquids)

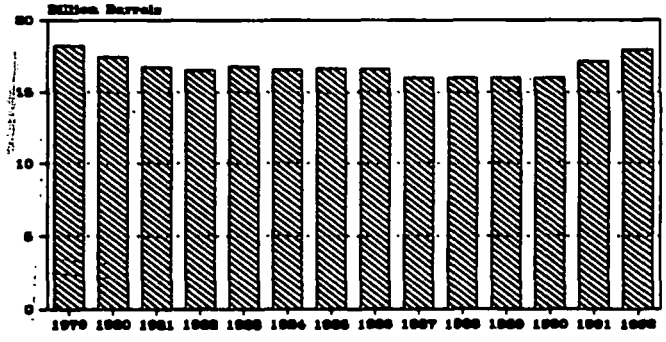


Oil Exploration and Development

The boom in exploration and development which began in the mid-1980's is expected to continue through the mid-1990's. Spending by oil companies increased by 30% in 1991. Of 136 blocks offered in the 1991 bidding round, 61 were awarded -- 23 in the Niger delta (some offshore), 27 in the Benue basin, 4 in the Benin basin, and 7 deep-water.

Shell's capital spending was $1.5 billion in 1991. Plans are to spend $6.6 billion over the next five years, boosting the company's production capacity to 1.3 MMBD by 1996. Shell has discovered and is developing many fields (Tunu, Ea, Okoroba, Agbaya, and Oyhor) and has won rights to two deep-water blocks. Another project is the **Sapale** field -- a 700 million barrel reserve of heavy crude, being developed using a condensate soak. Upgrading of treatment, transportation, and storage facilities is also planned.

Proven Oil Reserves



Mobil plans to raise production capacity by 225,000 b/d to 525,000 b/d by 1995, and to add over 500 million barrels to oil reserves. Mobil brought on-stream the **Edop** and **Lyak** fields in 1991. Edop, developed at a cost of $600 million, has a 700-million barrel reserves. Current Edop production is 50,000 b/d, with increases to 165,000 b/d expected within 3 years. Lyak has a 146-million barrel reserve, and production should reach 52,000 b/d by 1993. Mobil's two recent finds, **Yoho 1** and **Oman 1**, are estimated to contain 500 million barrels of oil reserves. The goals of the $900 million **Oso** gas/condensate project are to eliminate gas flaring and to produce 100,000 b/d of condensate, with a planned start-up in late 1992. Condensates are not counted in OPEC production quotas.

Chevron plans to spend $2 billion over the next 5 years on exploration, development, and production in Nigeria. Planned spend- ing for 1992 is $500 million. Eight new fields are to begin production by 1993. Production is expected to reach 400,000 b/d by 1995.

ELF plans to spend $1.7 billion over the next 5 years. Development of its offshore fields -- **Afia, Odudu, Ime,** and **Edikan** -- is the main goal. ELF expects production to double by 2000 to 200,000 b/d. The **Olo** and **Ibewa** fields will be developed with associated gas to supply a LNG project in Rivers State.

Ashland Oil in early 1992 signed a 5-year production sharing contract to explore two offshore blocks with 250-600 ft depths, 25 miles from Brass River. In Nigeria since 1974, Ashland produces about 26,000 b/d from 2 blocks one of which is offshore.

British Petroleum is returning to Nigeria after an 11 year absence. BP, and partner **Statoil**, were awarded two offshore blocks in the Niger delta basin last year. BP's assets were nationalized in 1979 because of alleged trade violations with South Africa.

The **Nigeria Petroleum Development Co.** (NPDC) plans to put nine wells in the **Oredo** oil field into operation during 1993. NPDC is also developing **Oziengbe**, which is still not fully defined, but may offer sizeable oil, gas, and condensate potential.

To get domestic firms involved, 17 Nigerian firms were awarded shallow water blocks in last years bidding round. The firms are seeking partners for capital and technical aid.

Oil Refining

NNPC has had a 20-year monopoly on refining in Nigeria. Over the last few years product imports have been required due to chronic problems at domestic refineries. In April 1992, it was reported that $16 million per day was being spent to import products. Low domestic fuel prices and a lack of pipe- lines have discouraged investment and led to smuggling into neighboring countries. Tenders for a 625-mile pipeline network to connect Nigeria's four refineries have been issued.

Nigeria's four refineries (three currently operating), have a design capacity of 430,000 b/d. These include: the 150,000 b/d **Rivers State** and the 60,000 b/d **Alesa Eleme** (closed in 1991, to reopen in early 1993) refineries at Port Harcourt, the 120,000 b/d refinery at **Warri**, and the 100,000 b/d refinery at **Kaduna**.

Nigeria has pursued foreign investment in export-oriented refineries. The former Petroleum Minister, **Jibril Aminu** had stated that exporting solely products is a future goal. Investors are being sought for a planned 100,000 b/d refinery and MTBE plant at Bonny Island. Construction costs for this project are put at $1-1.2 billion.

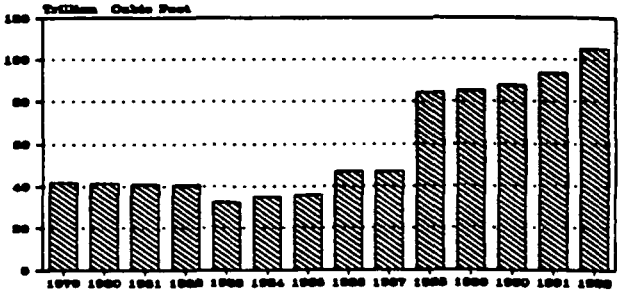
Petrochemicals

The $1 billion **Eleme** petrochemical complex in Rivers State is expected to start operations by 1993. **Foster Wheeler** has managed the project since construction began in 1974. The project has overcome many delays and finan- cial setbacks. **Chiyoda Corp.** is constructing an olefins plant to produce 300,000 metric tons per year (mt/y) of ethylene and 90,000 mt/y of propylene. **Kobe Steel** is constructing a 250,000 mt/y polyethylene/butene complex. **Tecnimont & JGC Corp.** is building a 80,000 mt/y polyproplene unit, that is expandable to 120,000 mt/y.

NATURAL GAS

Nigeria's natural gas reserves of 105 TCF, and are more plentiful than its oil reserves. Gas production was 1.38 TCF in 1991, however, only 0.113 TCF were marketed, while nearly 0.8 TCF were flared. Electricity generation and fertilizer production are the main markets for natural gas. Nigeria raised the fines for flaring gas and wants to encourage construc- tion of infrastructure to capture gas resources, but low domestic prices provide little incen- tive for the large capital investment needed.

Natural Gas Reserves



A 220-mile pipeline from Escravos to Lagos, operated by Shell, was completed in 1988. A project to build a pipeline north to Kaduna for potential industrial users would cost an estimated $500 million. Both of these projects have been hampered by the low price of natural gas and the lack of capital.

Chevron and NNPC will start a project to gather associated gas from the Okan, Mefa, and Delta fields off Escravos in 1992. The first stage will cost $400-500 million. Plans to process 140-150 million cubic feet per day (MCF/D) by 1995, with increases to 500 MCF/D over the next 10 years are planned as more fields are included.

Nigeria's most promising opportunity to utilize natural gas resources and diversify sources of income is the export of liquified natural gas (LNG).

LNG

Nigeria Liquified Natural Gas Ltd. (NLNG) manages the country's LNG operations. NLNG ownership is: 60% NNPC, 20% Shell, and 10% each Agip and Elf Aquitaine. During April and May of 1992, NLNG signed LNG supply contracts, beginning in 1997, with companies in France, Spain, and Italy. **Gaz de France** agreed to purchase 500 million cubic meters per year for 22 years. Spain's **Enagas** signed a $2 billion, 22-year contract for 1 billion cubic meters (BCM) per year.

The **Italian National Electricity Co. (ENEL)** signed an $8.3 billion, 20-year contract for 3.7 BCM per year. Negotiations are also in progress with **Distrigas** of the United States to supply 700 million cubic meters per year for 22.5 years.

Total cost of the two-train, 5.7 million tonnes per year plant, to be built at Bonny in south- eastern Rivers State, is estimated at $4.1 billion.

DOWNSTREAM INVESTMENT

Efforts to acquire downstream assets have proven elusive for Nigeria. A potential agreement with **Farmland Industries** (U.S.) that collapsed at the last moment would have given NNPC a 49 percent share in the 60,000 b/d refinery at Coffeyville, Kansas in exchange for 20 years of crude supply. Another agreement nearly signed was with **PetroMed** of Spain. The deal would have formed a joint venture, **NigerMed**, to process Nigerian crude at PetroMed's 120,000 b/d Castellon refinery.

Nigeria has held equity-for-crude talks with Sun, ARCO, Mapco, ELF and others. Recent efforts with Phibro, for 20% of its down- stream assets have also stalled. Other discussions have included a possible refinery investment deal with Argentina and a proces- sing arrangement with Trinidad & Tobago.

Russia

COUNTRY PROFILE

President: Boris Yeltsin
Population (1989): 147 million
Size/Location: 4.6 million square miles from Eastern Europe across 11 time zones to Asia and the Pacific Ocean
Ethnic Divisions: Russian (81.5%), Tatar (3.8%), Ukrainian (3.0%), and 100 other nationalities (11.7%)
Major Cities: Moscow (capital), St. Petersburg, Nizhniy Novgorod, Nobosibirsk, Kuibyshev, Sverdlovsk
Major Trading Partners: Eastern Europe, other republics of the Commonwealth of Independent States (CIS)

ECONOMIC PROFILE

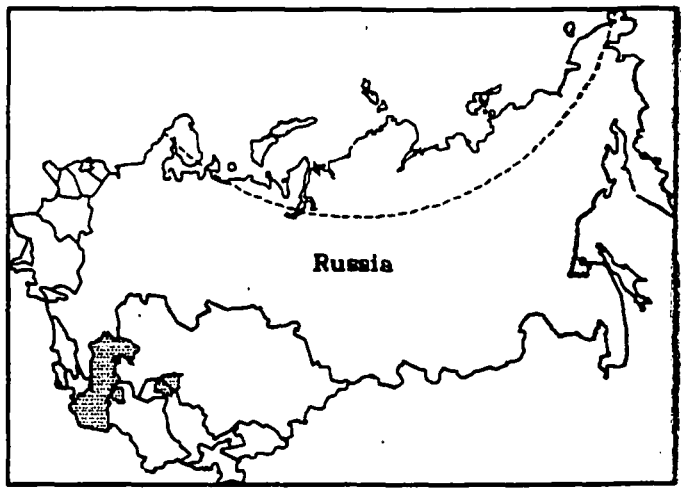
Gross Domestic Product (1991): 1130 billion rubles
Currency: Ruble
Commercial Exchange Rate (10/27/92): US$1 = 393 Rubles
Energy Export Revenues (1991): $13.4 billion
Energy Exports as Percent Merchandise Exports (1991): 36.3%

ENERGY PROFILE

Minister of Oil: Viktor Chernomyrdin
Proven Oil Reserves (1989E): 43 billion barrels
Oil Production (1992E): 7.9 million barrels per day (b/d)
Domestic Oil Consumption (1992E): 5.2 million b/d
Refinery Throughput (1991): 5.7 million b/d
Petroleum Exports (1992E): 2.7 million b/d
Proven Gas Reserves(1989E): 1,200 trillion cubic feet (Tcf)
Natural Gas Production (1992E): 22.7 Tcf
Natural Gas Consumption (1992E): 17.0 Tcf
Natural Gas Exports (1992E): 5.7 Tcf
Coal Production (1992E): 382 million short tons (MST)
Coal Consumption (1992E): 400 (MST)

OIL AND GAS INDUSTRY PROFILE

Organization: Rosneftegas (State oil corporation); Nafta Moskva, formerly Soyuznefteexport (State crude exporter); Transneft (State pipeline company); Gazprom (State gas producer).
Major Customers: Eastern and Western Europe and other republics of the Commonwealth of Independent States (CIS)
Major Oil Fields: Samotlor, Fedorovo, Ust-Balyk, and Mamontovo (West Siberia); Romashkino (Volga-Urals)
Major Gas Fields: Urengoi, Yamburg, Zapolyarnoye, Bovanenko, Medvezh'ye (in Western Siberia), Orenburg (Volga-Urals),
Major Oil Ports: Novorossiysk, Tuapse, St. Petersburg
Oil Export Pipelines (Capacity): Druzhba (Friendship) Pipeline to Eastern Europe (1 million b/d products)
Major Gas Export Pipelines (Capacity): Soyuz, Urengoi (Brotherhood), and Progress (1.0 Tcf each); Northern Lights (0.8 Tcf); Shebelinka-Izmail (0.7 Tcf); West Ukraine (0.1 Tcf)
Major Oil Refineries (1991 throughput): Ufa (600,000 b/d), Kuybyshev-Novokuybyshevsk (560,000 b/d), Omsk (460,000 b/d), Angarsk (440,000 b/d), Novo-Gor'kiy (420,000 b/d), Kirishi (420,000 b/d)



HISTORICAL BACKGROUND

The Russian Republic was formed on November 7, 1917 and joined the Union of Soviet Socialist Republics (USSR) on December 30, 1922. With more than three-quarters of the area of the USSR, half the population, the majority of energy and industrial production, and enormous military power, Russia was the most important of the Soviet republics. The dissolution of the Soviet Union in December 1991 created the need for a new system of economic, political, and military relationships between Russia and the smaller republics.

Russia has since assumed much of the power that was the Kremlin's, and retains a prominent position in the Commonwealth of Independent States (CIS), a loose confederation of former republics. Russia itself is a federation that includes 20 autonomous republics and 49 administrative units known as oblasts, several of which have sought greater independence and control over their resources. In particular, the Tatarstan and Chechen-Ingushetia republics and the Tyumen oblast are significant oil producers.

The dominant concern of the current government under Boris Yeltsin is its economic reform program. The conservative Congress of Peoples Deputies, however, advocates a more gradual transition to a free market system. For this reason, reformers are seeking to postpone the next session of the Congress (scheduled for December 1992) for several months to give reform measures a chance to work.

Some key elements of economic reform are already in place, including:

Privatization - In October, 1992, the government began issuing vouchers for purchasing shares in state-owned factories, stores, and other enterprises. An experimental program for privatization of land was added later.

Price Controls - State price controls on oil were removed in response to pressure from the International Monetary Fund (IMF), resulting in a doubling of domestic oil prices in September 1992. The government promised no further increases until the end of 1992, and included tax provisions which effectively limit how quickly prices will rise.

Exchange Rates - A single, unified market exchange rate was introduced in July 1992. The rate is determined by twice-weekly auctions and replaces several government-set exchange rates. However, full ruble convertibility is not expected to be introduced before the end of 1993.

OIL AND GAS INDUSTRY

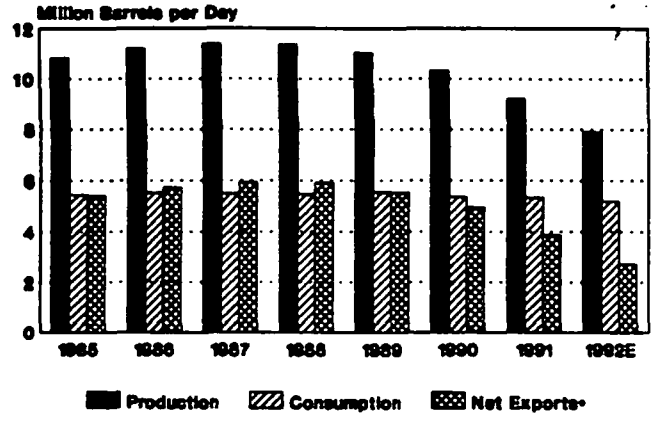
Russian oil production is centered mainly in West Siberia, specifically the Tyumen Oblast. Production in the older Russian oil fields in West Siberia is declining. Russian oil exports to Eastern Europe are transported primarily by pipeline, and to Western Europe via tanker through ports in the Black Sea and the Baltics. In the face of continuing declines in production, and with more than 20,000 oil wells reportedly idle, Russia announced in September it would cut exports to other former Soviet republics by up to 50 percent in 1993, while maintaining hard-currency sales to the West.

Russian natural gas production, like oil production, is concentrated in West Siberia, particularly the giant Urengoi field. Vast amounts of natural gas are also believed to lie beneath the Arctic Ocean. Russian natural gas export capacity is now limited to the area of Europe served by pipelines from western Siberia and the Urals. Future possibilities include links to Japan and Korea. For both oil and natural gas, future production will come largely from relatively inaccessible fields, necessitating a major exploration and development effort requiring huge investments of capital. The World Bank estimates between $17 and $24 billion in capital will be needed over the next 8 years just to maintain current Russian oil output, and is negotiating a $500 million loan for rehabilitating three western Siberian oil fields.

Russian refineries are relatively antiquated and technically unsophisticated, operating at a much lower capacity utilization rate than their counterparts in the United States. In addition, Russian refineries have much less reforming and cracking capacity than U.S. refineries, meaning that a much lower percent of distilled crude can be turned into light products. Most Russian refineries rely on western Siberian crude delivered by pipeline. Most refined products are transported by train, although several refineries in the Volga-Urals region are connected to the Druzhba (Friendship) product pipeline.

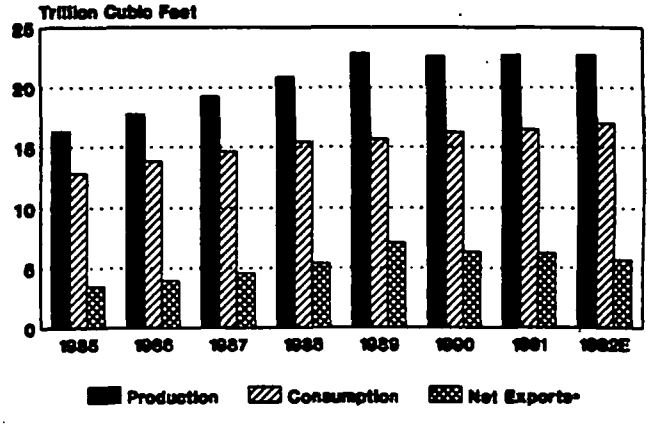
The energy sector is a top priority in the government's reform efforts, largely because oil and gas exports are the primary source of hard currency. An energy policy approved in September 1992 encompasses new energy

Petroleum
Production, Consumption and Exports



*Including inter-Republic trade

Natural Gas
Production, Consumption and Exports



*Including inter-Republic trade

legislation; reequipment of the industry; a fiscal structure approximating market conditions; and state regulation of finances, industry development, and environmental protection. The policy is to be implemented in three stages. An initial 10-to-15-month crisis management program to stop the annual decline in production will be followed, at the end of 1993, by a regulated market in which the industry will be "de-monopolized". The final stage will focus on developing industries which are less energy-intensive.

Under a draft decree to restructure the oil industry, the existing oil-producing associations would be reorganized into joint-stock, integrated oil companies under a newly created holding company outside the Fuel and Energy Ministry.

Investment from abroad has proceeded cautiously so far, in part because petroleum legislation, which would define ownership of natural resources and the basis on which Western companies can do business, has not yet been approved. In addition, exporters are currently required to register with the Foreign Economic Relations Ministry and to pay export tariffs many argue are frustrating their efforts to aid the ailing industry. Nevertheless, as of October 1992, companies from the United States, Canada, Europe, the Middle East, and elsewhere were operating 12 joint ventures in Russia's oil and gas industry and had signed many more agreements for future investments. Most of these projects are in the relatively mature European region of Russia and are heavily oriented towards fields that have been underdeveloped. They include well workovers; horizontal drilling; enhanced oil recovery; and upgrading of refineries, pipeline grids, and other downstream infrastructure.

In July 1992, Russia joined the Caspian Pipeline Consortium with Kazakhstan, Azerbaijan, and Oman to construct a pipeline to transport Caspian Sea crude to world markets.

ECONOMIC DEVELOPMENT

Russia is seeking a $24 billion aid package from the West to assist its transition to a free-market economy and establish a ruble stabilization fund. Progress to date includes:

-Humanitarian and medical loans from the European Community totaling almost 550 million ECUs have been approved.

-A $1 billion International Monetary Fund (IMF) credit was approved in August 1992 (Russia is negotiating a standby IMF credit of up to $4 billion and a $6 billion ruble stabilization fund)

-A $1.15 billion package of U.S. agricultural credit guarantees ($900 million) and food aid ($250 million) was announced in September 1992, plus $417 million in cash assistance for economic reform under the Freedom Support Act.

Other countries have been less forthcoming with aid. Japan's reluctance is linked to territorial disputes over the Kuril Islands, while a German study argues that Russia does not yet meet the political and economic conditions necessary for any major aid program to succeed.

Saudi Arabia

COUNTRY PROFILE

Head of State: King Fahd ibn Abdul Aziz as-Sa'ud
Population (1990): 14.9 million
Language: Arabic
Religion: Muslim
Location/Size: Persian Gulf/830,000 square miles
Defense: Army 72,300; Air Force 16,500; Navy 7,800; National Guard 10,000 (+20,000 reserves, 26,000 tribal levies)
Major Cities: Riyadh, Jeddah, Mecca
Major Import Products: Industrial goods (25%), metal (16%), food (15%)

FINANCIAL PROFILE

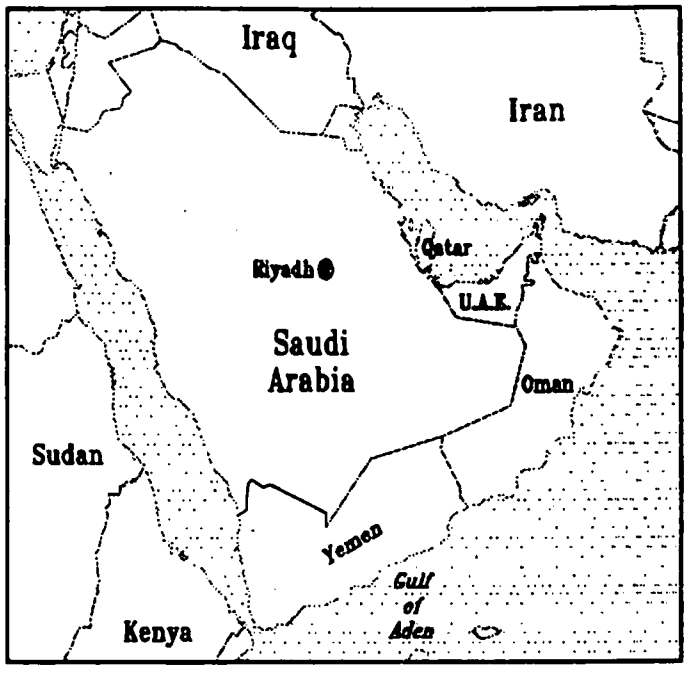
Monetary Reserves (Non Gold, 1991): $11.7 billion
Gross Domestic Product (1991): $101.5 billion
Currency: Riyal (SR)
Exchange Rate (1/93): US$1 = SR3.745
Current Account Balance (1991): -$22.81 billion
Petroleum Export Revenues (1991): $47 billion
Petroleum Exports/Total Export Revenues: 94%

ENERGY PROFILE

Minister of Petroleum and Mineral Resources: Sheikh Hisham Mohi ed-Din Nazer
Proven Oil Reserves (1/1/93E): 258 billion barrels
Oil Production Capacity (1992E): 9.5 million b/d
Oil Production* (1992E): 9.2 million b/d (8.6 million b/d crude)
OPEC Quota* (1Q93): 8.395 million b/d (crude only)
Domestic Oil Consumption (1991): 1.1 million b/d
Refining Capacity (1/1/93): 1.6 million b/d
Petroleum Exports (1992E): 8.1 million b/d
U.S. Imports (1992E): 1.7 million b/d
Natural Gas Reserves(1/1/93E): 183 trillion cubic feet
Natural Gas Production/Consumption (1991E): 1.2 Tcf
Major Customers: Japan, Western Europe, United States
** Including 1/2 Neutral Zone*

OIL INDUSTRY PROFILE

Organization: The Supreme Petroleum Council governs the nationalized oil industry, which includes: *Saudi Arabian Oil Co. (Saudi Aramco)* - crude production; *Saudi Arabian Marketing and Refining (SAMAREC)* - refining and marketing; *Saudi Basic Industries Corp. (SABIC)* - petrochemicals; *Star Enterprise* - 50/50 joint venture with Texaco (U.S.); *Han-Saudi Oil Refining Co.* - 35/65 joint venture with Ssangyong (South Korea)
Major Oil Fields: Ghawar, Abqaiq, Safaniya, Barri
Export Refineries (Capacity): Ras Tanura (265,000 b/d) Jubail/Shell (284,000 b/d), Yanbu/Mobil (300,000 b/d), Rabigh/Petrola (332,500 b/d)
Export Pipeline: East-West Pipeline (Petroline), 3.2 million b/d
Ports: Dammam, Gizan, Jeddah, Jubail, Ras Tanura, Yanbu



RECENT DEVELOPMENTS

Saudi Arabia has maintained relatively high oil production levels since it brought excess capacity online in response to Iraq's invasion of Kuwait in August 1990. The Kingdom is pursuing programs to expand production capacity, upgrade refineries, expand its tanker fleet, and make downstream investments with foreign partners that will ensure future markets for its crude production. Aramco's ongoing maintenance and drilling program has added capacity through infill drilling, flow-line expansions, and facility refurbishment. By the end of 1993, new output facilities are expected to add 1 million b/d or more from expansion of the offshore Marjan field and from water injection at Hawiya, part of the onshore Ghawar structure.

During 1992, Saudi Aramco began a joint feasibility study with a consortium of Japanese companies for a 50-percent joint venture for refineries in Saudi Arabia (300,000 b/d) and Japan (450,000 b/d). Saudi Arabia also became involved in the manufacture of the fuel additive methyl tertiary butyl ether (MTBE). The first MTBE unit within a Saudi refinery began operating at the joint venture Mobil refinery at Yanbu in August 1992. SABIC also has several projects already built or under construction.

With the dissolution of the Soviet Union in December 1991, Saudi Arabia became the world's largest oil producer. Already the largest

exporter and holder of the majority of the world's excess production capacity, the Kingdom has a major influence on the world oil market. Saudi Arabia maintains a moderate oil price policy, generally opposing price increases of the magnitude that would trigger demand cutbacks. It also opposes the European Community's carbon tax proposal on the grounds it would unfairly siphon off revenue from oil exporters.

Since 1988, Saudi Arabia has been the largest single source of oil imports for the United States, providing 27 percent of U.S net imports in 1991 (1.7 million b/d in the first 10 months of 1992). Since August 1990, the United States has agreed to sell Saudi Arabia $25 billion in defense equipment. Recent Saudi investments in the United States include acquisition of United Press International and significant shares in Citicorp and Chase Manhattan.

During 1992, border disputes with Yemen and Qatar strained Saudi relations with its Persian Gulf neighbors. The dispute with Qatar was resolved in December, while discussions with Yemen are continuing. In March 1992, Saudi Arabia had sent warning letters to international oil companies exploring in disputed areas of northern Yemen. In response, BP temporarily suspended its offshore Red Sea operations, but other companies continued operating without incident.

OIL PRODUCTION

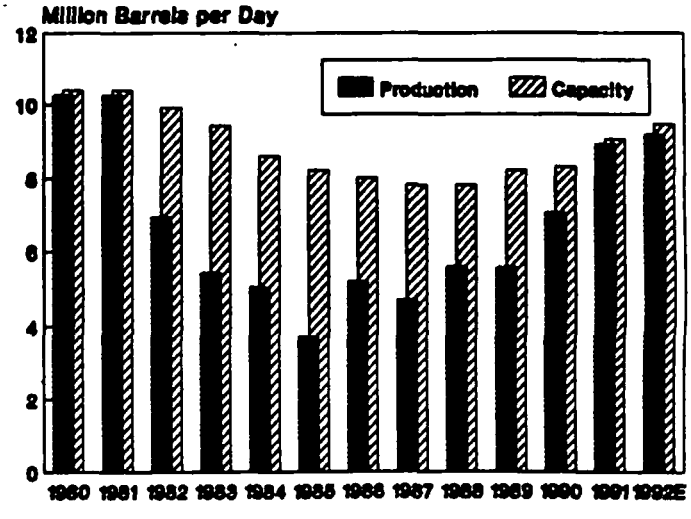
Saudi Arabia is the world's largest exporter of crude oil, and there is no reason to expect a change in this position in the foreseeable future. It has relatively low domestic petroleum consumption, its crude production levels exceed that of every other country on earth, it has an aggressive production capacity expansion program, and its proven oil reserves account for more than a quarter of the world's total. Saudi Arabia's planned development of natural gas reserves for the domestic market is designed to fuel economic growth with minimal impact on oil export revenues.

Most of Saudi Arabia's oil is produced on behalf of the Saudi Government by the Saudi Arabian Oil Company (Saudi Aramco). Saudi crude is currently produced exclusively in the coastal area of the Eastern Province. More than half of Saudi Arabia's current production capacity is located in the giant Ghawar field, the largest oil-producing field in the world. Arab Light oil from the Ghawar field, the Abqaiq field, and other smaller fields in the area is processed at Abqaiq, Saudi Arabia's main processing center. Arab Heavy is produced primarily at Safaniya, the largest offshore field. The Barri field produces Extra Light crude oil, and the Zuluf field is the main producer of Arab Medium. Saudi Arabia also shares production from the Neutral Zone with Kuwait. Crude production is routed either to shipping terminals (Ras Tanura and Jubail on the Persian Gulf, Yanbu on the Red Sea) or to refineries for processing. The major export refineries are located in Rabigh, Ras Tanura, Yanbu and Jubail. There are also domestic refineries at Yanbu, Jeddah and Riyadh.

Recent exploration activity has identified reserves in the Central region, coastal areas of the Red Sea, and along its southern borders. Although exploration traditionally has not been a high priority, Saudi Aramco increased its exploration activities in the early 1990s. Its focus is on light crude, delineation of resources, and identification of natural gas along the Red Sea. The Kingdom is also pursuing exploration and development of frontier areas bordering Yemen, Jordan, and Qatar and plans to expand or sustain production from existing areas such as the Abqaiq, Ghawar, and Safaniya fields.

Although seven discoveries made in Central Arabia during 1989-90 are now estimated to contain much less oil than originally expected, they do include some high-quality (48-gravity, 0.06% sulfur) crude oil in the Hawtah field

Total Liquids Production* and Capacity



*Includes 1/2 Neutral Zone

(planned for development by 1994). Saudi Arabia is planning a pipeline network to link the smaller fields with a trunkline running from Hawtah south of Riyadh to the East-West Pipeline, and has begun a construction project to expand the capacity of the East-West Pipeline from 3.2 million b/d to 4.7 million b/d. The new field configuration would produce a high-quality blend named Arab Ultra Light. Longer-term projects include expansion of the lighter reservoir at the offshore Zuluf field and development of the Shayba field on the border with the United Arab Emirates.

Saudi Aramco conducted its first-ever international borrowing in March 1992, with two loan agreements totalling $2.9 million (a $2.0 million general purpose loan for 4 years and a $900,000 loan to finance tanker purchases over 10 years).

DOWNSTREAM ACTIVITIES

Saudi Arabia is in the process of overhauling its refineries, with work concentrated on Samarac's domestic refineries and Aramco's export refinery at Ras Tanura, whose output was cut significantly as a result of a fire in late 1990. In later phases of the program, the three joint venture export refineries will also be upgraded and expanded.

Saudi Arabia is vertically integrating its petroleum industry through downstream investments on a global scale. Its long-term target is to acquire up to 3 million b/d in overseas refining capacity and outlets. Its first venture - Star Enterprise of Houston - was formed as a 50-percent joint venture with Texaco in 1988. Star Enterprise controls Texaco's U.S. refining and marketing in 23 southern and eastern states and has contracts to buy up to 600,000 b/d of Saudi crude oil. In 1991, Saudi Arabia entered into another joint venture - this time with South Korean company Ssangyong. Saudi Arabia holds a 35 percent share of the company and a crude supply contract for up to 300,000 b/d.

Saudi Arabia maintains stocks near consuming markets in the Caribbean, Northwest Europe, and the Mediterranean. In 1992, it owned or leased storage capacity totalling 20-25 million barrels and reached an agreement on a plan for 40 million barrels of storage in South Korea.

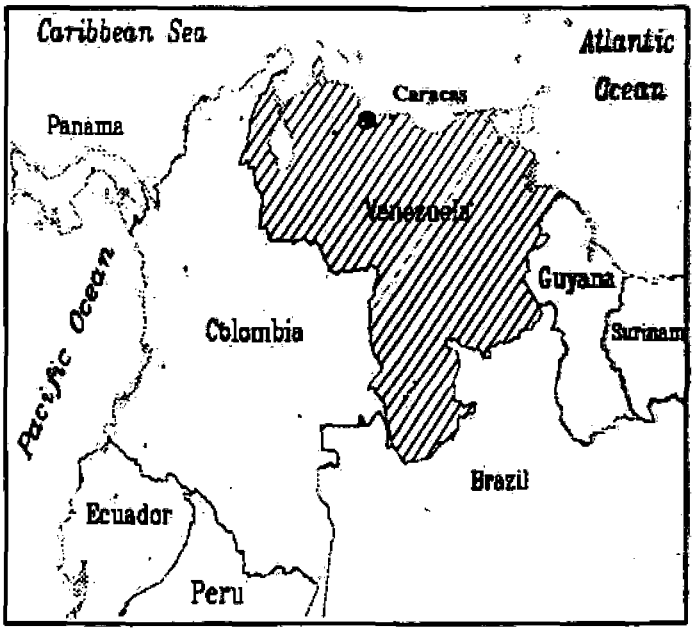
ECONOMIC AND POLITICAL DEVELOPMENTS

Saudi Arabia drew heavily on its monetary reserves to finance its share of Operation Desert Shield/Desert Storm and, for the first time in its history, had to seek external borrowing and issue domestic treasury instruments. The Persian Gulf crisis cost the Kingdom about $55 billion between August 1990 and the end of 1991 (according to Saudi government estimates). In November 1992, Saudi Arabia contributed $30 million to a United Nations escrow account to pay for U.N. operations in Iraq and Kuwaiti war reparations.

Saudi Arabia is developing a broader and more diversified economic base to reduce its reliance on oil revenues. The Saudi Government's 5-year economic development plan (1990-1995) stresses growth in the non-oil sectors. Under this plan, the country has increased petrochemical production and expanded its agricultural and industrial sectors (including fertilizers, steel, cement, glass, and plastics).

As an absolute monarchy, Saudi Arabia has no Western-style legislature, political parties, or constitution. In March 1992, King Fahd issued decrees that would establish a 61-member Majlis al-Shura (or Consultative Council), a "Basic System of Government" analogous to a constitution, and Provincial Councils. These political reforms are modest in that they formalize the existing system of government under Islamic law, provide only limited advisory roles for the councils, and include no provisions for the election of council members. These reforms are nevertheless the most profound in Saudi history. As of the end of 1992, however, there has been little progress in implementation.

Venezuela



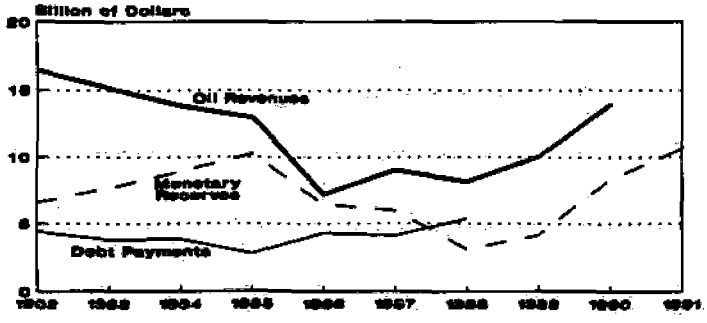
COUNTRY PROFILE

President: Carlos Andres Perez
Population(1991E): 20.4 million
Languages: Spanish
Defense: Army: 34,000; Air Force: 5,000; Navy: 10,000
Religion: Roman Catholic
Location/ Size: South America / 352,143 sq. mi.
Major Cities: Caracas, Maracaibo, Valencia
Major Import Products: Capital and consumer goods, and raw materials

FINANCIAL PROFILE

Monetary Reserves (6/92 Non Gold): $8.9 billion
Gross Foreign Debt (1991): $28.9 billion
Gross Domestic Product (1991E): $52.7 billion
GDP per capita (1991E): $2,579
Currency: Bolivar
Exchange Rate (8/92): US $1 = 66 bolivars
Current Account Balance (1991) $1.1 billion
Petroleum Export Revenues (1991E) $14 billion
Oil Export Revenues / Total Export Revenues: 90%

Financial Statistics



ENERGY PROFILE

Minister of Energy and Mines: Alirio Parra
Proven Oil Reserves (1992): 59 billion barrels
Oil Production Capacity (1992): 2.7 million b/d
Oil Production (1991): 2.4 million b/d
Oil Production Quota (7/92): 2.1 million b/d
Domestic Oil Consumption (1991E): 450,000 b/d
Domestic Refining Capacity (1992): 1.2 million b/d
Major Refineries: Amuay, Curacao, El Cardon, Puerto La Cruz
Petroleum Exports (1991E): 2 million b/d
U.S. Net Oil Imports (1991): 1 million b/d
Natural Gas Reserves (1992): 106 TCF
Oil Terminals: Puerto Miranda, La Salina, Bajo Grande
Oil Fields: Lagunillas, Bachaquero, Tia Juana, Centro
Orimulsion Reserves(1992): 270 billion barrels

OIL INDUSTRY

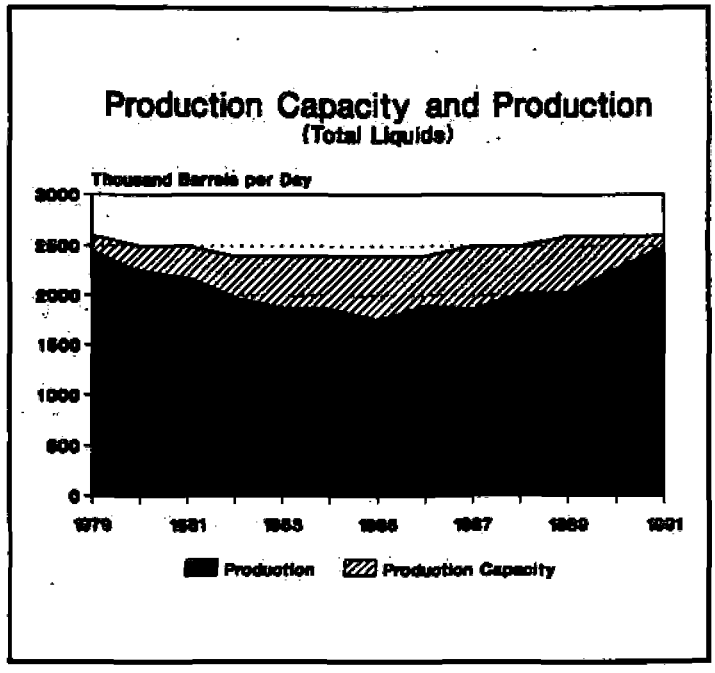
President of PDVSA: Andres Sosa Pietri
Organization: The nationalized oil industry is governed by the Ministry of Energy and Mines. Petroleos de Venezuela (PDVSA) is the parent company and operates through subsidiaries derived from original private ownership. Subsidiaries include **Lagoven, Maraven, and Corpoven.** Three other companies, **Bitor, Interven, and Pequiven,** have been formed to manage heavy crude oil marketing, foreign investment and the petrochemical industry, respectively. PDVSA's legacy from the majors has given it the reputation of being the best-managed state oil company in the world. Today, PDVSA has developed into an international oil company in its own right, with major refinery, pipeline, and service station networks in Europe and the United States.

Major Customers:
United States, Germany, Canada, and Italy.

Downstream Investment:
Europe - Owns nearly 230,000 b/d in capacity through **Ruhr Oel** joint venture with Germany's **Veba,** and 26,000 b/d through its **Nynas** partnership with Finland's **Neste.**
United States - Owns 4% of U.S. refining capacity (see attached map). Acquired **CITGO,** including its **Lake Charles** refinery (320,000 b/d capacity) as well as its network of U.S. service stations, from the bankrupt Southland

Corporation in 1985-1987; purchased the **Champlin** refinery (160,000 b/d) at **Corpus Christi** in 1985; owns the **Seaview Petroleum Company** and its 84,000 b/d refinery; and holds a 50% share in UNOCAL's 153,000 b/d **Chicago** refinery.

PDVSA also has been active in the **Caribbean** region, leasing the 310,000 b/d **Curacao** refinery, and acquiring extensive storage facilities in the **Bahamas** and **Bonaire**. PDVSA has marketing agreements with **BP** and **Mitsubishi** for Orimulsion, its bitumen-based boiler fuel. Most recently, PDVSA became a partner in the **Schwedt** refinery in the former **East Germany**, giving it a bridgehead in eastern Europe.



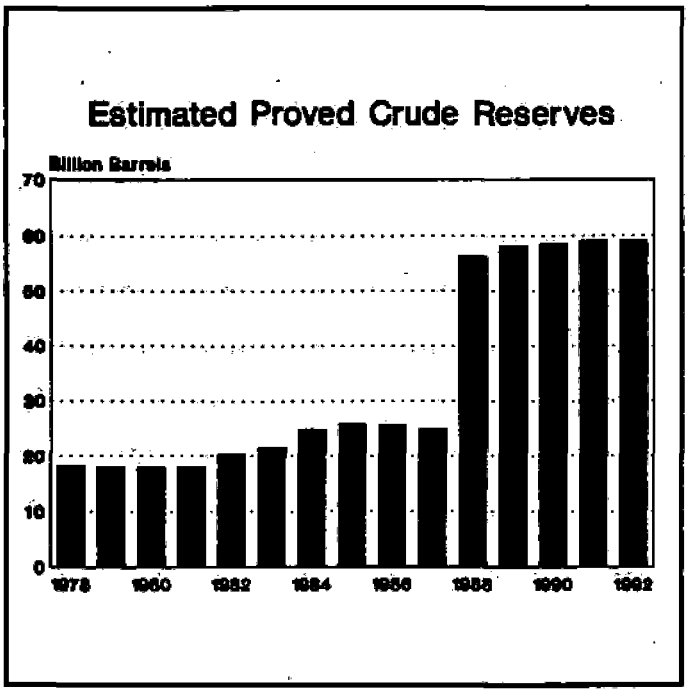
RECENT DEVELOPMENTS

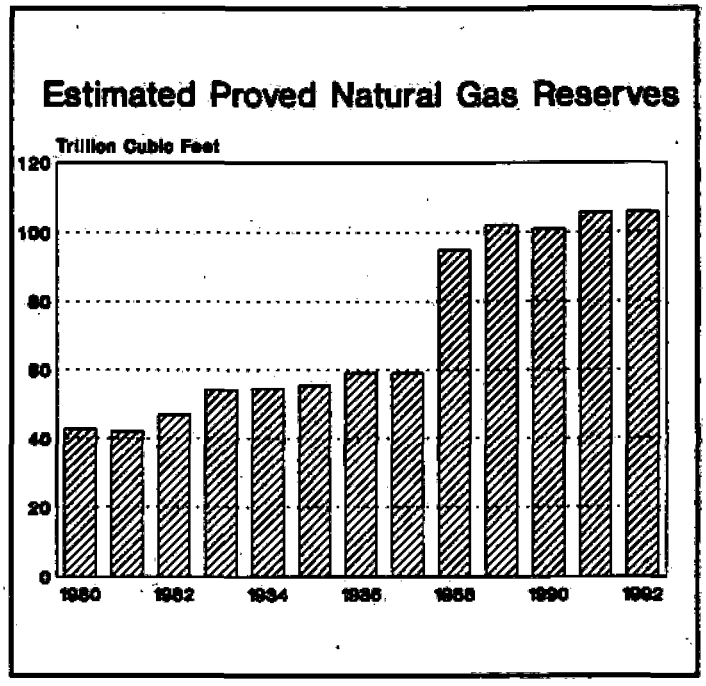
An unsuccessful coup attempt in February 1992 followed months of economic problems, including lower oil revenues in the aftermath of the Gulf war, rapid inflation, a sharply reduced trade surplus, and a one-day general strike on November 7, 1991. All of these problems contributed to a lessening of public confidence in President Perez's government. President Perez responded to the coup attempt by promising to rewrite the constitution, as well as freezing prices on staple foods, medicines, electricity and gasoline. He also vowed, however, not to resign or to abandon his free-market economic policies.

The recent coup attempt was a culmination of problems that beset President Carlos Andres Perez since he took the oath of office on February 2, 1989. Following his inauguration, President Perez quickly enacted new policies to deal with Venezuela's economic problems. The strategy included an austerity program, return to a single market-oriented floating exchange rate, relaxation of import controls, and the freeing of interest rates - all measures to help obtain new loans and restructure debt. The austerity program also included increases in the prices of gasoline and public transportation, which provoked nationwide riots resulting in the death of hundreds of people. To restore order, the Government was forced to suspend various constitutional rights temporarily, to impose a curfew, and to call in troops to patrol Caracas. To quell further protests Perez offered additional concessions, including across-the-board wage increases and a 4-month firing freeze to halt layoffs. Tensions inside Venezuela calmed for a while, but flared up again recently, as evidenced by the failed coup attempt of February 4, 1992.

OIL INDUSTRY

In the wake of the recent coup attempt, the Venezuelan government is faced with an urgent need to raise revenues to help alleviate social and economic discontent. This will undoubtedly affect PDVSA, which is the main source (around 80%) of government revenues, and could even threaten PDVSA's ambitious, $48 billion expansion plan for the period 1992-1997. Already, President Perez has curtailed PDVSA's foreign refinery acquisition program, preferring that emphasis be placed on attracting foreign investment within Venezuela. Overall, Perez is attempting to rein in PDVSA's investment spending, particularly in the development of the country's huge oilsands reserves. As a result of this clampdown on spending, PDVSA's original objective of producing 1 million b/d of under 22-gravity crude oil by 1996 no longer appears realistic. The future outlook for PDVSA's rapid expansion plans is seriously complicated by the government's overwhelming financial dependence on, and control of, the Venezuelan oil industry. PDVSA's investment resources are further constrained by an effective 82% income tax, as well as frequent demands by the government for hundreds of millions of dollars worth of loans and forced bond purchases.





According to the president of PDVSA (Andres Sosa Pietri), the company's long-term oil strategy will not be affected by recent events, including economic changes announced by President Perez. In an effort to keep its expansion program on track, PDVSA is prepared to borrow over $3 billion this year, as well as to maximize its efforts at attracting foreign investment. In this regard, Chevron recently signed a letter of intent with PDVSA to study joint ventures in refining, production, and the potential upgrading of Orinoco heavy crudes. PDVSA is also discussing with Germany's Veba Oel a possible joint venture aimed at producing and upgrading 120,000 b/d of extra-heavy crudes (12-14 degrees API) into more marketable synthetics. Despite these apparent successes, PDVSA's future efforts at attracting additional foreign investment may prove more difficult, however, in the wake of the failed coup, which highlights Venezuela's political and economic uncertainties.

PDVSA's ambitious expansion program is based on three major considerations: 1) world oil demand will increase by the end of the decade; 2) hydrocarbon revenues are essential to the Venezuelan economy; and 3) in order to become a more significant player in OPEC, Venezuela needs to improve its relative standing in terms of oil production capacity and reserves. Based on these assumptions, PDVSA hopes to expand both at home and abroad. Domestically, PDVSA hopes to raise oil production capacity from today's 2.7 million b/d to 3.7 million b/d in 1997, and 4.1 million b/d (excluding 1 million b/d of Orinoco bitumen production) in 2000. Overseas, PDVSA's objective is to move away from crude sales, toward sales of products and petrochemicals, in order to capture more profit from the value added to national resources. PDVSA therefore continues to look for additional downstream opportunities overseas, where it already holds about 1.6 million b/d in foreign refining capacity (700,000 b/d in the United States, 900,000 b/d elsewhere). PDVSA hopes to expand their refinery capacity to roughly 2.3 million b/d by 1997. PDVSA is also looking to open the upstream sector to foreign partners for the first time since the Venezuelan oil industry was nationalized over 15 years ago. With that goal in mind, it has begun to look at formation of "strategic alliances," such as the proposed $3 billion "Cristobal Colon" partnership with Shell, Exxon and Mitsubishi to export liquefied natural gas to US markets.

FORMER YUGOSLAVIA

COUNTRY PROFILE

President (acting): Branko Kostic
Prime Minister: Ante Markovic - resigned Dec. 1991
Population (1990): 23.8 million
Location/ Size: Eastern Europe / 98,766 sq. miles.
Ethnic Divisions: Serb (36.3%), Croat (19.7%), Muslim (8.9%), Slovene (7.8%), Albanian (7.7%), Macedonian (5.9%), Yugoslav (5.4%), Montenegrin (2.5%), Hungarian (1.9%), other (3.9%)
Religion: Eastern Orthodox (50%), Catholic (30%), Muslim (9%), Protestant (1%), and other (10%)
Major Cities: Belgrade, Zagreb, Osijek and Nis

ECONOMIC PROFILE

Monetary Reserves(1/92, Non Gold US): $2.2 billion
Gross Domestic Product 1990 (1980 US): $58.1 billion
GDP Per Capita Income (1990): $2,439
Gross Foreign Debt (1990): $20.8 billion
Exchange Rate (1/91): 105 Dinars = $1 US
Currency: Dinar; Slovenia converted to Tolars 10/91; Croatia converted to Croatian Dinars 12/91

ENERGY PROFILE

Oil Consumption (1991): 311,000 b/d
Crude Oil Production (1991): 58,200 b/d
Crude Oil Reserves (1991): 240 million barrels
Crude Oil Imports (1991): 239.5 thousand barrels
Gas Production (1991): 75.5 billion cubic feet (BCF)
Gas Consumption (1991): 213 BCF
Gas Reserves (1991): 2.9 trillion cubic feet
Coal Production (1991): 78.6 million short tonnes
Total Refining Capacity (1991): 615,000 b/d
Republic Refining Capacity: Croatia, 310,000 b/d; Serbia, 168,000 b/d; Bosnia-Hercegovina, 110,000 b/d; Slovenia, 15,000 b/d; Macedonia, 15,000 b/d; Montenegro, none.

The Adria Pipeline: The Adria Pipeline, which is not currently operating, had carried 193,000 b/d from the Adriatic Sea to various destinations inland. Of these, 27,000 b/d went to supply Hungary and Czechoslovakia. With the pipeline not operating, Hungary and Czechoslovakia must find supplies elsewhere. The Friendship (Druzhba) pipeline out of the former Soviet Union could be that source. The former Soviet Union had been Yugoslavia's primary supplier of crude oil as well as natural gas, followed by Iraq, a distant second (Table 2). This, despite that during the second half of 1990 the Soviets fell behind on their delivery schedule, and Iraq was cut off by the U.N. trade embargo.

Croatia's continued blockade of the Adria pipeline, has forced Serbia's state NIS to build a new crude pipeline from the Adriatic port of Bar in Montenegro to the Serbian refineries at Novi Sad and Pancevo. An additional branch is planned to supply the Macedonian refinery at Skopje. The project is scheduled to be completed by the end of 1993 at a cost of $300 million.

Profile of the Major Republics (Table 1)

	Serbia	Croatia	Slovenia	Bosnia-Herzegovina
Population (1990)	9.3 million Includes 1.7 million ethnic Albanians	4.5 million Includes 600,000 Serbs	2 million Ethnically homogeneous	4 million 20% Croatian 30% Serbian 40% Muslim
President	Slobodan Milosevic	Franjo Tudjman	Milan Kucan	Alija Izetbegovic
Political Summary	Socialist Party (Formerly Communist) Party). Wants centrally ruled Federation	Center-right Croatian Democratic Union. Wants alliance of sovereign states	Center-right coalition. Wealthiest Republic.	
Petroleum Consumption (1991)	63 MBD	80 MBD	35 MBD	25 MBD

Recent Developments

Since the civil war in Yugoslavia began, the European Community(EC) has tried to negotiate a sustainable cease-fire that would allow the break-away republics of Croatia, Slovenia, Macedonia and Bosnia-Hercegovina to gain sovereignty. After numerous failed attempts, the EC looked to the United Nations for help. On May 30, 1992, the United Nations imposed sanctions on Serbia and Montenegro, in hopes of forcing a cease-fire. These sanctions include an oil embargo, a trade ban, and a freeze on foreign assets and airline flights.

Oil Industry Overview

Industrija Nafta (INA) directs refining and refined product marketing in Croatia. **Petrol** distributes petroleum products in Slovenia.

In Serbia, state owned **Nafta Industrija Serbija** (NIS), a union between Belgrade based Yugopetrol and Naftagas, oversees most oil related activities while Yugopetrol operates product distribution.

Slovenia finalized a barter agreement with Russia in December of 1991. The deal includes the 1992 deliveries of natural gas, metals, and textiles by Russian suppliers in return for commercial goods. Specific quantities have not been disclosed.

Production and Consumption

Croatia's prewar crude production of 50,000 b/d has been slashed to about 30,000 b/d. INA had to evacuate the three fields in eastern **Slavonia** (a region of Croatia near the borders of Serbia and Hungary) because of the fighting. INA managed to export 16,000 b/d to Austria's OMV the first 11 months of 1991.

Domestic Refining

Crude runs at most of the refineries in Yugoslavia have been reduced substantially, either by the loss of supply or by direct damage as a result of the civil war.

In Croatia, the 150,000 b/d **Sisak** refinery, 35 miles south of Zagreb, which provided about 50% of Croatia's refining capacity was set on fire by Serbian troops. The 160,000 b/d refinery at **Rijeka**, the only operating refinery in Croatia, has been receiving crude in small amounts. INA put December 1991 runs at about 36,000 b/d, made up of spot imports and local production.

In Bosnia-Hercegovina the 110,000 b/d refinery at **Bosanki Brod**, closed due to lack of crude, was attacked by Serbian troops. Bosanki Brod is run by Energoinvest. Damage was limited to external installations only, including a storage tank that caught fire. Bosanki Brod is the republic's only refinery.

Much of Serbia's 170,000 b/d refining capacity has been idled since the closure of the Adria pipeline. The 108,000 b/d **Pancevo** and 60,000 b/d **Novi Sad** refineries have received little crude since the closure. The only foreign crude they have taken delivery on has been imported from the Black Sea via the Danube.

Yugoslavian Oil Consumption and Production, 1987–1991

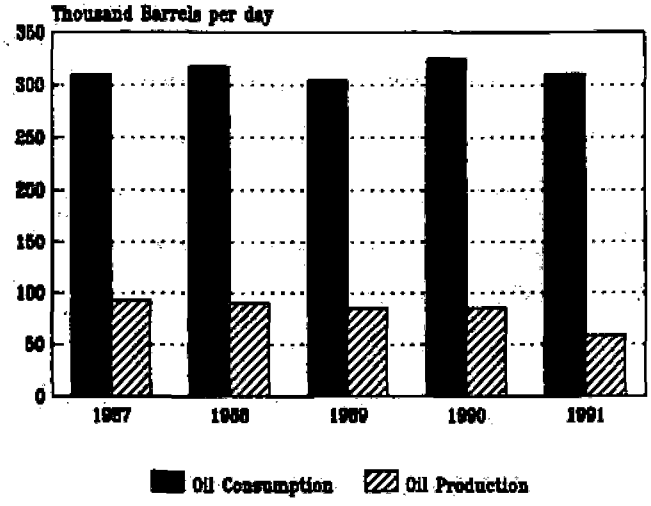


Table 2: 1990 Yugoslavian Crude Oil Imports

	b/d
U.S.S.R.	119,500
Iraq	37,700
Iran	27,600
Libya	26,200
Angola	12,300
United Kingdom	5,700
Saudi Arabia	4,600
Egypt	4,300
Norway	1,600
Total	239,500

In Macedonia the 20,000 b/d refinery at **Skopje** is running at normal levels. It is receiving crude, as well as some products, through the Greek port of Thessaloniki.

In Slovenia the 10,000 b/d refinery at **Lendava** has not been able to produce any gasoline for either state distributor Petrol or Austria's OMV.

NATURAL GAS

Natural Gas looks to have the brightest future in Yugoslavia. Finds in the Adriatic sea have increased reserves to 2.9 TCF. Gas fields in the northern Adriatic have produced commercial quality gas fields whereas discoveries in the south are of a questionable quality.

The country's largest gas field, **Molve**, is located in northern Croatia. Molve provides about one third of all domestic gas production.

Country Profiles: 1992

Algeria
Colombia
Ecuador
Estonia
Indonesia
Iran
Iraq
Kazakhstan
Kuwait
Latvia
Libya
Lithuania
Mexico
Nigeria
Russia
Saudi Arabia
Venezuela
Yugoslavia

Algeria

COUNTRY PROFILE:

President: Ali Kafi
Prime Minister: Belaid Abdesselam
Population (1990): 25 million
Languages: Arabic, French, Berber dialects
Defense: Army: 120,000; Navy: 6,500; Air Force: 12,000
Religion: 99% Sunni Muslim
Location/Size: North Africa/918,497 sq. miles
Major Cities: Algiers, Oran, Constantine, Annaba
Major Import Products: Industrial equipment, intermediate goods, food, consumer goods

FINANCIAL PROFILE

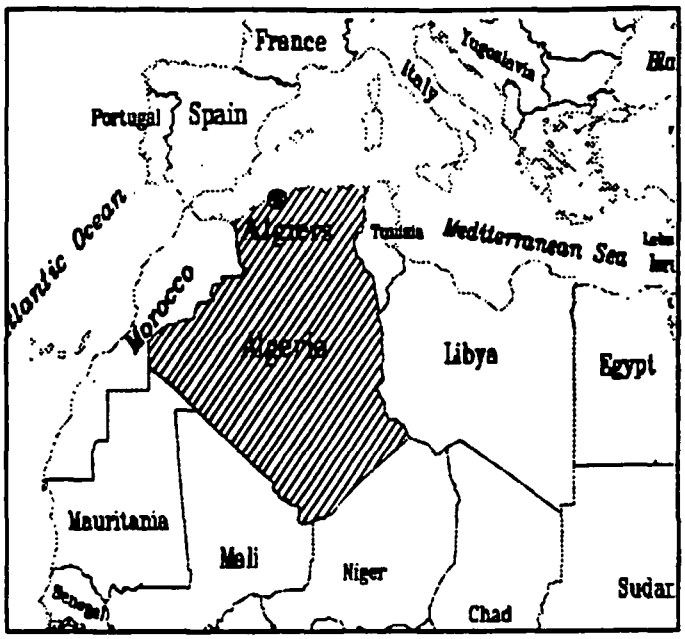
Monetary Reserves (Non-Gold, 9/91): 800 million dollars
Foreign Debt (1990E): 25 billion
GDP (1990): 45 billion dollars
Currency: Algerian Dinar (AD)
Exchange Rate (12/91): US$1 = AD 21.774
Current Account Balance (1990): 0.55 billion
Hydrocarbon Export Revenues (1990): 12.3 billion
Hydrocarbon Export Revenues/Total Export Revenues (1990): 97%

ENERGY PROFILE

Minister of Energy: Hassan Mefti
Proven Oil Reserves (1992): 9.2 billion barrels
Oil Production Capacity(1991): 1.38 million barrels/day (b/d)
Oil Production (1991E): 1.34 million b/d
Domestic Oil Consumption (1990E) 0.19 million b/d
Refining Capacity (1991): 0.465 million b/d
Major Refineries: Skikda, Arzew, El Harrach, Hassi Messaoud
Petroleum Exports (1991E): 1.1 million b/d
U.S. Net Oil Imports (1991): 0.253 million b/d
Natural Gas Reserves (1992): 114.7 trillion cubic feet (TCF)
Natural Gas Production (1990E): 1.77 TCF
Natural Gas Exports (1991E): 1.205 TCF. Of which: LNG - 689 BCF; Pipeline - 516 BCF.
Major Pipelines: Houd el-Hamra/Bejaia, In Amenas/La Skhirra, Haoud el-Hamra/Arzew, Beni Mansour/Algiers, Haoud el-Hamra/Skikda
Oil Terminals: Algiers, Annaba, Oran, Arzew, Skikda, Bejaia, La Skhirra
Major Oil and Gas Fields: Hassi R'Mel (gas), Hassi Messaoud (oil), Zarzaitine (oil), El Agreb (oil), Gassi Touil (oil).

OIL INDUSTRY PROFILE

Organization: Societe Nationale pour la Recherche, la Production, le Transport, la Transformation et la Commercialisation des Hydrocarbons (SONATRACH) - State-owned organization for exploration, transport and marketing of petroleum, natural gas and their products.
Major trading Partners: France, Italy, USA.



RECENT DEVELOPMENTS

Following the June 29,1992 assassination of Council of State leader Mohammed Boudiaf, a new president, Ali Kafi, was chosen by the Council. This event comes after months of violence and unrest in Algeria. To date, this unrest has not adversely affected the oil and gas sectors.

In mid-January, days before the second round of voting in the first multi-party elections in Algeria's history, former President Chadli Benjedid of the National Liberation Front (NLF) party resigned. The government was subsequently controlled by the army-backed Council of State in order to prevent the Islamic Salvation Front (ISF), the expected victor in the second round of voting, from creating a new government. In the first round of voting on December 26, 1991, the ISF had set itself apart from the other parties in Algeria as the likely winner in the democratically held elections.

The ISF was expected to take control of the government following the January 16, 1992 round of elections, until these elections were postponed following the takeover by the State Security Council. Prior to the military takeover, acting ISF leader Abdelkader Hachani had pledged that the new government would honor previous obligations and agreements.

HYDROCARBON INDUSTRY

Should the current unrest in Algeria cause a disruption in its oil and gas exports, world energy markets would be affected for two main reasons: 1) Refiners find valuable Algeria's high-quality light, sweet crude that yields clean products and low-sulfur fuel oil (LSFO); and 2) Algeria is a major supplier of LSFO to Italy and the U.S.

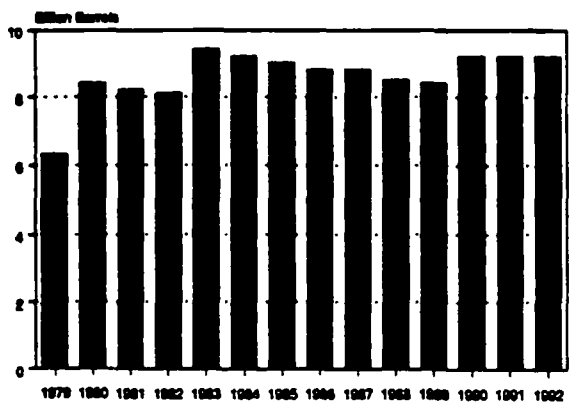
Rather than causing a major change in the price of crude, the impacts of such a disruption would be more likely to include:

- widening of price differentials between light, sweet crudes, such as North Sea Brent and U.S. WTI, to sourer Middle Eastern and Latin American crudes;
- relative rise of residual fuel oil prices in response to the LSFO scarcity and its premium over higher sulfur grades of residual fuel oil;
- Italy's loss of 20 percent of its natural gas imports;
- loss of LNG to France, Belgium and Spain.

Hydrocarbon Exports

Hydrocarbon revenues are vital to Algeria's economic stability, comprising over 95 percent of the country's export earnings. These revenues are Algeria's primary means to finance essential economic and social reforms, as well as to repay its substantial foreign debts. State energy company SONATRACH reported that hydrocarbon exports increased by 36 percent, to $12.3 billion, in 1990. Although export sales are increasing, the relative importance of crude oil to total energy sales is decreasing. In 1990, hydrocarbon export revenues were split approximately 1/3 each between crude oil, natural gas and LNG, and refined products.

Estimated Proved Crude Reserves



Oil Sector

Despite the decline of oil's share in overall hydrocarbon exports, Algeria's light, sweet crude is expected to be central to the country's development over the next ten years. Since the early 1970s, Algerian oil and liquids production has held steady at 1.0 to 1.3 million b/d. Nearly all of the 1.1 million b/d of exports during 1990 went to the U.S and OECD Europe. Algeria produced an estimated 1.3 million b/d (total liquids) during 1991, including: crude - 0.8 million b/d; NGLs - 0.41 million b/d; and condensates - 0.13 million b/d.

Sonatrach reported a major oil discovery in June 1991 - estimated at 240 million barrels - 1,000 miles southwest of Algiers.

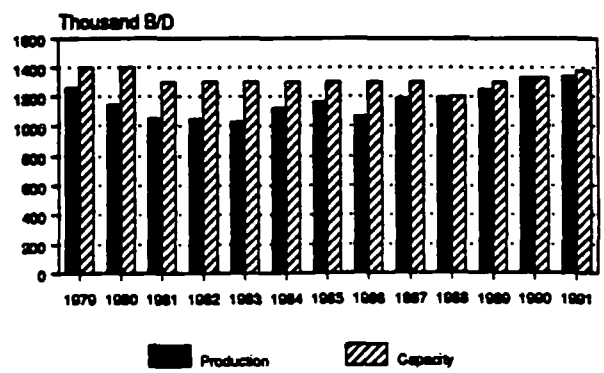
Algeria has modified its oil exploration legislation to attract foreign investors, despite opposition within its own parliament. It is thought that foreign companies might find in Algeria a wide range of desirable options short of a full production sharing arrangement.

Natural Gas Sector

Algeria's main focus is on development of its large natural gas reserves (114.7 TCF). The government is encouraging greater flexibility in pricing and marketing strategies to expand the market for Algerian hydrocarbon exports. The European market in particular is being targeted for increased penetration of Algerian natural gas.

To accomplish its goal of doubling natural gas export capacity, Algeria is planning several projects, including: 1) expanding the Trans-Mediterranean (Transmed) natural gas pipeline to Italy; 2) possibly constructing a new 12- to 15-billion-cubic-meter (420 to 530 billion

Total Liquids Production and Crude Oil Production Capacity

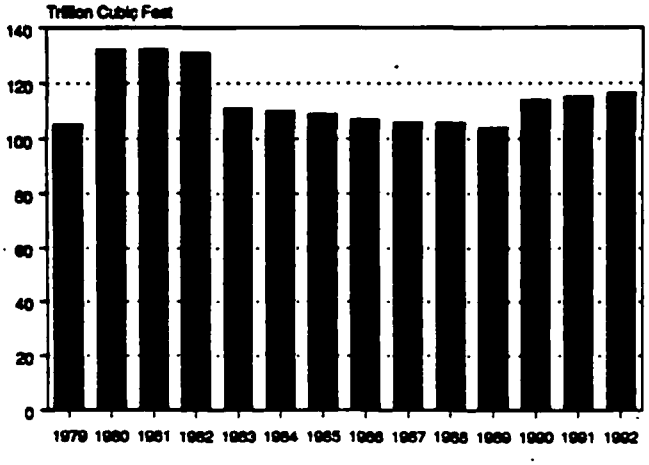


cubic feet) per-year capacity natural gas pipeline to Spain via Morocco and the Strait of Gibraltar; and 3) implementing a 5-year plan to double export capacity of LPG.

1. Italian public companies are expected to carry out most of the construction to expand the Transmed gas pipeline to meet the increased demand for gas in Italy and other central European countries. Italy plans to take at least 19 billion cubic meters (BCM) of natural gas per year from Sonatrach starting in 1994. Construction is expected to take three years.

2. Algeria, Morocco and Spain signed an accord on April 30, 1991 to proceed with a 1,265 km western gas pipeline linking the three countries. The pipeline would be completed by 1995 at a projected cost of $1.3 billion and may receive some financial support from the EC. OMEGAZ, a company jointly held by gas agencies of Algeria, Spain, Morocco, Germany, France and Portugal, has been established to conduct feasibility studies and develop the project. The pipeline would lessen Western Europe's dependence on North Sea gas supplies.

Estimated Proved Natural Gas Reserves



3. Algeria's 5-year plan to double LPG output includes: building extraction and other facilities in 10 fields between 1992 and 1997 (at about $100 to $200 million apiece); laying about 1,000 kilometers of pipeline and constructing the long-planned "jumbo" LPG Plant in Arzew.

- The 10 new facilities, for which two tenders have already been issued, are all located near existing oil or gas fields. The LNG unit at one of the two, Oued Noumer, is expected to treat 7 million cubic meters of gas a day.
- The 14 to 22-inch-diameter pipeline will link Alrar (east, at the Libyan border) and Hassi R'Mel (located inland, south of Algiers). The pipeline will then connect to an existing LPG pipeline that runs from Hassi Messaoud through Hassi R'Mel to Arzew. An existing natural gas pipeline links Alrar with Hassi R'Mel and Arzew (on the Mediterranean coast, east of Algiers).
- The construction of the Jumbo LPG plant at Arzew was originally tendered to a Japanese company in the early 1980s. The project was revived in 1989 as part of the plan to raise LPG capacity from 195,000 b/d in 1989 to 346,000 b/d by 1995. The plant is scheduled to come onstream in 1995.

Colombia

COUNTRY PROFILE

President: Cesar Gaviria Trujillo
Population (1990): 33 million
Location/Size: NW South America/440,831 sq. mi.
Language: Spanish
Religion: Roman Catholic (95%)
Major Cities: Bogota, Medellin, Cali
Import Products: Industrial inputs, capital goods consumer goods.

FINANCIAL PROFILE

Monetary Reserves (11/91, non-Gold): $5.988 billion
Total Foreign Debt (1991): $17.059 billion
Gross Domestic Product (1990E): $41.1 billion
Exchange Rate (1/92): US $1 = 712 pesos
Petroleum Revenue (1991): $1.0 billion

ENERGY PROFILE

Minister of Mines and Energy: Juan Camilo Restrepo
Proven Oil Reserves (1992): 1.9 billion barrels
Oil Production Capacity (1992): 475,000 b/d
Oil Production (1991): 425,000 b/d
Domestic Oil Consumption (1991E): 225,000 b/d
Refining Capacity (1992): 274,100 b/d
Gross Petroleum Exports (1991E): 230,000 b/d
Petroleum Exports to the U. S. (1991): 91,000 b/d
Natural Gas Reserves (1992): 4.1 TCF
Natural Gas Production (1991): 144 BCF
Coal Reserves (1991): 10.6 billion short tons
Major Ports: Covenas (Caribbean Coast)
Major Fields: Cano Limon, San Francisco, Provincia

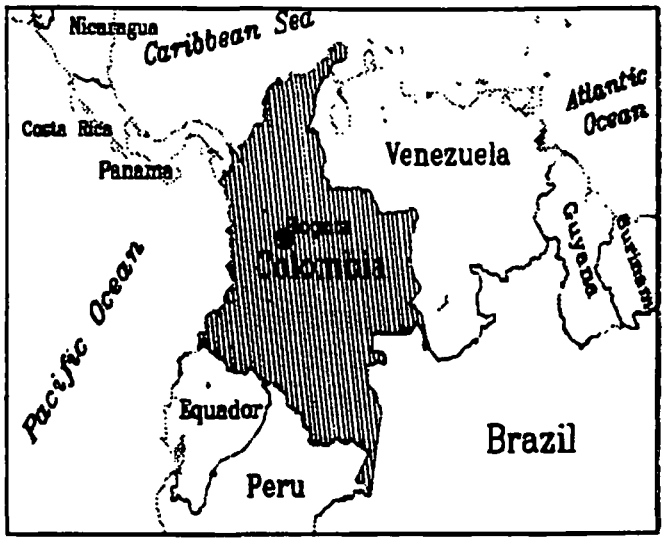
OIL INDUSTRY PROFILE

Organization: State-owned
Empresa Colombiana de Petroleos (ECOPETROL)
President of ECOPETROL: Andres Restrepo Londono
Major oil companies: Occidental, British Petroleum, Shell, Exxon, Texaco, Chevron, Total, and ELF
Major Customers: United States

RECENT OIL INDUSTRY DEVELOPMENTS

Discovery of large, high quality oil reserves in July 1991 at **Cusiana** has reshaped Colombia's future. This discovery will more than double oil reserves, has rejuvenated oil companies' interest, and should boost economic growth. Although some problems remain unresolved, such as guerrilla activities, oil workers' union demands, and the landowner rights issue, Colombia's hydrocarbon potential and the attractive terms for investment have renewed the confidence of foreign investors.

A major concern of oil companies has been the guerrilla attacks on critical infrastructure and kidnapping. Between 1986 and 1991 there were 195 attacks on oil facilities, resulting in lost revenue and infrastructure damage totaling



nearly $800 million. Hopes of a decrease in attacks came in the fall of 1991, with the arrest of drug-cartel members and with the decision by one of the principle guerrilla movements, M-19, to cease its attacks and become a political party. Other guerrilla groups, Quintin Lame and the People's Liberation Army (ELP), also chose to follow M-19's lead. These actions followed ratification of a new constitution intended to strengthen political participation and to secure more human rights protection. The two rebel groups that remain are the National Liberation Army (ELN) and the Simon Bolivar Guerrilla Front. Tenuous negotiations continue with the rebels to reach some accord, and to bring an end to the hostilities. There is fear that increased oil exploration and development will only offer more targets for attack. In the first three months of 1992, over a dozen attacks have been carried out.

To offset lost oil revenues, pay for repair of damage and increase security, the government imposed a "war tax" on production of 55 cents per barrel of oil in 1991. Landowners have claimed title to subsoil rights and want a royalty payment of 4% on earnings on mineral production. A state tribunal is responsible for resolving this claim, with a ruling expected by later in 1992.

The discovery by **British Petroleum** of large oil reserves comes at a critical time for Colombia. Declining oil reserves, combined with growing domestic demand, had raised doubts as to Colombia remaining an oil exporter through the 1990's. Revised forecasts, with Cusiana added, double oil production and triple oil exports. The potential size of oil reserves is still under study, with most estimates ranging from 3 to 5 billion barrels, and some as high as 10 billion barrels.

Cusiana is 120 miles northeast of Bogota in the eastern foothills region of the Llanos Basin. BP has a 40% share and leads the development, along with its partners Total (40%) and Triton (20%).

ECOPETROL has a 20% royalty share, and is expected to exercise its right to 50% of the concession, thus reducing BP and Total to 15.2% shares and Triton to a 9.6% share. Full production of 400,000 - 500,000 b/d is 3 to 5 years away, with output of 60,000 b/d considered possible by the end of 1992. BP plans to spend $200 million in 1992 on the development of Cusiana and other nearby areas. Over the next three years, total investment in Cusiana by ECOPETROL, BP, Total and Triton could total $1 billion.

LASMO announced a second discovery of oil on the Espinal block in the Upper Magdalena Basin, at **Venganza**, in early 1992. The first discovery was **Purification**. LASMO, two-thirds owner, and **Sun**, one-third owner, estimate the Espinal block may hold oil reserves of 2 billion barrels.

These recent discoveries have put new vigor in foreign investment activity, with 35 international oil companies currently involved in exploration and development endeavors inside Colombia. ECOPETROL has announced that $2 billion will be invested to explore 50 million acres through 95 joint ventures over the next five years. This represents only about 30% of the acreage available for exploration. ECOPETROL will seek international loans of $3 billion to finance its 5-year, $5.3 billion energy investment plans.

Oil Production

About half of Colombia's production is from the **Cravo Norte** fields in the eastern Llanos Basin near the Venezuelan border. Oil is transported from the fields to the Caribbean port of Covenas via the 480 mile, 240,000 b/d capacity Cano Limon pipeline. **Occidental de Colombia** operates the fields and shares ownership with **Repsol SA** on a 75/25 basis. **Shell** and ECOPETROL operate other fields in the region.

Colombia's other producing areas are: the lower, middle, and upper Magdalena River Valley regions -- with principle operators Occidental, Esso and Hocol; the southern and central Llanos Basin -- with principle operators Chevron, ELF and LASMO; and the Putumayo and Catatumbo areas in southern Colombia -- mainly operated by ECOPETROL and several smaller oil companies.

Oil Exploration and Development

Tuskar Resources, a Dublin-based company, discovered heavy crude in the southern Llanos Basin at Rubiales in 1991. Reserves are put at 390 million barrels, and production is expected to plateau around 75,000 b/d. Tuskar is seeking a partner to help complete work required by ECOPETROL, to avoid a suspension of operations.

Garnet Resources Corp. and ECOPETROL plan to bring on new production from southern Colombia's Putumayo region during 1992.

Hondo Oil has drilled three successful wells with a fourth planned, at the Opon association concession in the Middle Magdalena River Basin.

Triton leads a team developing the Tauramena concession, south of Cusiana. Triton has a 50% share, and partners BP and Total have 25% shares.

Occidental de Colombia has agreed to explore the 500,000-acre Samore Block in the Llanos Basin, 90 miles north of Cusiana and 40 miles west of Cano Limon. Occidental also signed an association contract to conduct geologic studies on 1.4 million acres in the Cauca Valley in western Colombia.

American International Petroleum is drilling test wells under an association contract in the Rio Planas region of the Llanos Basin, results so far have been encouraging.

Chevron signed a 6-year association contract to explore a 435,000 acre tract in the Sumapaz region, 50 miles southwest of Bogota.

Repsol SA and LASMO, in a 50/50 joint venture, will explore in the eastern Llanos Basin.

BP has rights to explore 5 million acres offshore.

Crude Oil Pipelines

Colombian oil fields are located mainly inland, making domestic consumption and export dependent on pipeline systems to deliver crude and products. The Magdalena/Llanos crude oil pipeline program includes the Cano Limon pipeline, the soon to be completed pipeline from Vasconia to Covenas, the recently expanded Central pipeline from the eastern plains to Vasconia, and a planned pipeline from the upper Magdalena Valley to Vasconia.

Completion of a 320-mile, 150,000 b/d pipeline from Vasconia, in the middle of the Magdalena Region, to the port of Covenas on the Caribbean, is scheduled for April 1992. This pipeline is an important step for the future development of the middle Magdalena region. It is being built by a consortium headed by Ecopetrol and Shell, with several other oil companies as partners.

The Central pipeline from Porvenir to Vasconia is undergoing a three stage expansion to raise capacity from 107,000 b/d to 200,000 b/d. There is also a 70,000 b/d pipeline from Tenay to Vasconia. The discovery and large potential of Cusiana could delay plans for the 425-mile pipeline to link the Upper Magdalena Valley region to Vasconia. Development of Cusiana will require the construction of a new pipeline, with construction cost estimated at $800 million, due to the distance and rough terrain to be crossed.

NATURAL GAS

New discoveries have improved the possibilities of carrying out plans to supply natural gas to cities to offset excessive use of electricity. Current consumption is about 400 million cubic feet per day, mainly in northern Colombia. A natural gas pipeline has been built to connect Ballenas on the Atlantic coast to Barrancabermeja in central Colombia. The Colombian government has deregulated the natural gas market, eliminating price subsidies and giving incentives for private investment. Colombia intends to spend $600 million over a 5-year period on a distribution network and imports. Prior to recent discoveries, natural gas reserves had been considered to small to justify construction of a marketing system. Now, Colombia's goal is to raise the share of natural gas from its current 7.6% of energy consumption to 27.5% by 2005, with projected savings in energy costs of $555 million.

Hocol SA (Shell) and **Triton** discovered natural gas in Rio Saldana, 120 miles southwest of Bogota. The Montanuelo well yield 12.4 mcf/d. **American International Petroleum** discovered natural gas 40 miles from Bogota, with reserves estimated at 8.35 BCF. Geologists estimate that total gas reserves in the **Puli Anticline** could reach 517 BCF. **Cusiana** is expected to yield marketable amounts of natural gas and other associated gases. Early output will be reinjected to ensure oil yield and to allow time for development of a distribution system. Meanwhile, importing natural gas from Venezuela has been discussed, but no plans are moving forward.

PETROLEUM REFINING

Colombia has four refineries, with a total distillation capacity of 274,100 b/d, but upgrading capacities are insufficient to meet demand for all products. The main refining center is Barrancabermeja with a capacity of 196,000 b/d. $100 million is being spent to add a catalytic cracker to the refinery, it which will boost gasoline production by 15,000 b/d. The only other major refinery is in Cartagena with a capacity of 70,700 b/d .

Colombia exports about 60,000 b/d of residual and distillate fuel oil – mainly to the United States – and imports gasoline. ECOPETROL has abandoned plans for a refinery at Puerto Trionfo, and now plans to build a 100,000 b/d refinery in the Casanare state near Cusiana by the mid-1990's.

PETROCHEMICALS

Colombia plans to invest $370 million over the next five years to expand its petrochemical capacity to meet domestic needs. In 1990 Colombia imported 70,000 metric tons (MT) of its 340,000 MT consumption. Colombia plans to raise capacity from 270,000 MT to 550,000 MT per year by 2000, with the largest growth coming in ethylene, increasing to 350,000 MT per year.

COAL

Colombia's 10.6 billion short tons (BST) of recoverable coal reserves are the largest in Latin America. In 1980, **Exxon** began development of Colombia's richest coal field, El Cerrejon. In 1989, Colombia produced 21 MST of coal, more than three times the amount produced in 1981. Colombia exported 11.8 MST of coal in 1989, mainly to Western Europe. Its goal is to supply 10 percent of the world coal market by 1999.

DOMESTIC ENERGY CONSUMPTION

Colombia's energy consumption pattern is very regionalized. Northern Colombia accounts for three-fourths of the county's natural gas consumption, while western Colombia is greatly dependent on electricity generated by hydroelectric plants, and with the country's propane use mostly limited to the area around Bogota. Consumption of oil products and coal is more evenly distributed. Firewood is still a main residential fuel, with one estimate placing consumption at 200,000 acres of forest yearly.

Ecuador

COUNTRY PROFILE:

President: Sixto Duran Ballen
Population (1990E): 10.8 million
Language: Spanish
Defense (1990): Army 50,000; Navy 4,800; Air Force 3,000
Religion: Roman Catholic
Location/ Size: Northwestern South America/109,483 Sq. mi.
Major Cities: Quito (Capital), Guayaquil
Major Imports: Industrial inputs, Capital goods.

ENERGY PROFILE:

Minister of Energy: Rafael Almeida
Proven Oil Reserves (1991): 1.55 billion barrels
Oil Production Capacity (1991): 300 thousand b/d
Oil Production (1991): 300 thousand b/d
Oil Production Quota (2Q/1992): 273 thousand b/d
Domestic Oil Consumption (1991): 60 thousand b/d
Refining Capacity (1991): 140 thousand b/d
Petroleum Exports (1991): 200 thousand b/d
U.S. Imports (1991): 63 thousand b/d
Natural Gas Reserves (1991): 3.9 TCF
Major Port: Guayaquil, Esmeraldas
Major Fields: Oil-Shushufindi, Sacha, Auca; Gas-Amistad.

FINANCIAL PROFILE:

Monetary Reserves (1991, Non Gold, US $ Mn): 936
Foreign Debt (1991 US $ Bn): 13.3
Gross Domestic Product (1991E US $ Bn): 11.6
Currency: Sucre
Exchange Rate (7/92): US $1 = 1433 Sucre
Current Account Balance (1991 US $ Bn): -0.47
Petroleum Export Revenues (1991E US $ Mn): 1.059
Oil Export Revenues /Total Export Revenues (1991): 37%.

OIL INDUSTRY PROFILE

Organization: Petroecuador, formerly CEPE, serves as the holding company for all state-owned petroleum operations. Restructured in August 1989, three subsidiaries of Petroecuador will manage exploration and production, refining, and marketing and distribution.

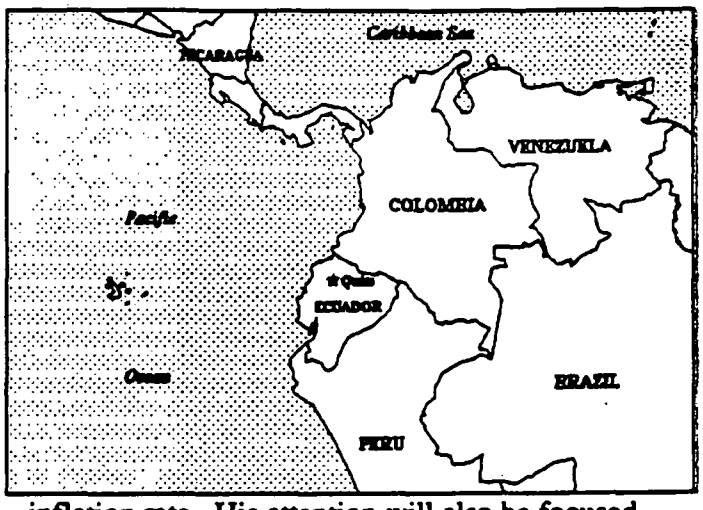
Major Oil Customers: United States, Japan.

RELATIONS WITH THE UNITED STATES:

Common participation in a number of international organizations and their extensive trade ties have resulted in close economic and political relations. The United States and Ecuador share mutual concern over international terrorist actions and the increasing narcotics traffic.

RECENT DEVELOPMENTS

On July 5, 1992, Sixto Duran Ballen was elected President of Ecuador, defeating Jaime Nebot Saadi by a comfortable margin. Mr. Duran's main concern will be to reduce state spending, which should help reduce Ecuador's 50 percent annual



inflation rate. His attention will also be focused on attracting foreign investment and privatizing state companies.

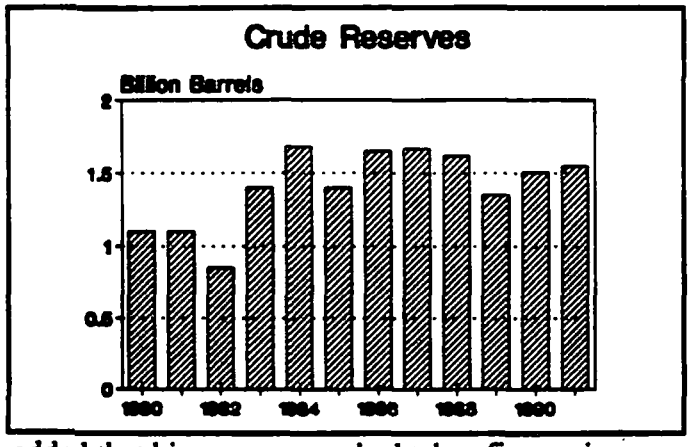
Some 4,000 Ecuadoran Indians marched into the capital of Quito in April, 1992 demanding that former president, Rodrigo Borja, turn over titles to their ancestral lands in the Amazon jungle. Several foreign oil companies have drilling rights to parts of Ecuador's eastern jungle region, but the Indians want the deeds to the undrilled areas of the rainforest. The reform was to be brought before the one-house legislature in June 1992. At the time of this writing, no conclusion was reached.

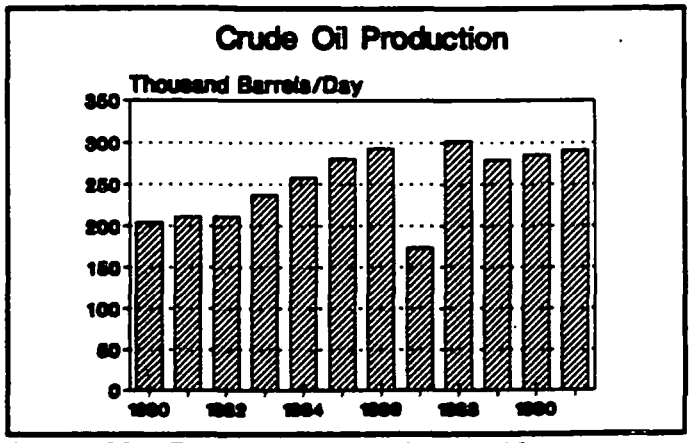
OIL INDUSTRY

In July 1992, Petroecuador, Ecuador's national oil company, discovered new oil reserves in the southeastern Amazon region with an estimated 250 million barrels of heavy crude oil. Production is expected to start in September.

On June 6, 1992, Texaco's 28-year contract with Ecuador expired. Petroecuador is preparing to take over complete ownership of production facilities as well as assets and obligations of the company. Ecuador expects an additional $40 million a year on the 33,000 barrels per day (b/d) exported by Texaco, which operated 15 oil fields and 22 production stations over 400,000 hectares (988,000 acres). At the end of 1991, Texaco operated the northeastern rainforest, which had 1.54 billion barrels in reserves and an average production of 222,800 b/d.

As the Texaco contract ended, former president, Rodrigo Borja, stated that oil production was stable and that the transfer from the US company to the Ecuadoran technicians was smooth. Borja





added that his government had taken five major steps to change the country's oil industry, including the creation of Petroecuador to manage the country's oil industry; the transfer of oil pipeline operations to Ecuadoran hands; the administration of the Petroecuador-Texaco consortium; the construction of a large oil pipeline network on the coast; and the transfer of Texaco's assets, rights and shares to Petroecuador.

Two new oil projects were introduced by Rorigo Borja in April 1992: 1) the expansion of the trans-Ecuadoran pipeline from 300,000 b/d capacity to 325,000 b/d and 2) a project to optimize the use of the Chuchufindi gas plant in the Amazon region, which would raise production from 230 tons a day to 500 tons a day.

Also involved in the oil industry is Atlantic Richfield Co., Arco, which struck oil in April 1992 in the Villano 2 well in Ecuador's eastern jungle region. The 11,800-foot well produced 2,500 b/d with an API gravity of 21. The field's reserves are estimated at 164 million barrels.

Two US companies, Maxus Energy Corporation (Dallas,TX) and CMS Energy Corporation (Dearborn, MI) signed oil agreements in April 1992 to develop and operate Ecuador's Block 16. Block 16 is located about 160 miles southeast of Quito in the Oriente region of eastern Ecuador. This agreement is a 20-year plan and estimated reserves total 216 million barrels.

Since 1985, Ecuador has signed about 12 exploration contracts with about 30 foreign private and state companies and has discovered reserves of over 500 million barrels. At the end of 1991, refinery capacity was roughly 142,000 b/d. A large portion, around 90,000 b/d, was located at Esmeraldas and was operated by Petroecuador.

The bulk of Ecuador's oil is produced in the Oriente Providence, the Amazon jungle region, and is transported via the Trans-Ecuador pipeline to the tanker-loading port of Esmeraldas. Oil exploration has been a priority in order to bolster Ecuador's lagging oil reserves. Oil revenues, down in 1986 due to lower oil prices, went lower in 1987 due to an earthquake that destroyed 25 miles of the Trans-Ecuador Pipeline. Following the earthquake, Ecuador's crude oil production level fell from nearly 300,000 b/d in 1986 to approximately 174,000 b/d in 1987, with an accompanying loss in oil revenues. During 1988 thru 1991, oil revenue recovered as oil production increased to nearly 300,000 b/d.

In 1991, Ecuador exported about 63,000 b/d, mostly crude oil, to the United States. Roughly one-third goes to the East coast, one-third to the West coast, and one-third to the Texas-Louisiana-New Mexico region.

Estonia

COUNTRY PROFILE

President: Lennart Meri
Prime Minister: *Mart Laar*
Government: Republic; declared independence from Soviet Union August 20, 1991; independence recognized by Soviet Union September 6, 1991
Population (1989): 1.6 million
Size/Location: 17,400 square miles in Eastern Europe, bordering the Baltic Sea on the West, the Gulf of Finland to the North, Russia to the East, and Latvia to the South
Ethnic Divisions (1989): Estonian (61.5%), Russian (30.3%), Ukrainian (3.1%), all other nationalities (5.1%)
Major Cities: Tallinn (capital), Tartu, Narva

ECONOMIC PROFILE

Gross National Product (est. 1992 @ purchasing power parity rate): $8.5 billion in $1990
Currency: Kroon
Commercial Exchange Rate (10/22/92): US$1 = 12 Kroon
Major Trading Partners: "Ruble zone" countries (down to 30 percent in 1992 compared to 95 percent in 1991), Germany, Poland, Scandinavia, United States.

ENERGY PROFILE

Energy Minister: Arvo Niitenberg
National Power Company: Eesti Energia
Proven Oil Reserves (1989E): none
Domestic Oil Consumption (1991): 50,000 b/d
Refinery Throughput (1991): none
Proven Gas Reserves(1989E): none
Natural Gas Consumption (1991): 5 million cubic feet
Coal Production (1991): none
Coal Consumption (1991): 600,000 short tons
Oil Shale Reserves (1991): 1.9 billion short tons (BST) usable
Oil Shale Production (1991): 23 million short tons (MST)
Peat Reserves (1991): 6.7 BST
Electricity Production (1991): 16 billion kilowatt hours (Bkwh)
Electricity Exports (1991): 7.9 Bkwh

OIL AND GAS INDUSTRY PROFILE

Major Oil Ports: None; Estonia receives products from Russia by rail. Tallinn is adding oil terminals to handle product imports
Major Gas Import Pipelines: Northern Lights pipeline from West Siberia
Major Oil Refineries: none

BACKGROUND

Estonia is the only Baltic republic with sizable fossil fuel resources, with oil shale, peat, and wood satisfying the majority of its primary energy demand. Estonia's oil shale is burned to generate all of the country's electricity. Electricity production is concentrated in two large thermal plants near Narva, with a total generating capacity of 3045 megawatts. This production enables Estonia to generate a surplus of power that is exported to Russia and Latvia. These plants are part of the North-Western Interconnected Power System linking the Baltics, Belarus, and Northwestern Russia. Estonia will discount its electricity imports to Latvia (in exchange for natural gas) as part of the effort by Baltic energy ministers to coordinate a mutual energy policy to meet expected fuel shortages this winter. In the future, however, severe environmental problems associated with mining and burning oil shale are expected to lead to decreases in these exports.

Estonia imports all of its coal, gas, and oil from Russia via rail. At present, Estonia lacks the infrastructure to import fuel from other sources. This lack of infrastructure, combined with the unreliability of Russian oil supplies, has prompted Estonia to sign contracts with West European investors to build oil import terminals, distribution, and service station networks. Russian natural gas supplies are more reliable, and Estonia also wants to increase the use of gas for environmental reasons. Natural gas accounted for 14% of primary energy consumption in 1990 (up from 8% in 1970), compared with 31% for oil and 74% for oil shale/peat (much of which is burned for power and exported, resulting in net negative consumption of primary electricity). Two pipelines currently link Estonia to West Siberian gas supplies. Estonia also has an extensive district heating network which is largely centralized and ideal for efficiency improvements. Like other republics of the former Soviet Union, Estonia is far more energy inefficient than other European countries.

Indonesia

COUNTRY PROFILE:

Head of State: Suharto
Population (1992): 183 Million
Languages: Bahasa Indonesia (official), Dutch, English
Defense : Army (215,000), Navy (43,000), Air Force (24,000)
Religion: Islam (88%), Christian (9%), Hindu, Buddhist
Location/ Size: Southeast Asia (a group of about 17,000 islands)/ 735,268 sq. mi. of land (the seven major islands are shown as shaded areas on the map).
Major Cities: Jakarta, Surabaya
Major Import Products: Raw materials & intermediates; capital goods; consumer goods.

FINANCIAL PROFILE:

Monetary Reserves (1991 Non Gold, US $): 9.26 billion
Foreign Debt (1991 US$): 76.3 billion
Gross Domestic Product (1991 US$): 107.3 billion
Currency: Rupiah
Exchange Rate (07/92): US $1 = 2028 Rupiahs
Current Account Balance (1991 US$): -3.6 billion
Petroleum Export Revenues (1991 US$): 7.39 billion

ENERGY PROFILE:

Minister of Mining and Energy: Ginandjar Kartasasmita
Proven Oil Reserves (1992E): 6.6 billion barrels
Oil Production Capacity (1991): 1.7 million b/d
Oil Production (1992): 1.53 million b/d
OPEC Oil Production Quota (1991): 1.4 million b/d
Domestic Oil Consumption (1992E): 0.7 million b/d
Refining Capacity (1991): 0.86 million b/d
Petroleum Exports (1991E): 0.97 million b/d
U.S. Net Oil Imports (1991): 0.106 million b/d
Natural Gas Reserves (1991): 91.5 TCF
LNG Exports (1990): 18.7 million tons
Major Terminals and Ports: Arun, Dumai, Pulau, Sambu
Major Fields: Duri, Minos.

OIL INDUSTRY PROFILE

Organization: (state owned) Pertamina
Major Oil Customers (1991): Japan, U.S., Australia

RECENT DEVELOPMENTS

To combat declines in oil reserves, production and exports, Indonesia has liberalized energy policies and contract terms to attract foreign investment. As stated at the Indonesian energy bilateral meeting with the U.S. on July 29, 1992, Indonesia's general policy on energy consists of three points: 1) to intensify the exploration of new potentials, 2) to diversify the use of energy sources, and 3) to conserve energy. Development and domestic utilization of natural gas is of considerable importance to Indonesia. On a net basis LNG revenue may match oil revenue in fiscal year 1990-91, and match gross revenues in the next five years. New energy policy strategy has maintained

oil production levels but economic growth has meant greater domestic demand and has led to increases in product imports.

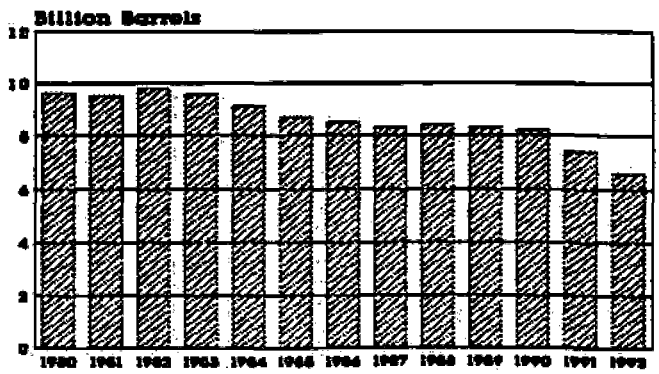
Revival of Investment

Indonesian oil fields are typically small and often require extensive use of secondary recovery techniques. This makes Indonesia dependent on a sustained flow of investment in oil exploration and development. To revive investment, Indonesia improved the terms of its production sharing contracts for foreign operators and opened secondary recovery areas for contract previously reserved for Pertamina. Indonesia's future plans are to open foreign investments in nine other oil and gas fields in the eastern provinces.

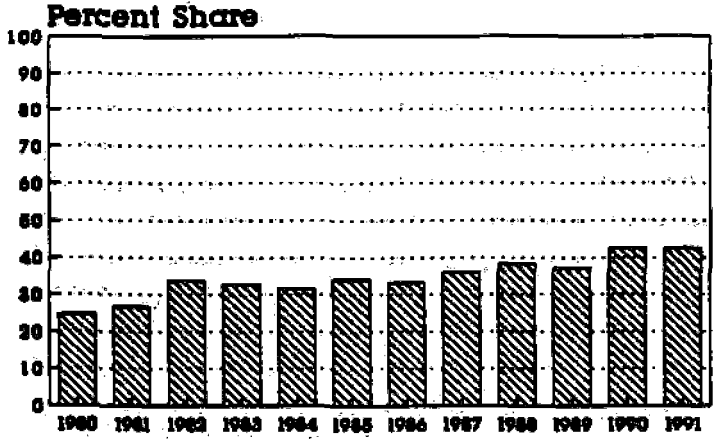
Expansion of Refinery Capacity

Indonesia plans to expand refinery capacity in order to reduce product imports and increase petroleum products exports. However, growth in

Estimated Proven Crude Reserves



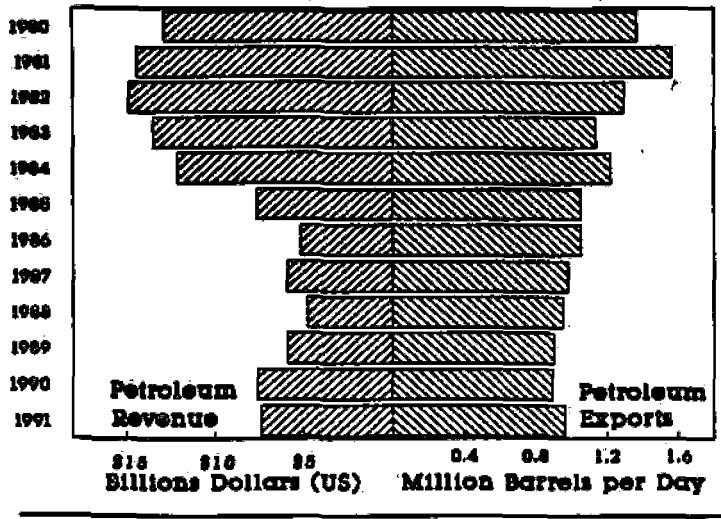
Consumption's Share of Production



domestic petroleum demand threatens those goals. To reduce petroleum demand, greater natural gas use is planned.

To promote refinery expansion a major change of energy policy was enacted by presidential decree, to allow foreign companies ownership of equity in oil sector assets. It is hoped that this policy change will revive several stalled refinery projects. The **125,000 barrels per day (b/d) refinery in West Java** appears on course for completion in 1993 and the **120,000 b/d Bintan Island refinery** (the first project under the new policy with foreign partners C. Itoh & British Petroleum) is planned for completion in 1994. Other projects under consideration that would add more refining capacity, still have to clear financial barriers and calm investors' concerns over long-term political stability.

Also under construction is a $2.25 billion olefin plant in the west Java town of Cilegon. When complete in late 1993, the plant will produce 550,000 tons/year (t/y)of ethylene; 300,000 t/y of propylene; 210,000 t/y of pyrolysis gasoline; 300,000 t/y of polyethylene; and 100,000 t/y of polypropylene. **Industry Minister Hararto** estimated imports savings of $1 billion a year from this project.

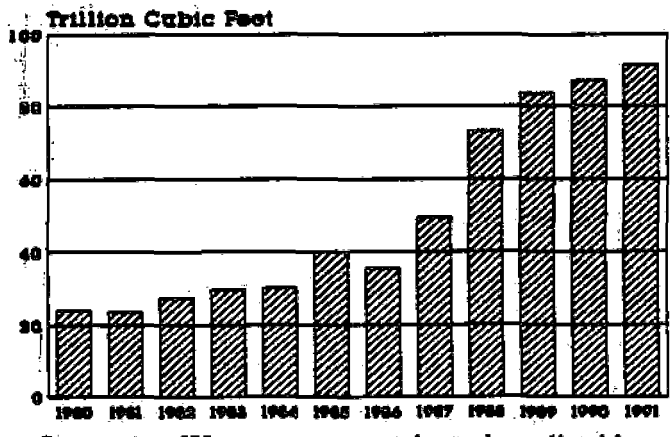


Natural Gas and LNG Exports

Large natural gas reserves, estimated as high as 150 TCF, have been discovered near Natuna Island in the South China Sea. A concession in this region, operated and half owned by Exxon, has 45 TCF of recoverable natural gas reserves. Exxon estimates development cost at $12-15 billion, with completion planned for 1998. Due to the high cost of development Pertamina wants to sell part of its share; some Japanese LNG importers are considered likely investors.

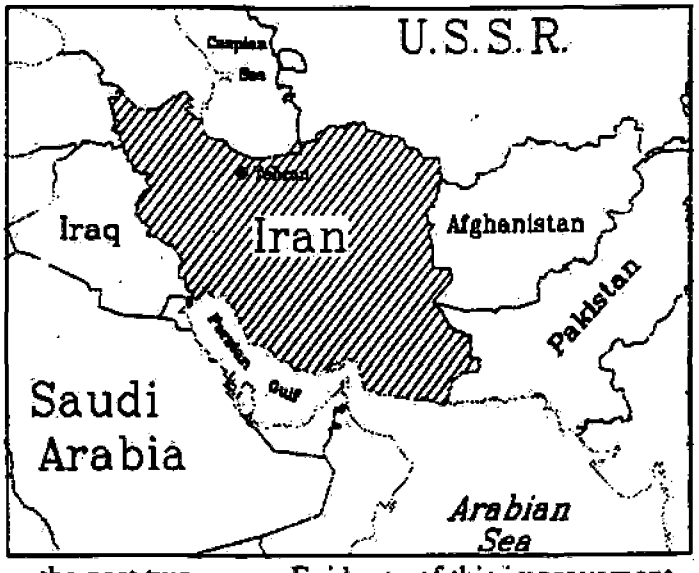
A gas distribution network design is being planned to supply natural gas for local energy needs. Plans are for natural gas to be used as a refinery fuel and in other domestic markets, exported to markets in Singapore and eventually supply the Arun LNG complex in Northern Sumatara. Waste gases, mostly carbon dioxide, will be used in enhanced oil recovery operations.

Estimated Proven Natural Gas Reserves



LNG exports were 18.7 million tons in 1990, almost 40 percent of the world's LNG market. Natural gas discoveries and development are important in providing adequate supply for potential expansion of LNG capacity. In March 1991, Pertamina awarded a $637 million contract to add a sixth liquefaction train of the LNG plant in Bontang to 2.3 million tons per year (MMT/Y). The contract is tied to a LNG supply contract with several Japanese utilities with completion planned for late 1994, and will raise total LNG capacity to 24 MMT/Y.

IRAN



COUNTRY PROFILE:

Head of State: Ali Akbar Hashemi Rafsanjani
Spiritual Leader: Ayatollah Ali Khamenei
Population (1992E): 60 million
Language: Farsi (Persian) 50%; Turkish 27%
Defense: Army (305,000); Revolutionary Guard Corps (150,000); Navy (14,500); Air Force (35,000)
Religion: Muslim (predominately Shi'a)
Location/ Size: Persian Gulf / 636,363 square miles
Major Cities: Tehran, Isfahan, Mashhad, Shiraz
Major Import Products: Industrial supplies (37%), machinery (30%), consumer goods (18%)
Major Trading Partners: Japan, Turkey, Germany

FINANCIAL PROFILE:

Gross Domestic Product (1992E US $ Bn): 87 (assumes international exchange rate)
Currency: Iranian Rial (IR)
Official Exchange Rate (3/92): US $ 1=IR 67.5
International Transactions Exchange Rate (August 1992E): US$1=IR600
Current Account Balance (1992E US $ Bn): -6.3
Petroleum Export Revenues (1992E US $ Bn): 15.4
Oil Exports as Percent of Merchandise Exports: 93%

ENERGY PROFILE:

Minister of Oil: Gholamreza Aghazadeh
Proven Oil Reserves (1992): 93 Billion barrels
Oil Production Capacity (1992E): 3.6 MMBD
Oil Production (1992E): 3.4 MMBD
Domestic Oil Consumption (1992E): 1.1 MMBD
Refinery Throughput (1991): 0.9 MMBD
Petroleum Exports (1992E): 2.4 MMBD
OPEC Production Quota (1992): 3.2 MMBD
Natural Gas Reserves (1992): 600 TCF
Oil Terminals: Kharg Island, Lavan Island, Sirri Island
Major Fields: Gachsaran, Agha Jari, Marun, Ahwaz Asmari, Ahwaz Bangestan

OIL INDUSTRY PROFILE:

Organization: National Iranian Oil Company (NIOC)
Major Customers: Western Europe, Japan, Brazil

RELATIONS WITH THE UNITED STATES:

Iran's spiritual leader, Ali Khamenei, said recently that Iran will not resume relations with the United States as long as it remains an "oppressive power." This statement reflects Khamenei's leadership of fundamentalist opposition to President Rafsanjani's relatively liberal policies. Despite such opposition, U.S.-Iranian relations have slowly improved over the past two years. Evidence of this improvement came in January 1991, when the U.S. began to allow selective purchases of Iranian oil, following a 3-year ban initially imposed in October 1987. In the months prior to this embargo, the U.S. had been a significant importer of Iranian oil.

RECENT DEVELOPMENTS:

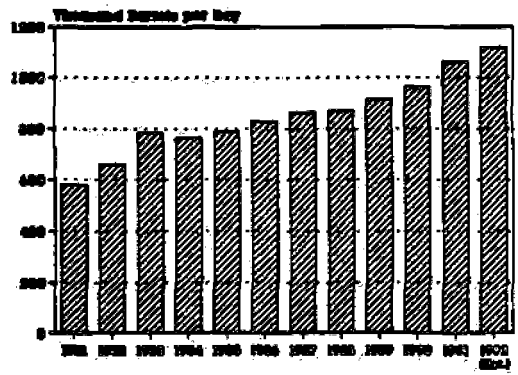
Iran faces immediate economic pressures, resulting both from the country's rapid population growth and the need to rebuild following the 8-year Iran-Iraq War. These economic pressures place a particularly heavy burden on the country's main source of revenues - the oil and gas industry. In order to maximize its oil export revenues, Iran has attempted to increase its own production, as well as to press for higher world oil prices. Iran also hopes to increase production from its huge natural gas reserves, both for export and domestic consumption. Substituting natural gas for oil consumption would also help free up more valuable oil for export.

Iran's need to rebuild its war-ravaged petroleum industry and to stimulate its economy has encouraged the country's recent move towards a more "pragmatic" foreign policy orientation. In the economic sphere, Iran has moved towards establishment of a market-based exchange rate, as well as towards allowing limited foreign participation in its upstream oil and gas operations.

Iran has also moved to assert itself in regional affairs, particularly among the newly independent former Soviet republics of Central Asia. In this regard, Iran has agreed with Azerbaijan and Ukraine to cooperate in construction of a 880-BCF-per-year-capacity gas pipeline from Iran,

through Russian and Azerbaijan, and on to Ukraine and possibly Europe. Iran has further offered to cooperate in exploring for oil and gas resources in the Caspian Sea with Azerbaijan, Russia, Kazakhstan, and Turkmenistan. Iran has also offered possible access for oil and gas exports from Central Asia to the Persian Gulf via pipelines through Iran.

Petroleum Consumption

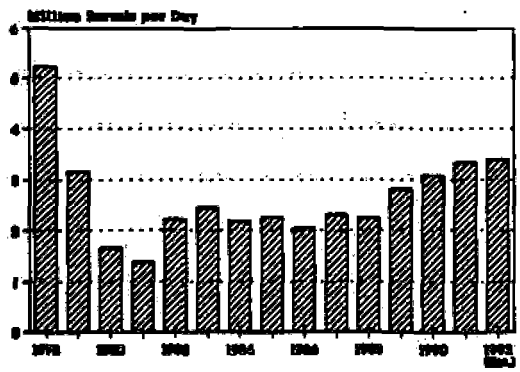


Finally, Iran has moved to reassert its power in the Persian Gulf region. In April 1992, Iran completed its occupation of a disputed island (Abu Musa) near the Strait of Hormuz. Abu Musa, along with two other islands - Lesser Tunb, and Greater Tunb - are also claimed by the United Arab Emirates.

OIL INDUSTRY

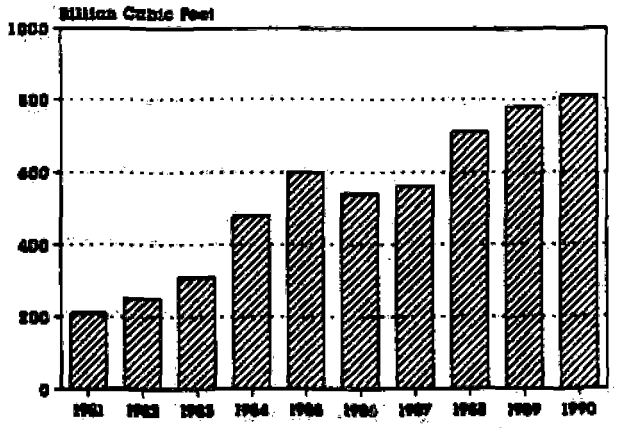
Iran has the fifth largest crude oil reserves in the world, estimated at nearly 93 billion barrels.

Crude Oil Production



Crude production in 1991 of 3.3 million barrels per day (MMBD) was about 13% of total OPEC production. Oil and gas revenues provided nearly 60% of government revenues in 1991. Iran's gas reserves of 600 TCF are the largest in the Middle East and the second largest in the world, representing around 13% of the world's total gas reserves. Natural gas resources are

Natural Gas Production



greatly underutilized, with only around 800 billion cubic feet being produced annually (over 700 years worth of production at this rate). The goal of a $1.4 billion gas development over the next 5 years is to free an additional 500,000-700,000 barrels per day (b/d) of crude oil for export.

After the war with Iraq, Iran began aggressive new programs designed to increase its recoverable oil reserves and to maintain and increase its production capacity. Secondary recovery techniques, involving the injection of associated and non-associated gas, have been applied to various oil fields - many of which suffered pressure loss due to lack of maintenance during the Iran-Iraq war. Current Iranian plans call for an expansion in oil production capacity from 3.6 MMBD currently to 5 MMBD by 1994 (actual production is anticipated at 4.5 MMBD, with 4.0 MMBD onshore and 0.5 MMBD offshore). In this regard, Iran plans to invest around $870 million in 1992 alone to modernize its petroleum industry. Of this amount, $620 million is earmarked for oil, and $250 million for petrochemicals. Overall, Iran has already spent $2.7 billion on rebuilding damage done to its petroleum industry during the war with Iraq. Iran claims it has plans to spend another $24 billion to complete this job.

In order to achieve its ambitious oil production goals, Iran has even resumed efforts at attracting foreign investors. Along these lines, Iran has pursued negotiations for development of offshore oil and gas fields with Japan, Europe and other international groups. Preliminary letters of intent or agreements have already been signed with France's Total (for the Sirri fields); Japan's Japex (for offshore fields in the Strait of Hormuz area);

and an Italian group (for a South Pars offshore gas and condensate project). Foreign investment - particularly onshore - is still politically sensitive, however, with a constitutional ban in place on foreign investment in the country's oil industry.

NIOC has also recently begun enhanced recovery programs at two aging fields - the Karanj/Paris and Nafteshah fields - currently producing 80,000 b/d and 15,000 b/d, respectively. NIOC's goal is to raise production at these fields to 250,000 b/d and 20,000 b/d, respectively.

Although Iran suffered heavy damage to its refineries during the war with Iraq, it has succeeded in getting its oil refinery industry back onto a normal footing in a relatively short time since the August 1988 ceasefire. In 1991, total refinery throughput reached 909,000 b/d (a record high), including over 300,000 b/d at Isfahan refinery, and over 200,000 b/d at the partially-rebuilt Abadan refinery. NIOC also plans to have the new 150,000 b/d Arak plant on line by mid-1993, while the 240,000 b/d-capacity Bandar Abbas refinery is scheduled to start production in 1994. Japan's Chiyoda and Italy's Snamprogetti are constructing the Bandar Abbas refinery. Other projects under discussion include a methanol plant on Kharg Island, a methyl tertiary butyl ether (MTBE) plant at Bandar Khomeini, and a linear alkyl benzene (LAB) plant in Isfahan.

Despite Iran's successes in restoring refining capacity, rapid growth in product demand has outstripped supply from domestic refineries. This growth in product demand has been caused mainly by rapid population growth and an upturn in industrial activity since the end of the war with Iran. This situation has forced NIOC to import significant amounts of product - 114,000 b/d in 1991 - in order to avert product shortages. Such shortages have helped fuel unrest over economic hardships brought about by two years of President Rafsanjani's economic reform program, as well as criticism of NIOC. This criticism resulted in a decision in March 1992 to relieve NIOC of responsibility for the country's refineries, which are now to operate as separate commercial units.

Iraq

COUNTRY PROFILE

Head of State: Saddam Hussein at-Takriti
Population(1990E): 19 million
Languages: Arabic, Kurdish
Defense (pre-1991): Army: 955,000; Air Force: 40,000; Navy: 5,000
Religion: 95% Muslim, more than half of whom are Shiites
Location/Size: Persian Gulf/168,040 square miles
Major Cities: Baghdad, Basra, Mosul, Kirkuk
Major Import Products (pre-embargo): Industrial supplies, capital goods, consumer goods

FINANCIAL PROFILE (Pre-Embargo)

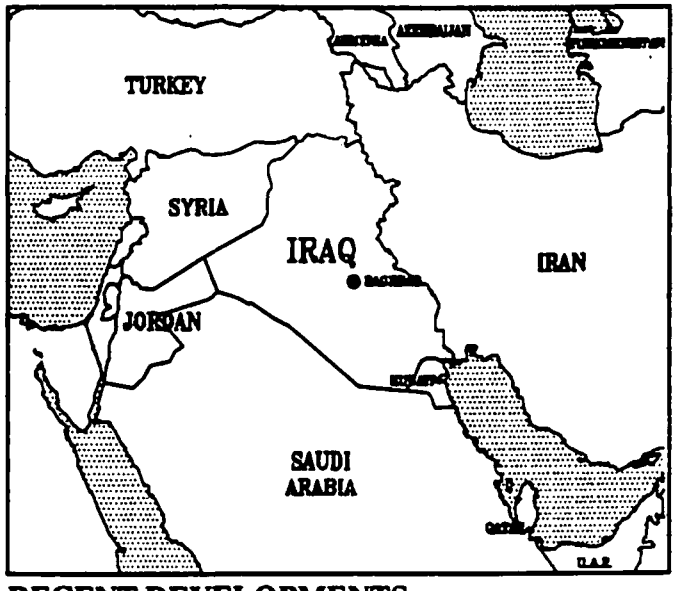
Monetary Reserves (Non Gold, 1987E): $0-2 billion
Foreign Debt (1989E): $65 billion
Gross Domestic Product (1988E): $41.3 billion
Currency: Iraqi Dinar (ID)
Exchange Rate (1/92): US$1 =ID 0.3109
Current Account Balance (1989): -$2.04 billion
Petroleum Export Revenues (1988E): $12 billion
Oil Export Revenues/Total Export Revenues: 94%

ENERGY PROFILE

Minister of Oil: Usama Abdel Razzaq Hithi
Proven Oil Reserves (1/1/92): 100 billion barrels
Oil Production Capacity (7/92E): 1.3-1.6 million barrels/day
Oil Production (7/92E): 400,000 barrels/day (b/d)
Oil Production Quota (5/92): 505,000 b/d
Domestic Oil Consumption (7/92E): 350,000 b/d
Refining Capacity (1992E): 550,000 b/d
Major Refineries: Baiji, Basra, Daura
Petroleum Exports (7/92E): 50,000 b/d
Exports to the United States (9/90-7/92): None
Natural Gas Reserves (1/1/92): 95 trillion cubic feet (TCF)
Natural Gas Production (6/92E): 240 million cubic feet/day
Pipeline Capacities: Iraq-Turkey, 1.0-1.2 million b/d; Iraq Pipeline-Saudi Arabia (IPSA II), 1.65 million b/d (closed to Iraq in 1990); Strategic Pipeline, 0.8-0.9 million b/d
Oil Terminals: Ceyhan, Turkey; Yanbu, Saudi Arabia (closed to Iraq); Mina al-Bakr
Major Fields: East Baghdad, Kirkuk, Rumaila, Zubair, Bai Hassan, Buzurgan

OIL INDUSTRY PROFILE

Organization: The Oil Ministry oversees the nationalized oil industry including: the Iraq National Oil Company (INOC), responsible for managing exploration and production; State Organization for Oil Marketing (SOMO); Iraq Oil Exploration Company (IOEC), responsible for oil equipment manufacturing; National Company for Distribution of Oil Products and Gas; Iraqi Oil Tankers Company; and the National Company for Oil Projects.
Major Customers (pre-embargo): Europe, United States, Japan

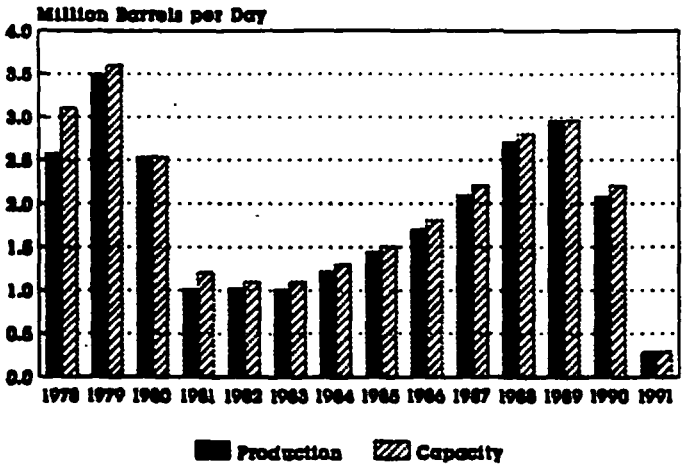


RECENT DEVELOPMENTS

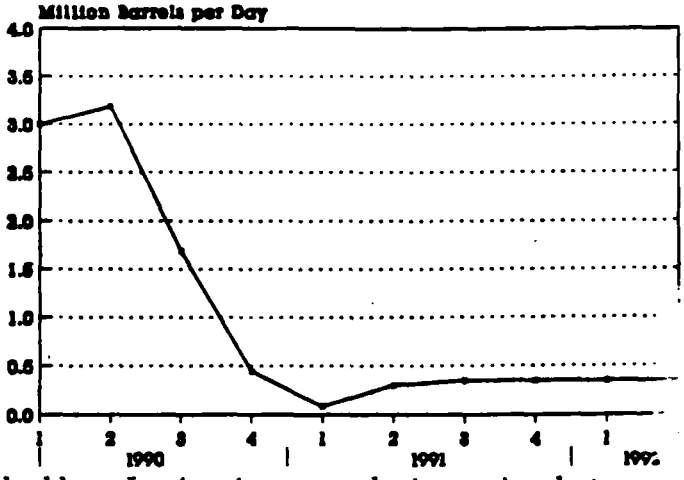
Iraq has been isolated both politically and economically since its invasion of Kuwait in August 1990. Iraq remains subject to United Nations (UN) sanctions and the threat of military action due to its failure to comply with the terms of the ceasefire resolution ending the Persian Gulf War. Two major points of contention are Iraq's failure to cooperate with UN inspection teams enforcing Iraq's agreement to destroy all weapons of mass destruction, and Iraq's treatment of the Shiites in the southern marshlands. In July 1992, Saddam Hussein told Iraqis not to expect an early lifting of sanctions.

Soon after Iraq invaded Kuwait, Iraq's overseas assets were frozen and all trade, except for humanitarian purposes, banned. In September 1991, the UN proposed a scheme that would allow Iraq to raise revenue for war reparations and humanitarian purchases by exporting up to $1.6 billion worth of oil over 6 months (about 450,000 b/d, assuming a price of $20/barrel). In several rounds of negotiation, Iraq has repeatedly rejected the plan. Iraq's basic objection is that the plan would violate its sovereignty, since it includes conditions on Iraq's use of oil terminals and sales of crude oil, and requires the monitoring of transport and drilling activity. Iraq has asked that exports be permitted through its Persian Gulf port at Mina al-Bakr (the UN plan specifies exports through Turkey to the Mediterranean terminal at Ceyhan), because of the transit fees it would have to pay Turkey as well as the line's vulnerability to attack by Kurdish rebels in northern Iraq. Iraq has also refused to accept a

Total Liquids Production and Capacity



Iraqi Oil Production



UN border agreement which would give Kuwait an area containing Iraqi naval facilities and several oil wells in the Rumaila field.

The military campaign to liberate Kuwait devastated Iraq's economy and infrastructure, with damage estimated in the range of $200 billion. Restoration efforts are proceeding with little known outside assistance due to the continued imposition and enforcement of UN sanctions. A high priority for Iraq is the restoration of its oil production and export capacity, since oil exports represent the primary future source of revenue for the economy. Iraqi dissidents estimate lost revenues and damage to oil installations have cost Iraq $35 billion since the Gulf crisis began in 1990. This estimate includes $5-10 billion in damage to pumping stations, pipelines, refineries, a petrochemical plant, export facilities, and several tankers.

RESTORATION OF OIL INDUSTRY

Progress in rebuilding Iraq's oil industry has been slowed by the lack of spare parts and access to foreign expertise and financing. Nevertheless, Iraq's claims to have restored a major portion of its oil producing, exporting, and refining capacity are largely substantiated by *Petroleum Intelligence Weekly* (*PIW*) reports (7/13/92 and 7/20/92). The following estimates are taken primarily from the *PIW* reports.

Production Capacity. In July 1992, Iraq's production capacity was estimated to total 1.3-1.6 million b/d, compared with 3.3 million b/d prior to the war (the estimate shown in the figure is lower because it represents an annual average for the year). Most of this capacity (0.8-1.0 million b/d) is reported to be in the northern fields near Kirkuk. The southern fields had been Iraq's primary producing region, but received more extensive damage in the war. Total capacity of these southern fields is estimated in the range of 0.5-0.6 million b/d, primarily from the Rumaila field. Iraq is expected to continue restoring its production capacity gradually once the embargo is lifted.

Export Capacity. Iraq claims it can export about 3 million b/d, but Saudi Arabia's objections to the use of the IPSA line and logistical constraints such as the lack of spare parts and limited storage facilities imply a lower total in the range of 1.5 million b/d (about 1 million b/d via the Iraq-Turkey Pipeline to Ceyhan on the Mediterranean and no more than 0.5 million b/d via Mina al-Bakr on the Persian Gulf). Current and pre-embargo export capacities are summarized as follows (million b/d):

	Pre-Embargo	Current
Yanbu (closed to Iraq)	1.65	1.65
Ceyhan	1.6	1.0-1.2
Mina al-Bakr	0.8	0.5

All four of the deep-water berths at Mina al-Bakr, Iraq's only operable Gulf port, reportedly have been repaired, while both Turkish and Iraqi officials claim the Iraq-Turkey Pipeline is capable of normal operations within their respective territories. Saudi Arabia, however, has stated it would not allow Iraqi exports to transit its territory via the IPSA pipeline to Yanbu on the Red Sea as long as Saddam Hussein remains in power. Another possible route for Iraqi exports - the line through Syria - has been closed since 1982 and is not likely to be reopened soon. Iraq's export route options are therefore limited to pipeline exports via Turkey, Persian Gulf exports via Mina al-Bakr, and continued small volumes via truck

to Jordan. Repairs to Iraq's reversible Strategic Pipeline linking the northern and southern fields and to a critical pump station at Haditha give Iraq the flexibility to export via either Turkey or the Gulf. Iraq has also recently mentioned the possibility of reviving plans for construction of a 1 million b/d pipeline to Jordan, which would provide an additional export route via Aqaba on the Red Sea.

Refining Capacity. Iraq has resumed operations at three main refineries, and has restored additional capacity at several smaller facilities whose production is not currently needed. Refineries at Daura (near Baghdad) and Baiji are reportedly operating at or near their pre-war levels. The Basra refinery received more extensive damage and is operating at about half its pre-war capacity. In June 1992, Iraq's oil minister claimed refining capacity was at 84 percent of its pre-war level. Iraq has also discussed longer-term plans to build additional refineries - one in Iraq and another in Sudan.

EXPLORATION AND DEVELOPMENT

Despite its current focus on repairing war damage, Iraq is already planning future exploration and development with the likely assistance of foreign companies and has established an output target of 6 million b/d by the end of the 1990's. Two French companies (Elf Aquitaine and Total) have begun negotiations with Iraq, and SOMO has established an office in Amman, Jordan for the purpose of attracting foreign companies. However, no commitments are likely until the uncertain political situation is resolved. In June 1992, Iraq signed a protocol with the former Soviet republic of Azerbaijan on cooperation in the sphere of oil and gas extraction. Iraq appears to be concentrating on the further exploration and development of four giant southern fields: Majnoun, West Qurna, Halfaya, and Nahr Umar.

ECONOMIC OUTLOOK

A report submitted to the UN by Iraq in January 1992 provides the official Iraqi assessment of the effect of the war and sanctions on the economy. Between 1989 and 1991, real GDP declined by more than 17 percent, personal income declined by 20 percent, and annual inflation averaged 140 percent. The balance of payments deficit for the last half of the 1980s was reported to be nearly $30 billion. In March 1992, Iraq's overseas assets were estimated by the *Middle East Economic Survey* to total $5 billion. Economic recovery is contingent on Iraq's ability to resume earning oil export revenue and to obtain access to its frozen assets and to foreign financial and technical assistance. This will not happen until the current political standoff is resolved.

POLITICAL BACKGROUND

The current internal political situation is difficult to gauge given Iraq's isolation, both from its Arab neighbors and most of the international community. Power rests with the President and a Revolutionary Command Council (RCC), comprised of nine members and chaired by Saddam Hussein. Considerable influence is wielded by the Iraq Regional Command of the Ba'ath Party, which is also headed by Saddam Hussein. Routine administration of the country is carried out by an appointed Council of Ministers. Legislative responsibility is shared between the RCC and the 250-member National Assembly, which is dominated by members of the ruling Ba'ath Party.

Internal political problems center on the rights of two groups: the Kurds in the north and the Shiites in the south. The first free elections for Iraqi Kurds, held in May 1992, produced no clear winners. So far, attempts at consolidating opposition groups have produced no visible results, despite general agreement among these groups that Saddam Hussein should be ousted.

Kazakhstan

COUNTRY PROFILE

President: Nursultan Nazarbayev
Prime Minister: Sergey Tereschenko
Population (1989): 16.5 million
Size/Location: 1.0 million square miles in Central Asia, bordering the Caspian Sea on the West, Russia to the North, China to the East, and Kyrgyzstan, Turkmenistan, and Uzbekistan to the South
Ethnic Divisions: Kazakh (39.7%), Russian (37.8%), German (5.8%), Ukrainian (5.4%), all other nationalities (11.3%)
Major Cities: Alma-Ata (capital), Karaganda, Chimkent, Dzhambul
Major Trading Partners: Other republics of the Commonwealth of Independent States (CIS), Holland, former Eastern Bloc, Finland, China

ECONOMIC PROFILE

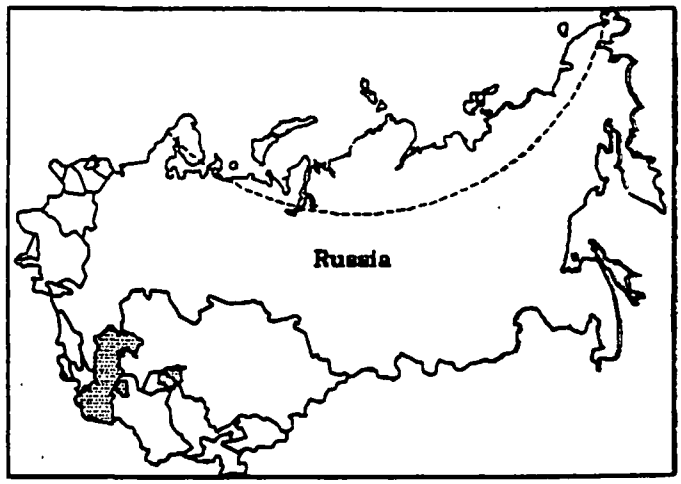
Gross National Product (1991): $135 billion (Note: assumes official 1991 exchange rate of 0.6 rubles/dollar)
Currency: Ruble
Commercial Exchange Rate (10/27/92): US$1 = 393 Rubles

ENERGY PROFILE

Minister of Fuel and Energy Resources: Kayir Baykenov
Proven Oil Reserves (1989E): 14 billion barrels
Oil Production (1992E): 600,000 barrels per day (b/d)
Domestic Oil Consumption (1991): 400,000 b/d
Refinery Throughput (1991): 360,000 b/d
Petroleum Exports (1991): 200,000 b/d
Proven Gas Reserves(1989E): 26 trillion cubic feet (Tcf)
Natural Gas Production (1992E): 0.4 Tcf
Natural Gas Consumption (1991): 0.5 Tcf
Natural Gas Imports (1991): 0.2 Tcf
Coal Production (1992E): 138 million short tons (MST)
Coal Consumption (1991): 94 MST

OIL AND GAS INDUSTRY PROFILE

Organization: Tengizneftegaz (Tengiz oil production association); Kazakhgazprom (State gas corporation); Kazakhstanugol' (State coal corporation, comprising both Karaganda and Ekibastuz production associations)
Major Customers: primarily Russia and Azerbaijan, but also Kyrgyzstan, Tadjikistan, Turkmenistan, Ukraine, Uzbekistan
Major Oil Fields: Mangyshlak fields (largest is Uzen), Tengiz (Aktyrau -formerly Gur'yev- Oblast), Korolev
Major Gas Fields: Karachaganak (Ural'sk Oblast)
Major Oil Ports: None; small tanker shipments to Baku and up Volga River to Volgograd from ports at Aktyrau and Aktau (formerly Shevchenko)
Oil Export Pipelines: Pipelines from Aktyrau to Russian cities of Orsk, Volgograd, and Samara (formerly Kuybyshev). Under construction - Caspian Pipeline Consortium line from Tengiz-Grozny has a completion date April 1993, continuing on to Novorossysk. Grozny-Novorossysk pipeline capacity is 1.5 million b/d
Gas Export Pipelines : Aktau-Aktyrau to Saratov in Russia
Major Oil Refineries (1991 throughput): Pavlodar (140,000 b/d), Chimkent (140,000 b/d), Aktyrau (80,000 b/d)



HISTORICAL BACKGROUND

The dry plains of southern Kazakhstan are inhabited by the nomadic Kazakhs. Russians arrived at the turn of the century in arable northern Kazakhstan, and greater numbers came in the 1950's with Khrushchev's Virgin and Idle lands programs. In addition, Stalin's resettlement programs moved entire ethnic groups out of European Russia into Kazakhstan, increasing its ethnic diversity. Kazakhs barely constitute a plurality now, with Europeans making up the plurality of the populace in the cities, industrial centers, and northern arable lands.

The Kazakh Republic was formed as an autonomous republic within the Soviet Federation on August 26, 1920, and reconstituted as an Union Republic on December 5, 1936. Kazakhstan declared its sovereignty on October 25, 1990, after 13 republics of the former Soviet Union had done so, but remains a member of the Commonwealth of Independent States, a loose confederation of 11 former republics of the Soviet Union.

Kazakhstan's importance as an independent republic arises because of its size, mineral wealth, and its possession of nuclear arms following the breakup of the Soviet Union. Kazakhstan is the second largest of the former Soviet republics in area, fourth largest in population, third largest in Net Material Product (NMP), and the third largest in both energy production and consumption.

Until its independence, Kazakhstan's economy was centrally directed and highly integrated with the other republics of the former Soviet Union. Foreign trade in particular was centrally directed by the former Soviet Union, with goods shipped primarily through Russia before being exported.

Most of Kazakhstan's economic and transportation infrastructure was planned without regard to its borders, with the result that Kazakhstan remains highly dependent upon trade with the other republics of the CIS.

ECONOMIC PROFILE

With independence, Kazakhstan has moved quickly to decentralize its economy and become more economically independent from Russia. Some key elements of economic reform are already in place, including:

Privatization - President Nazarbayev has moved quickly to implement privatization measures. All agricultural enterprises are to be privatized by the first quarter of 1993. In addition, Nazarbayev has issued decrees that will push small Kazakh industrial enterprises to be privatized, with a goal of privatizing up to 1/3 of all Kazakh enterprises within the next few years. The privatization measures have met with opposition from lower levels of the Kazakh government, especially from former communist leaders. Nazarbayev is in the process of replacing many local leaders with his own appointees.

Price Controls - State price controls on most goods were removed on January 6, 1992. However, some restrictions remain on communications, energy, food, housing, municipal services, and transportation. Coal, diesel fuel, gasoline, and retail natural gas price increases were limited to 300-500 percent, while crude oil, electricity, and natural gas price increases for producers were limited to 400-800 percent.

Currency - Kazakhstan continues to use the ruble. Kazakhstan plans to develop its own currency, and in preparation for this President Nazarbayev officially opened Kazakhstan's own gold fund in January 1992.

Economic Development - Kazakhstan has moved quickly to attract foreign investment by creating a political/legal/tax climate conducive to foreign aid. President Nazarbayev's regime appears to enjoy strong support, and he is committed to economic reform. On June 10, 1992, President Nazarbayev issued a decree creating a state foreign investment agency to be run by Deputy Prime Minister Kadir Baykanov. This agency will coordinate actions by state bureaucracies, draft legislation on foreign investment, conduct international tenders on mineral deposits, help evaluate competitive bids for resource development, and draft proposals for granting concessions. It will also formulate proposals for government guarantees for high-priority projects, and represent Kazakhstan in international loan and credit negotiations.

In May 1992, Kazakhstan adopted its law on "Underground Resources and Processing of Mineral Resources" to provide a legal framework for resource development. The law is broad in scope and is thought to be adequate but lacking in details, which are left for negotiations with individual investors.

Kazakhstan has been successful in attracting foreign capital, and has exploited foreign reluctance to invest in Russia. Kazakhstan claims 300 foreign joint ventures, with 20 reported joint energy ventures. Kazakhstan and Japan have set up a council for economic development, and plans include opening Japan's trade mission in Alma-Alta and launching a number of joint ventures.

OIL AND GAS INDUSTRY

In 1991, Kazakhstan was the former Soviet Union's second largest oil producer, third largest coal producer, sixth largest natural gas producer, and third largest overall energy producer and consumer. Kazakhstan's energy was developed primarily during the Soviet period beginning with the 1930's. Kazakhstan's oil and gas production is concentrated primarily in the Northwest, while its main consuming sectors are in the opposite end of the country. This has led to a large inter-republican trade in energy, with domestically produced oil and gas shipped northward while oil imports from Siberia and gas imports from Russia and Uzbekistan supply the rest of the country.

Kazakhstan's oil production has centered in the fields of the Mangyshlak peninsula bordering the Caspian Sea. The North Caspian Basin has recently been the center of much interest, culminating in the $20 billion joint venture with Chevron at the Tengiz field bordering the Caspian Sea. This field is estimated to contain between 3-10 billion barrels of oil, and eventually produce over 800,000 b/d. In July 1992, Kazakhstan joined the Caspian Pipeline Consortium with Russia, Azerbaijan, and Oman to construct a pipeline to transport Caspian Sea crude to world markets. Completion of the

Tengiz-Grozny segment is expected in April 1993. The French oil company Elf-Aquitaine has recently signed a deal to explore the Aktubinsk region of northwest Kazakhstan as well.

Kazakhstan has been successful in attracting foreign investment not only because of its stable legal/political environment, but also because its tax structure reportedly allows a high internal rate of return on energy investments of 30 percent, compared with 10 percent in Russia. The Omani government has been advising the Kazakhs on energy joint ventures, and is not only the project coordinator for the Caspian Pipeline Consortium, but has also been rewarded with its own exploration venture near Akyrau.

Gas production has been centered in the Karachaganak field in the Northwest, bordering the Orenburg field in Russia. British Gas and Agip recently won a $6-$7 billion contract to further develop the field, thought to contain 20 Tcf of reserves, with eventual production of over 0.7 Tcf/year - roughly equivalent to current Iranian production. Some associated gas is also produced in the Mangyshlak oil fields.

COAL INDUSTRY

Despite its oil and gas potential, Kazakhstan is very different from every other republic in the CIS in that coal, not oil or gas (the dominant fuel in the CIS), is the primary fuel used for energy consumption. Because of the abundance of coal, Kazakhstan is also a large coal exporter. The Karaganda basin in north-central Kazakhstan produces high quality coking coal which supplies the Ukrainian and Urals iron and steel industries. The Ekibastuz basin in the North is the third largest basin in the former Soviet Union, and produces brown (sub-bituminous) coal suitable for use in power stations in Urals power plants and Kazakhstan. This brown coal is produced from several huge strip-mining operations.

Kuwait

COUNTRY PROFILE

Head of State: Shaikh Jaber al-Ahmad al-Jaber as-Sabah
Population(3/92): 700,000 Kuwaiti citizens
Language: Arabic
Religions: Muslim (95%), of which approximately 70% are Sunnis
Defense: Army: 16,000; Air Force: 2,200; Navy: 2,100
Location/Size: Persian Gulf / 6,880 sq. mi.
Major Cities: Kuwait City, Salmiya, Hawalli
Imports: Industrial goods (24%), consumer goods (24%), transport equipment (19%), machinery (18%), food (13%)

FINANCIAL PROFILE

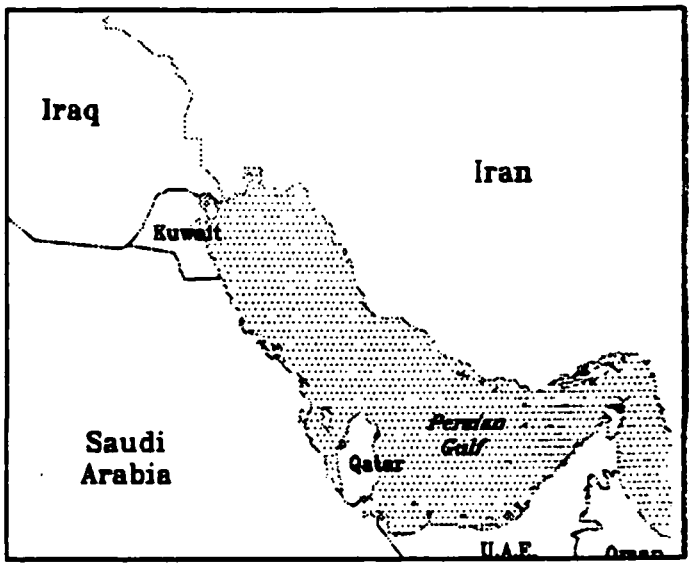
Gross Domestic Product (1992E): $12.4 billion
Currency: Kuwaiti Dinar (KD)
Exchange Rate (11/92): US $1 = KD 0.30
Current Account Balance (1992E): -$7.7 billion
Petroleum Export Revenues (1992E): $7 billion
Oil Revenues/ Total Revenues (1992): 90%

ENERGY PROFILE

Minister of Oil: Ali Ahmed al-Baghli
Proven Oil Reserves(1/1/92): 94 billion barrels
Oil Production Capacity (4Q92E): 1.3 MMBD
Oil Production (11/92): 1.5 MMBD*
Domestic Oil Consumption (8/92): 0.1 MMBD
Refining Capacity (10/92): 0.4 MMBD
Refineries: Mina Ahmadi, Mina Abdullah, Shuaiba
Petroleum Exports (1992E): 1.3 MMBD*
Natural Gas Reserves (1/1/92): 48 trillion cubic feet
Major Oil Fields: Burgan, Raudhatain, Sabriyah, Umm Gudair, Minagish, Magwa, Ahmadi
Major Ports: Shuwaikh, Shuaiba, Doha
* Includes Neutral Zone production

OIL INDUSTRY PROFILE

Organization: The *Supreme Petroleum Council* governs the nationalized oil industry. *Kuwait Petroleum Corporation* (KPC) is the parent company. Subsidiaries include: *Kuwait Oil Company* - exploration and production of oil and gas; *Kuwait National Petroleum Company* - refining and shipping; *Kuwait Petroleum International* - refining and product marketing; Petrochemical Industries Company - production and marketing of chemical products; *Kuwait Foreign Petroleum Exploration Company* - foreign exploration; and *Kuwait Oil Tanker Company* - tanker operations.
Major Trading Partners (1992): United States, Japan, Europe
Downstream Investment: British Petroleum (9.8% ownership), Hong Kong's Guoco Group Ltd. (24%), Britain's Midland Bank (10%), and Spain's Fesa-Enfersa (40%)



RECENT DEVELOPMENTS

In October 1992, Kuwait held its first postwar parliamentary election, with Kuwait's organized opposition groups winning an unexpectedly large majority of 35 seats. This is the first parliament to be formed since Kuwait's ruling Emir dissolved the legislature in 1986 for its harsh criticism of the government.

Shortly after the liberation of Kuwait in February 1991, reconstruction costs were estimated as high as $100 billion, with repairs expected to continue into the next century. Almost two years later, a revised version of the rebuilding process should cost only one fifth of the initial estimate. The fast pace of rebuilding, especially in the oil sector, has put production far ahead of the original schedule. With its oil industry heavily damaged by bombing and sabotage (including the setting afire of its oil wells by retreating Iraqi troops), Kuwait was forced to borrow on international financial markets to avoid liquidating its core investments. Current business opportunities in Kuwait focus on rebuilding the emirate's economic and physical infrastructure. With its own workforce depleted by the departure of large numbers of foreign nationals (who were deported during the occupation) and the voluntary exile of many Kuwaiti citizens, Kuwait has entered into numerous contract arrangements with companies around the world for assistance.

RELATIONS WITH THE UNITED STATES

The United States, having led the coalition which liberated Kuwait, is now taking the lead in rebuilding the country. The U.S. firm Bechtel Corp. was hired to oversee the reconstruction of

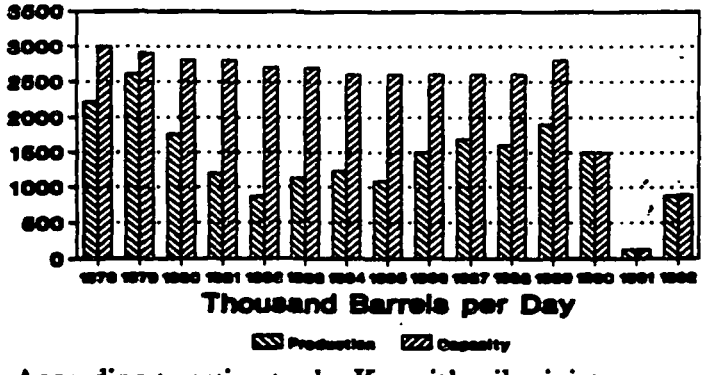
Kuwait's oil, gas and petrochemical facilities, and the U.S. companies of C.F. Braun and Foster Wheeler are responsible for the new design of the Mina al-Ahmadi and Mina Abdullah refineries. Also U.S. electrical equipment and supplies are being used in these refineries. Texaco's Getty Oil Co., which acts jointly with Kuwait Oil Co. and manages Kuwait's Neutral Zone production, is responsible for repairing wells and production centers.

Prior to the invasion by Iraq in August 1990, U.S. imports of crude oil and petroleum products from Kuwait had been increasing -- from an average 68,000 barrels/day (b/d) in 1986 to 157,000 b/d in 1989 (2 percent of net U.S. imports). In the first nine months of 1990, the United States imported an average 115,000 b/d from Kuwait. Imports were nonexistent in 1991 until September and October (34,000 b/d and 33,000 b/d, respectively) and averaged 66,000 b/d in August 1992.

STATUS OF REBUILDING EFFORTS

Since the liberation of Kuwait, 727 of the 940 oil wells have been brought back into production. Losses from the fires and leaks were estimated at 6 million b/d until the first well was extinguished on April 7, 1992. These losses were equivalent to $120 million/day in lost revenues. By August 1992, nine months after Iraqi-set oil well fires were put out, Kuwait had nearly tripled its oil revenues and cut its budget deficit by two-thirds since the end of the war.

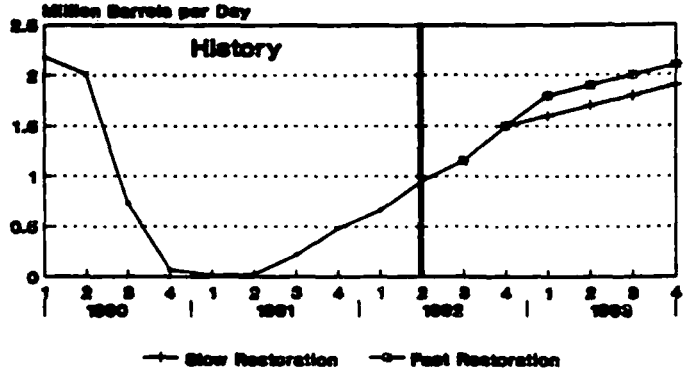
Total Liquids Production and Oil Production Capacity



According to estimates by Kuwait's oil minister, up to 3 percent of reserves may have been lost as a result of damage to the oil fields. This equates to 2.8 billion barrels, based on estimated reserves as of January 1992 .

Kuwaiti oil production, which had come to a complete halt following Iraqi sabotage and the conduct of Operation Desert Storm, resumed in June 1991. Throughout 1991 and into 1992, production increased steadily from an average of 450,000 b/d at the end of 1991 to 780,000 b/d by March 1992. Production is currently estimated at 1.5 million b/d. Kuwait's goal for the end of 1993 is 2.0 million b/d.

Kuwaiti Production*



*Includes Neutral Zone

Product exports have been slower to recover due to extensive refinery damage. The Mina Ahmadi refinery, the oldest of the three major refineries, is currently processing 185,000 b/d, all for domestic product demand. The other two major refineries -- Mina Abdullah and Shuaiba -- received more extensive damage. Refinery capacity in Mina Abdullah is currently 230,000 b/d, which is mostly for export. Shuaiba refinery, which was the hardest hit by the Iraqi damage, will not be processsing any crude oil before November of 1993, when it is scheduled to refine 130,000 b/d. The three refineries are expected to reach their full capacity levels by 1995 after repairs and updates are completed.

The occupation, war, reconstruction, and loss of oil revenues have been costly for Kuwait. Since Iraq's invasion, Kuwait is reported to have sold about $40 billion in assets. Of the $16 billion Kuwait had pledged to pay for Desert Shield and Desert Storm, it had paid all but $2.8 billion by September 1991. In July 1992, the government approved a $24 billion plan to buy out bad debts, which have been carried for a decade by Kuwaiti banks following the collapse of the Manakh stock market in 1982. In December 1991, Kuwait signed a $5.5 billion loan agreement, its first borrowing on such a large scale. The 5-year

reconstruction loan, coordinated by J. P. Morgan and Company, is being provided by a syndicate of 81 institutions, including many European and Japanese banks. The loan is complemented by export credit packages (with the United States, Britain, Japan, and Canada) totalling $5.5 billion.

OIL INDUSTRY

Kuwait has been a major world oil producer since World War II, and has used its oil revenues to develop an advanced welfare system and provide jobs for over a half-million people. In the late 1960's, Kuwait bought 100 percent equity in the Kuwait Oil Company (KOC). In 1980-1981, it completely reorganized its oil sector by forming a new holding company, the Kuwait Petroleum Corporation (KPC) to consolidate the upstream operations of KOC and the downstream operations of the Kuwait National Petroleum Company. Since that time, it has been expanding facilities for distribution, marketing and retail of its refined products. In 1983, it established a London-based subsidiary (Kuwait Petroleum International, KPI) to manage newly acquired distribution outlets, mainly in Europe.

The emirate plans to reestablish itself as a major producer as it recovers from the war with Iraq. Assuming war-damage to reserves is no more serious than assessed, Kuwait's reserves will last for another two centuries at the pre-invasion production rate. Kuwait therefore has a strong motivation to hold and expand its market share. Future expansions are expected to be slower than before the war, however, due to financial limitations.

KPI refines and markets its products in Europe under the brand name of "Q8", with 5,000 filling stations in Italy, Sweden, Great Britain, and the Benelux countries. In 1991, KPC formed a new company (Kuwait Oil Thailand) to construct 100 filling stations in Thailand. Thailand currently has 17 filling stations operating. Thus, Kuwait's oil industry has developed into a totally integrated sector, controlling operations from wellhead to pumping station.

KPC has regained 90 percent of its traditional customers in East Asia, Japan, India and Brazil, plus new "major" customers in the United States. Kuwait also supplies about 30,000 to 40,000 b/d of crude oil to the Chinese Petroleum Corporation (CPC) and 60,000 b/d of crude supplies to the South Korean firm of Yukong.

DOWNSTREAM INVESTMENTS

Kuwait's once aggressive overseas investment policy, originally intended to supplement the country's oil revenues and to protect the country from oil price fluctuations, cushioned the financial impact of Iraq's occupation. Kuwait's world-wide investment portfolio before the Gulf War was estimated between $100-120 billion. Kuwait's current overseas investments are estimated at $30 billion. Kuwait has had to draw on nearly $40 billion to cover war-related costs, and the value of some its investments, particularly real estate, has fallen as a result of general market conditions.

Latvia

COUNTRY PROFILE

Prime Minister: Ivars Godmanis
Government: Republic; declared independence from Soviet Union August 21, 1991; independence recognized by Soviet Union September 6, 1991
Population (1989): 2.7 million
Size/Location: 24,900 square miles in Eastern Europe, bordering the Baltic Sea to the West, Estonia to the North, Russia to the East, and Belarus to the Southeast
Ethnic Divisions (1989): Latvian (52%); Russian (34%); Belarussian (4.5%); Ukrainian (3.5%); other nationalities (6%)
Major Cities: Riga (capital), Daugavapils, Liepaja, Ventspils

ECONOMIC PROFILE

Gross National Product (est. 1992 @ purchasing power parity rates): $15.2 billion in $1990
Currency: Latvian Ruble (Rublis)
Commercial Exchange Rate (10/22/92): US$1 = 160 Rublis
Major Trading Partners: "Ruble zone" countries, Germany, Poland, Scandinavia, United States

ENERGY PROFILE

Industry and Energy Minister: Ivars Millers
National Power Company: Latvenergo
National Petroleum Company: Latvijas Nafta
National Gas Company: Latvijas gaze
Proven Oil Reserves (1989E): none
Domestic Oil Consumption (1991): 70,000 b/d
Refinery Throughput (1991): none
Proven Gas Reserves(1989E): none
Natural Gas Consumption (1991): 100 billion cubic feet
Coal Production (1991): none
Coal Consumption (1991): 700,000 short tons
Electricity Production (1991): 5.6 billion kilowatt hours (Bkwh)
Electricity Imports (1991): 3.7 Bkwh

OIL AND GAS INDUSTRY PROFILE

Major Oil Ports: Ventspils, the second largest export point for oil from the Commonwealth of Independent States (CIS), has a capacity of 800,000 b/d and is ice-free. Exports in 1991 were 386,000 b/d. Products are received mostly by rail from Russia, Lithuania, and Belarus
Crude Oil Import Pipelines: Druzhba (Friendship) pipeline from Russia via Novopolotsk (Belarus) to Ventspils
Major Gas Import Pipelines : Northern Lights pipeline from West Siberia (Russia) to Riga and storage reservoir at Incukalns
Major Oil Refineries: none

BACKGROUND

Latvia has no fossil fuel resources and contains only small amounts of peat and firewood. Latvia's major indigenous source of primary energy is the cascade of three hydroelectric plants on the Daugava River totalling about 1500 megawatts. All other energy must be imported, largely from Estonia, Lithuania, Poland, and Russia. Latvia is the only Baltic country to be a net importer of electricity. Latvia hopes to offset expected declines in electricity exports from other Baltic republics by increasing its own power production. Latvian energy requirements could also be cut by using its district heating system more efficiently and by closing many of its highly inefficient, energy consuming factories. Like other republics of the former Soviet Union, Latvia is far more energy inefficient than other European countries.

Latvia contains the second largest export point for Russian oil (the port at Ventspils), and Latvian transit fees for the port have been an important source of hard currency earnings. However, Russia has shifted much of its exports to its own ports for strategic and financial reasons, and Ventspils is not as vital as before. Latvia is planning to use Ventspils and the port at Riga to import products and reduce the dependency on Russian products; these imports are part of the coordination effort between Baltic energy ministers to coordinate a mutual energy policy to meet expected fuel shortages this winter. Latvia has also invited foreign investors to develop a distribution and service station network.

Natural gas is becoming increasingly important to Latvia, and the country is negotiating a joint venture with Gazprom (Russia) to expand and operate Latvia's underground gas storage facility at Incukalns. Natural gas accounted for 28% of primary energy consumption in 1990 (up from 9% in 1970), second only to oil (40% in 1990, down from 63% in 1970).

LIBYA

COUNTRY PROFILE

Head of State: Muammar Gadhafi
Population (1990): 4.54 million
Location/Size: North Africa/685,524 Sq Mi
Major Cities: Tripoli, Benghazi
Major Import Products: Machinery, 32%; Military supplies, 20%; Food, 12%

FINANCIAL PROFILE

Monetary Reserves (Non Gold, 1991): $5.7 billion
Foreign Debt: Negligible
Gross Domestic Product (1990): $32.7 billion
Currency: Libyan Dinar
Exchange Rate (1/92): US $ 1 = 0.275 Dinar
Petroleum Export Revenues (1990E): $10.1 billion
Petroleum Revenue/Total Revenue (1990): 98.5%

ENERGY PROFILE

Secretary of Petroleum: Abdullah Salim al Badri
Proven Oil Reserves (1992): 22.8 billion barrels
Oil Production Capacity (1992): 1.6 million b/d
Oil Production (1991): 1.5 million b/d
Crude Production Quota (2Q/92): 1.395 million b/d
Domestic Oil Consumption (1991E): 155,000 b/d
Domestic Refining Capacity (1992): 350,000 b/d
Foreign Refining Capacity (1992): 199,000 b/d
Petroleum Exports (1991E): 1.3 million b/d
Natural Gas Reserves (1992): 43 TCF
Natural Gas Production (1991): 547 BCF

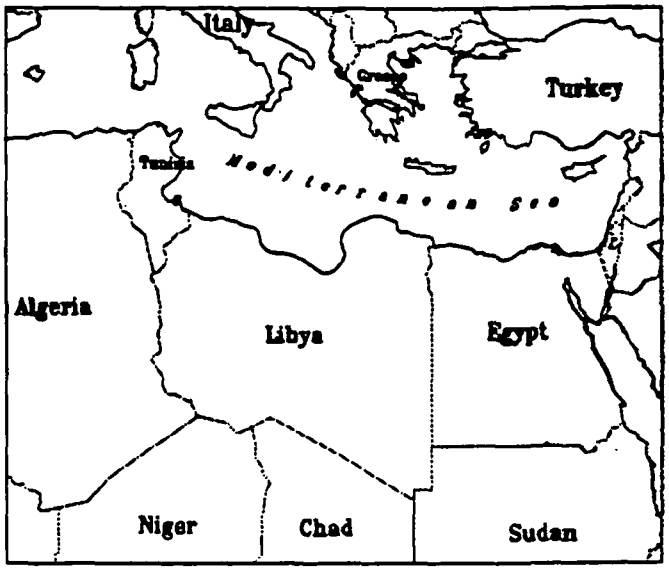
OIL INDUSTRY PROFILE

Organization: *Libyan National Oil Company* (LNOC)- Manages the state-owned oil industry
Major customers: Italy, Germany, other Europe, the CIS and the former Eastern Bloc countries

RECENT DEVELOPMENTS

Libya's relations with the United States have been strained recently over the issue of the 1989 bombing of Pan Am flight 103 over Lockerbie, Scotland that killed 270 people. To date, Libya has not released the two men accused of being responsible for the bombing, or four others implicated in the bombing of a French airliner over Nigeria in 1989.

On April 15, 1992, the United Nations implemented economic sanctions on Libya. These sanctions include the grounding of all air traffic to and from Libya, severing of diplomatic relations, and the halt of all arms sales to the country. Gadhafi appealed to the World Court to override the sanctions but was denied.



U. N. sanctions do not include any restrictions on Libyan oil. If enacted, oil sanctions would be potentially devastating to the Libyan economy, since oil export revenues represent nearly all of Libya's export earnings. Oil sanctions could also be hard on the countries that rely heavily on Libyan oil, mainly Italy. Italy imports over 450,000 b/d from Libya, almost one-third of its petroleum imports and about 35% of Libya's petroleum exports. However, given the current political environment, there is little probability that oil sanctions will be agreed upon in the near future.

OIL INDUSTRY OVERVIEW

The Libyan oil industry was nationalized in 1973, and the Libyan National Oil Corporation (LNOC) was created to oversee oil activities. LNOC controls oil production of the six major Libyan oil systems. The six production systems are operated by; Arabian Gulf Oil Company (Agoco), Waha, Sirte, Zueitina, Agip and Veba. Brega International was dissolved in 1991 and LNOC now directly administers the marketing of petroleum. Oilinvest is in charge of LNOC's international holdings.

Petroleum revenues represent nearly all of Libya's export revenues and about 30% of its GDP. Due to its dependence on petroleum earnings Libya favors efforts to defend world oil prices. At the OPEC meeting in February 1992, Libya agreed to a crude production quota of 1.395 million barrels per day, a 10% reduction from its previous quota.

Libya's economic condition has suffered since the 1986 oil price decline, with the Persian Gulf crisis providing a temporary boost in oil revenues. Lower petroleum export earnings have reduced

domestic spending, eroded the value of oil as payment for trade debt, increased restrictions on imports, and slowed Libya's efforts to expand downstream investments. To counter lower domestic spending in the oil sector, Libya has pursued foreign investors to provide capital and to overcome its shortage of qualified personnel.

Libya's market strategy is to expand downstream market share and to lobby other OPEC members to defend crude oil prices over higher production quotas. The strategy reflects Libya's relatively limited ability to increase oil production and its need to maximize the return on its oil reserves.

Reserves and Production

The bulk of Libya's output comes from wells operated by **Agoco, Waha, Sirte,** and **Zueitina.** They represent about 80% of the total production while the European companies that still operate in the country (**Agip, Veba, Wintershall** and **Elf Aquitaine**) account for the remaining 20%.

12 oilfields in Libya have reserves of 1 billion barrels or more, and two others have reserves of 500 million to 1 billion barrels. The offshore **Bouri** field, discovered in 1976, is the biggest find in Libya since the Bu Attifel and Baki fields were discovered in 1968. The offshore frontier is the most promising for Libya since there are large areas that have not been fully explored. Onshore areas have been thoroughly explored and the likelihood of a new major find is small.

The official Libyan government estimate of proven crude reserves, 45 billion barrels, is significantly higher than independent estimates of 22.8 billion barrels. Industry sources believe that LNOC's enhanced oil recovery (EOR) program could raise the volume of recoverable reserves by 7 billion barrels, only about one-third of the government's estimate. EOR techniques could add an additional 13 years to the current 42-year life expectancy of reserves, using a crude oil production rate of 1.5 MMBD.

Exploration and Development

The major component of Libya's expansion plan is the development of the **Bouri** field, the largest producing oil field in the Mediterranean Sea. Italy's **Agip** is the developer of the field which is estimated to have 5 billion barrels of crude, of which 600 million are considered to be recoverable. First phase of development cost $2 billion, with an initial production of 75,000 b/d in June 1990. Current production from the field is about 150,000 b/d. Agip's second stage expansion plans include the addition of new wells, more platforms, and a pipeline to the shore. A major problem with achieving maximum production in the field is its relatively high gas-to-oil ratio (GOR). Horizontal drilling has been tested at Bouri to alleviate this problem. With this large amount of associated gas, this field is proving to be the country's greatest potential for natural gas production.

Agoco is planning to boost output at its **Sarir** field in the eastern part of Libya through water injection at the 7 billion barrel reservoir.

Domestic Refining

Libya's refining industry has expanded considerably since the early 1970's, when it operated a single 10,000 b/d refinery at **Marsa Al Burayqah.** In 1977, the 120,000 b/d **Az Zawiyah** refinery came on stream, and in 1984 the 220,000 b/d **Ra's Lanuf** refinery began operation. In 1985 a small unit at **Tobruk** was completed, and in 1986 a topping plant was added at **As Sarir.** Currently, Libya's total refining capacity is near 350,000 b/d.

A large percentage of the output at the Ra's Lanuf refinery supplies nearby oil-fired electric power plants along the coast, and provides feedstock to the local petrochemical plants. Az Zawiyah's product output meets about 70% of domestic demand in the Tripoli area, while part of the jet fuel, gas oil and naphtha production is aimed at foreign markets. The refinery also produces about 30,000 tons per year of lube oil that meets all of Libya's domestic needs.

A 220,000 b/d refinery at **Misratah** has been under consideration for a number of years, but plans have yet to proceed.

Petrochemicals

Phase I of the **Marsa al Burayqah** fertilizer complex began production in 1978, with all units completed in 1981. The complex produces ammonia, urea and methanol. The second phase, completed in 1985, doubled the capacities of each plant. Despite the fact that the complex is operating only at about 35% of its nominal capacity, production of urea and ammonia far exceed the domestic demand for such products.

The **Ra's Lunaf** complex came on stream in 1987 with a 330,000 tons/year capacity ethylene unit that uses naphtha from the nearby refinery as feedstock, a propylene unit and a butene unit. In 1989 a group of four companies led by the Yugoslavian company **Energoinvest** signed a $130 million contract for the construction of the four units that will make up the second phase of the Ra's Lanuf complex. These four units include

a butadiene recovery unit, an MTBE unit, a butane-1 unit and an aromatics unit. Construction is expected to be completed by late 1992.

Among the projects being considered, the biggest is a fertilizer complex at Sirte. It was reported in 1989 that the project would be smaller than the originally planned $1 billion complex. No tenders have yet been awarded.

FOREIGN INVESTMENTS

Oilinvest directs all of Libya's overseas oil refining and marketing investments. It currently sells about 300,000 b/d of crude oil and products and owns refineries and/or marketing interests in Italy, Switzerland, Greece, Spain, Hungary, and Czechoslovakia.

In early 1992, Oilinvest purchased 180 service stations for almost $50 million from the Italian firm **Cameli Petroli**. Libya now owns over 2,100 gasoline outlets in Italy.

Also in early 1992, Oilinvest took control of the Hamburg-based German oil products retailer **Hamburg Eggert Mineraloilhandels (HEM)**. Oilinvest's control of HEM will give it a direct outlet for products produced at the 70,000 b/d **Holborn Europa** refinery it operates in Hamburg. Oilinvest is currently working on plans to expand in Egypt and attempting to expand into France.

Libya has been working with Egypt on a plan to build a string of service stations that will carry Libyan petroleum products, including high octane gasoline, on the coastal highway between the cities of Alexandria and Salum in Egypt. Plans call for a 560 kilometer (336 mile) product pipeline to be built from Tobruk, Libya to Alexandria, Egypt.

NATURAL GAS

LNOC's Gas Projects Department is responsible for all gas exploration, development, production, processing and marketing operations. Most of Libya's gas is associated, and therefore production is largely governed by crude oil output. **LNOC** and **Agip** are assessing the feasibility of developing the natural gas structures at the offshore Bouri field in northwest Libya.

A $3.5 billion development plan is currently being drawn up. If determined to be economical, natural gas will be exported to Italy via a 583 kilometer (350 mile), 580 million cubic feet per day pipeline under the Mediterranean. More than 20 oil and gas finds have already been made in the vicinity of the Bouri Field.

Agoco awarded **MAN Guthofnungshuette** of Germany a $96 million contract to build a gas treatment plant at the **Sarir** oil field in early 1990. Work entails the building of six compressor stations and a gas treatment and purification plant for the supply of 75 million cubic feet per day of treated gas to the Great Man-Made River power station some 90 kilometers away. The work is scheduled to be completed in 1992.

Sirte awarded a contract to the Italian firm **Bonatti** for the construction of a gas gathering and treatment plant with a 75 million cubic feet per day capacity. It will draw gas from the **Al-Sumud** field near Marsa al Burayqah.

OTHER INVESTMENTS

Libya's major non-oil effort is the construction of the Great Man-Made River (GMR). Phase I of the GMR was completed in 1991 and includes an 1,100 kilometer (660 mile) pipeline that is four meters in diameter. The pipeline will interconnect the water wells in the Fezzan region in central Libya and carry the water to Tripoli at a rate of 71 million cubic feet per day (cu f/d). The whole project is expected to take 25 years to complete at a cost of over $27 billion. Once completed the five phase project is expected to carry 200 million cu f/d from the reservoirs under the deserts in central Libya to the coast, 70 million cu f/day to the north western system and 130 cu f/d to the north eastern region.

Lithuania

COUNTRY PROFILE

President: Algirdas Brazauskas (Acting)
Prime Minister: Bronislovas Lubys
Government: Republic; declared independence from Soviet Union March 11, 1990; independence recognized by Soviet Union September 6, 1991
Population (1989): 3.7 million
Size/Location: 25,200 square miles in Eastern Europe, bordering the Baltic Sea to the West, Latvia to the North, Belarus to the East, and Russia (Kaliningrad) and Poland to the Southwest
Ethnic Divisions (1989): Lithuanian (79.6%); Russian (9.4%); Polish (7%); all other nationalities (4%)
Major Cities: Vilnius (capital), Kaunas, Klaipeda, Panevezys, Siauliai

ECONOMIC PROFILE

Gross National Product (est. 1992 @ purchasing power parity rate): $15.1 billion in $1990
Currency: Talonas
Commercial Exchange Rate (10/22/92): US$1 = 246 Talonas
Major Trading Partners: (First half of 1992) Russia (47%), Ukraine (12%), Belarus (11%), Latvia (5%), Germany, Sweden, Poland, United States

ENERGY PROFILE

Energy Minister: Leonas Asmantas
National Energy Enterprise: Litovenergo
National Power Company: Lithuanian Electricity Board
State Enterprise - Gargzdai Oil Deposit Exploration: Gargzdai Oil Geology
Proven Oil Reserves (1989E): 150 million barrels
Oil/Gas Production (1991): negligible
Domestic Oil Consumption (1991): 110,000 b/d
Refinery Throughput (1991): 230,000 b/d
Proven Gas Reserves(1989E): negligible
Natural Gas Consumption (1991): 200 billion cubic feet
Coal Production (1991): none
Coal Consumption (1991): 600,000 short tons
Electricity Production (1991): 28.4 billion kilowatt hours
Electricity Exports (1991): 8.9 billion kilowatt hours

OIL AND GAS INDUSTRY PROFILE

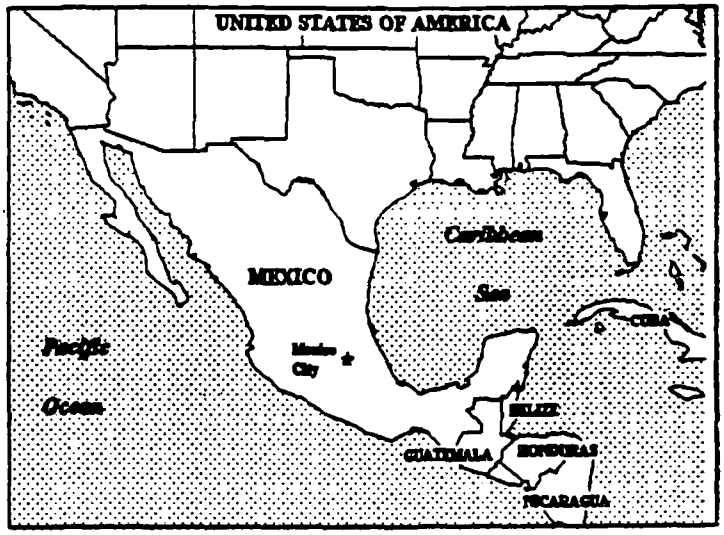
Major Oil Ports: Klaipeda. 1991 exports were 150,000 b/d refined products; ice-free port.
Major Gas Import Pipelines : West Siberia (Russia) to Vilnius
Major Oil Refineries: Mazeikiai (throughput in 1991 was 230,000 b/d; capacity is currently 260,000-280,000 b/d)

BACKGROUND

Lithuania has few oil, gas, or hydropower resources. As a result, it must import almost all of its primary energy from Russia, the other former Soviet republics, and Poland. Primary energy consumption is led by oil (45% in 1990, down from 66% in 1970), and natural gas (37% in 1990, up from 17% in 1970). On the other hand, Lithuania contains the only refinery in the Baltics and the second largest port in the region at Klaipeda, and generates a surplus of electricity for export from its nuclear and thermal power plants. The twin 1500-megawatt nuclear reactors at Ignalina are the largest in the world. However, the safety and reliability of the reactors at Ignalina, which are similar in design to those at Chernobyl, are cause for concern.

Lithuanian energy security is also a problem as oil supply shortages have disrupted Mazeikiai's operations. Lithuania's negotiations with Russia on security of energy supplies will include Russian access and transit fees charged for the port of Klaipeda. Lithuania is planning to build an oil import terminal to reduce its dependence on Russian oil, and could refine imported crude oil and re-export products for hard currency. Lithuania is planning to use Klaipeda to import products and reduce the dependency on Russian products; these imports are part of the coordination effort between Baltic energy ministers to coordinate a mutual energy policy to meet expected fuel shortages this winter. Compounding the problem of shortages its that like other republics of the former Soviet Union, Lithuania is far more energy inefficient than other European countries. Lithuania has also invited foreign investors to develop a distribution and service station network.

Mexico



COUNTRY PROFILE

Head of State: President Carlos Salinas de Gortari
Population(1990E): 86.1 million
Location/Size: N. America/764,000 square miles
Major Cities: Mexico City, Guadalajara, Monterrey
Major Import Products: Raw materials and intermediate goods (78%), capital goods (21.3%)

FINANCIAL PROFILE

Monetary Reserves (Non-Gold 6/91): $14 billion
Foreign Debt (1990): $98 billion
Gross Domestic Product (1990): $238 billion
Exchange Rate (9/91): US $ 1 = 3050 Pesos
Current Account Balance (1990): -$5.26 billion
Petroleum Export Revenues (1990): $10 billion
Oil Revenues / Total Revenues (1990): 37.7%

ENERGY PROFILE

Proven Oil Reserves (1991): 52 billion barrels
Oil Production Capacity (1991): 3.2 MMBD
Oil Production (1991E): 3.17 MMBD
Domestic Oil Consumption (1990E): 1.7 MMBD
Refining Capacity (mid-1991): 1.5 MMBD
Petroleum Exports (1991E): 1.4 MMBD
Natural Gas Reserves(1991): 73 TCF
Natural Gas Production (1990): 1.33 TCF
Petroleum Product Imports (1991E): 0.12 MMBD

OIL INDUSTRY PROFILE

Organization: Petroleos Mexicanos (PEMEX)
PEMEX Director: Francisco Rojas
Major Customers (1990): United States (56%), Spain (17%), Japan (11%), and France (4%)
Downstream Investment: A five percent share in Repsol - the state oil company of Spain.

RELATIONS WITH THE UNITED STATES

Mexico and the United States have maintained good relations since 1938. During the 1980's, Mexico ranked as one of the United States' top five oil suppliers. From 1980 till 1989, oil imports from Mexico averaged from 8 to 19 percent of U.S. net imports; representing from 42 to 52 percent of Mexico's total petroleum exports each year. During 1990, U.S. crude oil imports from Mexico averaged 689,000 b/d, and products imports averaged 66,000 b/d, while U.S. product exports to Mexico averaged 89,000 b/d. Mexico was one of the first countries to respond to President Bush's call for higher production to offset the loss due to the Persian Gulf crisis.

RECENT EVENTS

PEMEX, the state-owned oil company, has made remarkable progress in revitalizing Mexico's oil industry under President Salinas and Francisco Rojas, the Director of PEMEX. The removal of the corrupt union leaders controlling PEMEX, in early 1989, was the first critical step and cleared the way for market-oriented reforms. Rojas has restructured PEMEX, improved its fiscal condition, changed the focus to profits, and encouraged PEMEX to behave more like its private-industry counterparts. To lower costs and improve profitability, the work force was reduced from 213,000 to 150,000, operations streamlined, renewed emphasis placed on upstream invesment, and more sophisticated marketing techniques put into use.

The improved financial health of PEMEX and Mexico's natural resource wealth were keys in acquiring greater access to capital markets. In addition, attempts by PEMEX to loosen the barriers to foreign investment in Mexico's oil industry have allowed access to much needed technical expertise. Although Mexico's constitution does not allow foreign companies to hold equity in domestic oil resources, use of innovative financing arrangements have produced deals with foreign firms.

PEMEX's goals are to increase petroleum exports, develop Mexico's natural gas resources, lower domestic oil demand, increase profitability, and "depetrolize" the economy. Although PEMEX generates just 8% of Mexico's GDP, it accounts for about one-third of tax revenues and an equal portion of foreign exchange.

PEMEX ORGANIZATION

PEMEX was reorganized to decentralize bureaucracy, establish profit and cost centers, and to make management more effective and accountable in controlling operations. Three geographic regions were defined; northern (Poza Rica), central (Villahermosa), and maritime (Ciudad Carmen). Each region has 6 functional areas; exploration, production, drilling and maintenance, technical services, administration, and planning.

PMI (PEMEX's marketing arm), headed by Pedro Haus, administers the sale of petroleum. PMI began using futures contracts for products in 1989, and has accounted for 220,000 b/d of product traded so far in 1991. With PMI's successful use of product futures, the possibility of using crude futures is being evaluated. As part of a strategy designed to

modernize commercial policy and improve its market flexibility and scheduling, PMI has tested the use of spot crude sales and begun to charter tankers to service customers without the ability to lift cargos. PMI was credited with saving PEMEX $60 million in 1990.

Financial Developments

PEMEX's 1991 capital budget was $2.4 billion, 20 percent above 1990 spending. PEMEX has put together an aggressive 5-year capital spending budget of $20 billion. To finance this investment, PEMEX plans to raise $8 billion in the capital markets of Europe and the United States, arrange loans through the export/import banks of interested nations, and contract for services with payments made in product.

Using part of the extra revenue from the Persian Gulf war, PEMEX retired domestic debt of $850 million, and more than halved its external debt to $5.6 billion. Debt reduction, lower operating cost, and new tax structures – which let PEMEX more clearly show profits – have strengthened PEMEX's financial position and eased the acquisition of funds in capital markets. In September 1991, PEMEX raised $150 million through a seven-year Eurobond issue. PEMEX had previously raised an equal sum through a three-year bond issue in October 1990.

In early 1991, Mexico and the U.S. Exlmbank agreed to a $5.6 billion, 5-year loan package ($1.3 billion in 1991) to be spent on exploration and production projects with U.S. companies. This amount represents over half of the export/import bank loans PEMEX had planned. In late 1991, opposition to the use of foreign contractors delayed the issue of more tenders, and could undermine U.S. involvement. The opposition is over the use of foreign contractors while Mexican firms are without work. New tenders are not expected until 1992.

Prior to the opposition, two contracts with U.S. companies had been arranged. In April 1991, Triton Energy signed a $14.8 million turnkey contract to drill in the Gulf of Campeche. The second was a contract with Smith International for drilling services and equipment.

Exploration and Production

Mexico has proven oil reserves of 56 billion barrels and estimates of probable reserves ranging from 250 to 700 billion barrels. No outside certification of reserves has been done since 1977. The mid-1980's policy, to allow crude production to decline to match domestic needs, reduced investment in exploration and field development and impeded the growth of crude production. Salinas reversed that policy, and directed PEMEX to increase exploration and production spending.

106 exploration/development wells were completed in 1990, down 13.8 percent from the previous year, but there was much evidence of a new surge in exploration. Wells spudded rose 61 percent in 1990 to 132, and footage drilled was up 75 percent to 1,726,916 feet. Areas with the most activity included Campeche Sound (31 wells), Villahermosa District (22 wells), and the Reynosa District (11 wells). In 1990, 14 of 43 exploratory wells drilled were successful – 10 oil and 4 gas. Two gushers were in Campeche Sound; Zaap-1 flowed 10,800 b/d, and Alux-1 flowed 5,623 b/d.

Crude production rose by 33,000 b/d in 1990 to 2.55 MMBD, and is expected to average 2.69 MMBD in 1991. Production of other liquids was 428,000 b/d in 1990 and should average near 450,000 b/d in 1991. Natural gas production was 1,333 billion cubic feet (BCF) in 1990 and is expected to be 1,350 BCF in 1991.

Offshore crude production is becoming a larger portion of petroleum output (all liquids), up to 60 percent in 1990 from 56 percent in 1985. The quality of crude is getting heavier also – 48 percent of total liquid production in 1990 was heavy, up from 43 percent in 1985. Onshore production, mainly light oils marketed as Isthmus Blend, is concentrated in the southeastern regions of Chiapas and Tabasco. Campeche Sound region accounted for 70 percent of Mexico's 1990 total liquid production. With onshore production declining, the immediate hope for increased production is offshore, which accounted for 80 percent of the recent increases.

The Cantarell Project in the Gulf of Campeche is an important undertaking by PEMEX. The project's goal is to maintain Maya crude production above one million barrels per day. The super-giant Cantarell geological complex has estimated recoverable reserves of 10 billion barrels, with 1990 production reaching 1.15 MMBD. Plans are to improve oil recovery by reducing back pressure with the installation of a new collection system and the drilling of 30 additional wells. Gas separation units will be installed on production platforms and connected to gathering centers. The Cantarell Project is estimated to cost in excess of $800 million.

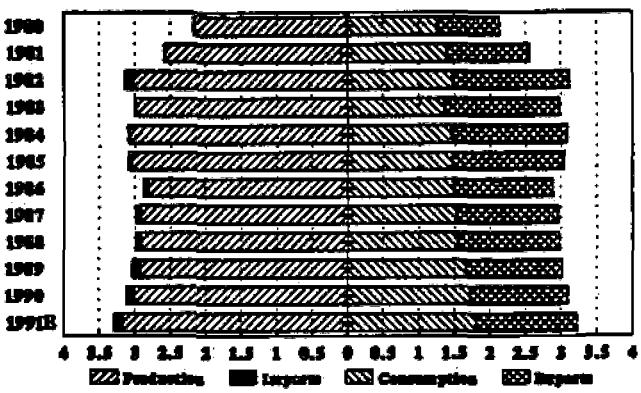
In 1991, ninety-two onshore and thirty-six offshore wells are expected to have been completed. Exploratory drilling has had a 40 percent success rate, which leads PEMEX to ask where is the "risk" in risk contracts, and to the viewpoint that PEMEX can purchase any required technical expertise without having to sell equity. Concerns have been expressed, some from inside PEMEX, that equity financing will be necessary to continue to increase production, in order to maintain exports, as domestic consumption grows. The risk politically for Salinas is substantial, as oil is seen in Mexico as a symbol of independence from the United States.

Consumption and Imports

Domestic consumption is rising by 7 to 10 percent a year, in 1990 averaging about 1.7 MMBD. Petroleum accounts for approximately 70 percent of Mexico's energy consumption. Gasoline is the fastest growing part of petroleum demand. Due to environmental and economic reasons driving restrictions were

imposed in Mexico City that prohibit the use of a car one day a week. PEMEX has also revised policy to allow the import of only unleaded gasoline with a maximum Reid vapor pressure of 9.5. Mexico's gasoline imports from the United States averaged 46,000 b/d during the first 10 months of 1991, more than twice the 20,000 b/d average for 1990.

Mexico's Oil Balance
(Million Barrels per Day)



In 1990 Mexico imported $850 million worth of petroleum products. Mexico recently signed a four-year contract to import 100 million cubic feet per day (mcf/d) of natural gas from Texaco, Conoco, Global Natural Resources, and Citizens, each with a one year deal. Extra spot purchases could boost gas imports to 240 mcf/d -- the maximum capacity of the pipeline being used. Natural gas imports are expected to average 116 mcf/d in 1991, or three times the 1990 imports of 42.5 mcf/d. Greater use of natural gas is necessary to replace oil in and around Mexico City to reduce pollution. Pemex also plans to use more domestic natural gas production in Mexico City. Currently industrial users are the major natural gas market.

Oil Refining

Rojas has established new goals for refinery operation, placing emphasis on profitability. The old criteria was to meet domestic demand with little regard for costs, the new goal is to meet domestic needs at the lowest cost and market products at the highest price -- regardless of the implications for imports or exports. At present PEMEX operates 6 refineries with a total distillation capacity near 1.5 MMBD. During 1991, three refineries -- Poza Rica, Azcapotzalco (inside Mexico City), and Reynosa -- a combined capacity of 150,000 b/d, were closed due to acute pollution problems. To offset the effects of these closures and to further ease pollution problems, a $750 million project is underway to expand and upgrade the Tula (near Mexico City) and Salina Cruz (Pacific coast) refineries. The project will add catalytic crackers, desulfurization and reformer units -- boosting gasoline production capacity by 30,000 b/d. Two contracts for the Tula refining complex were reported in late 1991. Pemex awarded Bufete Industrial Construction a contract to add a 40,000 b/d cracker, with M.W. Kellogg, -- a U.S. company which owns a 25 percent share of Bufete, to provide technical assistance. The second award was to the U.S. firms HRI and Texaco, which signed a contract to provide technical assistance for a 50,000 b/d sulphur removal unit.

$7 billion of PEMEX's 5-year, $20 billion capital budget, is for the construction and expansion of refineries, storage and transportation. Studies are under way that will determine which other refineries to expand and the types of capacity to add. A new 300,000 b/d refinery is planned, at a site not yet selected, with a cost of $2.5 billion and construction expected to take 4 years.

Petrochemicals

Petrochemical activities were consolidated into a single sub-directorate in 1990, headed by Raul Robles Sequra. As of January 1991, PEMEX had petrochemical production capacity of 20.1 million tons per year. In 1990, 17.65 million tons of petrochemicals were produced. Revenue from petrochemical sales was $1.3 billion, 12.5 percent of PEMEX revenue. Petrochemical production has rebounded from a dip in the late 1980's, as a result of insufficient investment. New investment of $5-7 billion, over the next 4 years, to modernize and construct new plants is believed necessary to keep Mexico competitive in the global market. Should the investment not be made, it is projected Mexico would need $9 billion of petrochemical imports by 1995. Because of its relatively low profile the petrochemical sector has served as a testing ground for new management strategies and techniques for foreign investment. If proven successful, corporate restructuring, along with the use of foreign financing and technology may be used as a role model for other parts of Pemex.

Under Mexican law only PEMEX can produce "basic" petrochemicals. Since 1986 the number of basic petrochemicals has declined from 60 to just 19, MTBEs being the most recent revision. "Secondary" petrochemicals are also defined, among which foreign ownership is restricted to 40 percent, unless a special trust is granted. The number of secondary petrochemicals has also declined dramatically, from 700 to 66. Red tape involved in obtaining a special trust has been reduced as well. Any petrochemical not defined "basic" or "secondary" is open to full foreign ownership.

$1 billion of PEMEX's 5-year capital pending plans is targeted to increase petrochemical production capacity. Twelve petrochemical projects are now being planned. Of these seven are plants to produce MTBE, which is crucial in reducing reliance on leaded gasoline. One of these plants will be built in an arrangement with ENI of Italy. Pemex will supply heavy crude to ENI and in return it will use the revenue to build a $350 million, 500,000 ton per year MTBE plant using ENI technology.

Nigeria

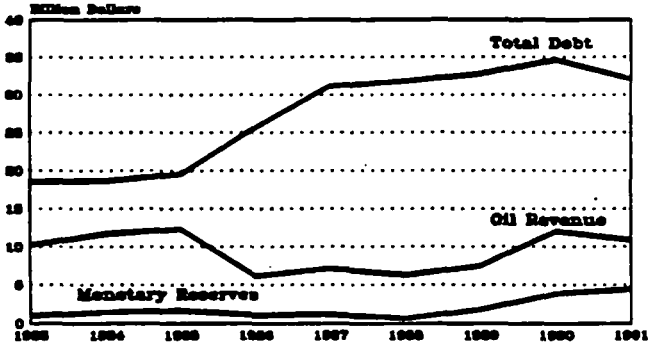
COUNTRY PROFILE

Head of State: General Ibrahim Babaginda
Population (1989): 105 million
Languages: English, Hausa, Ibo, Yoruba
Defense: Army (80,000); Navy (5,000); Air Force (9,500)
Religion: Muslim (47%), Christian (34%)
Location/ Size: West Africa/ 356,700 Sq. mi.
Major Cities: Lagos, Ibadan, Ogbomosho, Kano,
Import Products: Industrial goods, machinery, food

FINANCIAL PROFILE

Monetary Reserves (12/91, Non Gold): $4.4 billion
Foreign Debt (1991): $32 billion
Gross Domestic Product (1990): $26.6 billion
Currency: Naira
Exchange Rate (12/91): US $1 = 9.862 Naira
Current Account Balance (1991): $1.09 billion
Petroleum Export Revenues (1991E): $10.9 billion
Oil Export Revenue/Total Export Revenue(1991): 96%

Financial Trends

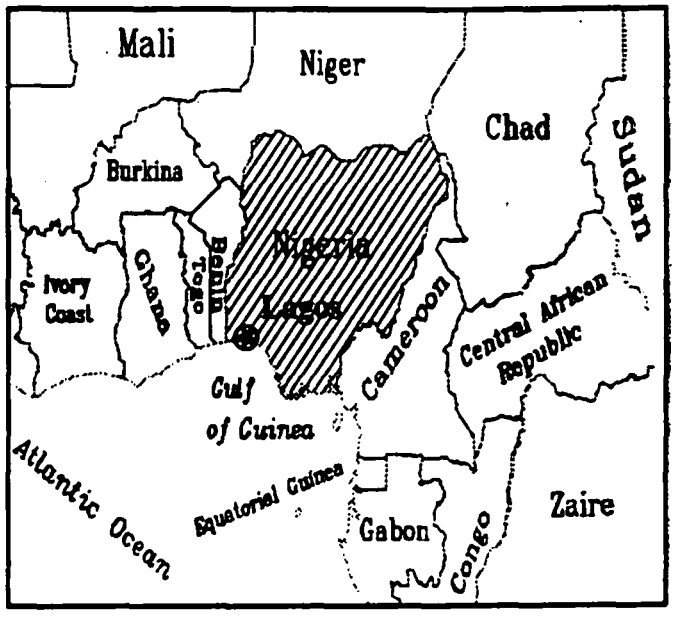


ENERGY PROFILE

Minister of Petroleum Resources: Chu Okongwu
Proven Oil Reserves (1992): 17.9 billion barrels
Production Capacity (1992): 2.0 million b/d
Oil Production (1991, all liquids): 1.95 million b/d
Crude Production Quota (2Q1992): 1.751 million b/d
Domestic Oil Consumption (1991E): 300,000 b/d
Refining Capacity (1992): 430,000 b/d
Petroleum Exports (1991E): 1.5 million b/d
Oil Exports to the United States (1991): 702,000 b/d
Natural Gas Reserves (1992): 104.7 trillion cubic feet
Marketed Gas Production (1991): 113 billion cubic feet
Major Ports: Lagos, Port Harcourt, Calabar, and Sapele
Major Fields: Forcados, Meren, Okan, Obagi, Oben

OIL INDUSTRY PROFILE

Organization: The Nigerian National Petroleum Co. (NNPC) manages the state-owned oil industry.
NNPC Chairman: Imo Itsueli
Major Oil Companies: Shell, Chevron, Mobil, Agip ELF, Ashland and British Petroleum.
Major Oil Customers: United States, Spain, France, and West Germany.



OIL INDUSTRY OVERVIEW

Nigeria is Africa's largest petroleum producer. The good yields and low sulphur content of Nigerian crudes are very attractive to refiners. Oil was discovered in the 1950's, oil exports began in 1958, and Nigeria joined OPEC in 1971. Since 1973, revenue earned from petroleum has provided around 90% of Nigeria's total export earnings and about 70% of federal government revenues.

The Babangida government, in power since August 1985, has been successful in promoting investment in oil exploration, expansion of production capacity, and development of natural gas resources. Nigeria has taken an aggressive role in encouraging investment through the introduction of more competitive methods to sell oil concessions and incentives for companies to invest. Nigeria's goals are to increase oil reserves to 20 billion barrels, raise production capacity to 2.5 million barrels per day (MMBD) by 1995, expand downstream operations, utilize natural gas resources, and diversify sources of income.

In late 1991, NNPC was reorganized into five divisions: **National Petroleum Investment & Management Services** (NAPIMS); **Corporate Upstream Development; Refining and Petrochemicals; Commercial and Investment;** and **Corporate Services.**

RECENT OIL DEVELOPMENTS

Nigeria is trying hard to ensure its position as one of the most active countries in oil investment. In acknowledgement of the higher costs incurred to find and develop new reserves, NNPC raised the minimum margin of return on investments that increase oil production capacity, from $2.00/bbl to $2.50/bbl. Incentives for offshore exploration and development have also been improved. In negotiating final agreements with winners of deepwater offshore blocks, NNPC has indicated that its rates on taxes and royalties will be reduced from 85% to 50%. Companies working offshore include Conoco, Mobil, Shell, Agip, ELF, Ashland, and a joint venture between Statoil and BP. Production of 500,000 b/d offshore is possible by early next century.

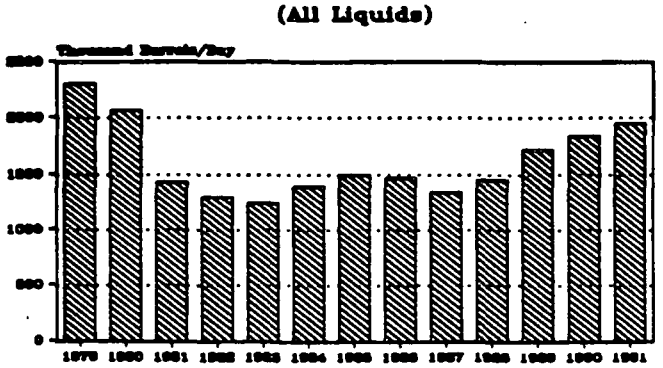
NNPC plans to end its use of joint venture contracts and convert to production-sharing agreements. This change will relieve NNPC of its capital-funding requirements. In 1990, to fund its capital requirements, NNPC sold a 20 percent share of its main oil concessions (NNPC-Shell) for $2 billion. Shell bought 10 percent, increasing its total share to 30 percent; while Agip and ELF both purchased 5 percent shares.

Oil Production and Exports

The bulk of Nigerian production comes from three joint ventures: **NNPC-Shell, Elf, Agip** -- 1,000,000 b/d; **NNPC-Chevron** -- 300,000 b/d; and **NNPC-Mobil** -- 300,000 b/d. Most production is from small reservoirs, located in the Niger delta region, and the Benue and Benin basins, in southeastern Nigeria.

Exports to the OECD account for most of Nigeria's exports. In 1991, Nigerian oil exports averaged 728,000 b/d to Western Europe, and 702,000 b/d to the United States.

Total Production
(All Liquids)

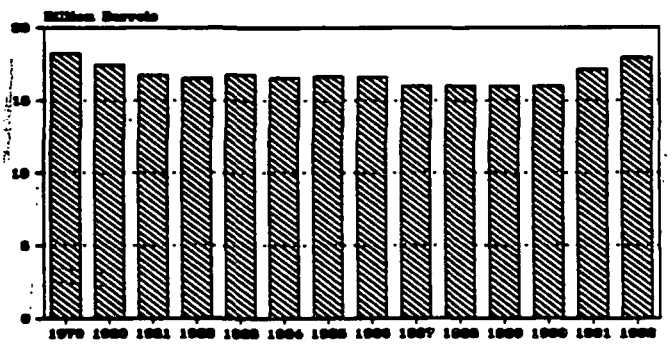


Oil Exploration and Development

The boom in exploration and development which began in the mid-1980's is expected to continue through the mid-1990's. Spending by oil companies increased by 30% in 1991. Of 136 blocks offered in the 1991 bidding round, 61 were awarded -- 23 in the Niger delta (some offshore), 27 in the Benue basin, 4 in the Benin basin, and 7 deep-water.

Shell's capital spending was $1.5 billion in 1991. Plans are to spend $6.6 billion over the next five years, boosting the company's production capacity to 1.3 MMBD by 1996. Shell has discovered and is developing many fields (Tunu, Ea, Okoroba, Agbaya, and Oyhor) and has won rights to two deep-water blocks. Another project is the **Sapale** field -- a 700 million barrel reserve of heavy crude, being developed using a condensate soak. Upgrading of treatment, transportation, and storage facilities is also planned.

Proven Oil Reserves



Mobil plans to raise production capacity by 225,000 b/d to 525,000 b/d by 1995, and to add over 500 million barrels to oil reserves. Mobil brought on-stream the **Edop** and **Lyak** fields in 1991. Edop, developed at a cost of $600 million, has a 700-million barrel reserves. Current Edop production is 50,000 b/d, with increases to 165,000 b/d expected within 3 years. Lyak has a 146-million barrel reserve, and production should reach 52,000 b/d by 1993. Mobil's two recent finds, **Yoho 1** and **Oman 1**, are estimated to contain 500 million barrels of oil reserves. The goals of the $900 million **Oso** gas/condensate project are to eliminate gas flaring and to produce 100,000 b/d of condensate, with a planned start-up in late 1992. Condensates are not counted in OPEC production quotas.

Chevron plans to spend $2 billion over the next 5 years on exploration, development, and production in Nigeria. Planned spend- ing for 1992 is $500 million. Eight new fields are to begin production by 1993. Production is expected to reach 400,000 b/d by 1995.

ELF plans to spend $1.7 billion over the next 5 years. Development of its offshore fields -- **Afia, Odudu, Ime,** and **Edikan** -- is the main goal. ELF expects production to double by 2000 to 200,000 b/d. The **Olo** and **Ibewa** fields will be developed with associated gas to supply a LNG project in Rivers State.

Ashland Oil in early 1992 signed a 5-year production sharing contract to explore two offshore blocks with 250-600 ft depths, 25 miles from Brass River. In Nigeria since 1974, Ashland produces about 26,000 b/d from 2 blocks one of which is offshore.

British Petroleum is returning to Nigeria after an 11 year absence. BP, and partner **Statoil**, were awarded two offshore blocks in the Niger delta basin last year. BP's assets were nationalized in 1979 because of alleged trade violations with South Africa.

The **Nigeria Petroleum Development Co.** (NPDC) plans to put nine wells in the **Oredo** oil field into operation during 1993. NPDC is also developing **Oziengbe**, which is still not fully defined, but may offer sizeable oil, gas, and condensate potential.

To get domestic firms involved, 17 Nigerian firms were awarded shallow water blocks in last years bidding round. The firms are seeking partners for capital and technical aid.

Oil Refining

NNPC has had a 20-year monopoly on refining in Nigeria. Over the last few years product imports have been required due to chronic problems at domestic refineries. In April 1992, it was reported that $16 million per day was being spent to import products. Low domestic fuel prices and a lack of pipe- lines have discouraged investment and led to smuggling into neighboring countries. Tenders for a 625-mile pipeline network to connect Nigeria's four refineries have been issued.

Nigeria's four refineries (three currently operating), have a design capacity of 430,000 b/d. These include: the 150,000 b/d **Rivers State** and the 60,000 b/d **Alesa Eleme** (closed in 1991, to reopen in early 1993) refineries at Port Harcourt, the 120,000 b/d refinery at **Warri**, and the 100,000 b/d refinery at **Kaduna**.

Nigeria has pursued foreign investment in export-oriented refineries. The former Petroleum Minister, **Jibril Aminu** had stated that exporting solely products is a future goal. Investors are being sought for a planned 100,000 b/d refinery and MTBE plant at Bonny Island. Construction costs for this project are put at $1-1.2 billion.

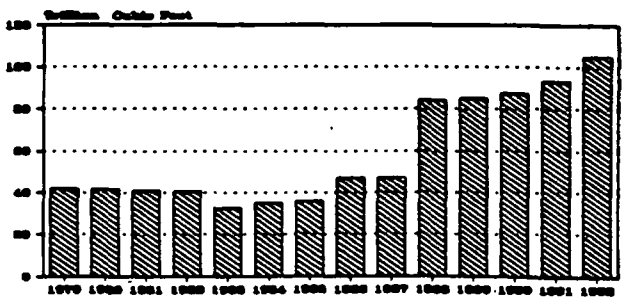
Petrochemicals

The $1 billion **Eleme** petrochemical complex in Rivers State is expected to start operations by 1993. **Foster Wheeler** has managed the project since construction began in 1974. The project has overcome many delays and finan- cial setbacks. **Chiyoda Corp.** is constructing an olefins plant to produce 300,000 metric tons per year (mt/y) of ethylene and 90,000 mt/y of propylene. **Kobe Steel** is constructing a 250,000 mt/y polyethylene/butene complex. **Tecnimont & JGC Corp.** is building a 80,000 mt/y polyproplene unit, that is expandable to 120,000 mt/y.

NATURAL GAS

Nigeria's natural gas reserves of 105 TCF, and are more plentiful than its oil reserves. Gas production was 1.38 TCF in 1991, however, only 0.113 TCF were marketed, while nearly 0.8 TCF were flared. Electricity generation and fertilizer production are the main markets for natural gas. Nigeria raised the fines for flaring gas and wants to encourage construc- tion of infrastructure to capture gas resources, but low domestic prices provide little incen- tive for the large capital investment needed.

Natural Gas Reserves



A 220-mile pipeline from Escravos to Lagos, operated by Shell, was completed in 1988. A project to build a pipeline north to Kaduna for potential industrial users would cost an estimated $500 million. Both of these projects have been hampered by the low price of natural gas and the lack of capital.

Chevron and NNPC will start a project to gather associated gas from the Okan, Mefa, and Delta fields off Escravos in 1992. The first stage will cost $400-500 million. Plans to process 140-150 million cubic feet per day (MCF/D) by 1995, with increases to 500 MCF/D over the next 10 years are planned as more fields are included.

Nigeria's most promising opportunity to utilize natural gas resources and diversify sources of income is the export of liquified natural gas (LNG).

LNG

Nigeria Liquified Natural Gas Ltd. (NLNG) manages the country's LNG operations. NLNG ownership is: 60% NNPC, 20% Shell, and 10% each Agip and Elf Aquitaine. During April and May of 1992, NLNG signed LNG supply contracts, beginning in 1997, with companies in France, Spain, and Italy. **Gaz de France** agreed to purchase 500 million cubic meters per year for 22 years. Spain's **Enagas** signed a $2 billion, 22-year contract for 1 billion cubic meters (BCM) per year. The **Italian National Electricity Co. (ENEL)** signed an $8.3 billion, 20-year contract for 3.7 BCM per year. Negotiations are also in progress with **Distrigas** of the United States to supply 700 million cubic meters per year for 22.5 years.

Total cost of the two-train, 5.7 million tonnes per year plant, to be built at Bonny in south- eastern Rivers State, is estimated at $4.1 billion.

DOWNSTREAM INVESTMENT

Efforts to acquire downstream assets have proven elusive for Nigeria. A potential agreement with **Farmland Industries** (U.S.) that collapsed at the last moment would have given NNPC a 49 percent share in the 60,000 b/d refinery at Coffeyville, Kansas in exchange for 20 years of crude supply. Another agreement nearly signed was with **PetroMed** of Spain. The deal would have formed a joint venture, **NigerMed**, to process Nigerian crude at PetroMed's 120,000 b/d Castellon refinery.

Nigeria has held equity-for-crude talks with Sun, ARCO, Mapco, ELF and others. Recent efforts with Phibro, for 20% of its down- stream assets have also stalled. Other discussions have included a possible refinery investment deal with Argentina and a proces- sing arrangement with Trinidad & Tobago.

Russia

COUNTRY PROFILE

President: Boris Yeltsin
Population (1989): 147 million
Size/Location: 4.6 million square miles from Eastern Europe across 11 time zones to Asia and the Pacific Ocean
Ethnic Divisions: Russian (81.5%), Tatar (3.8%), Ukrainian (3.0%), and 100 other nationalities (11.7%)
Major Cities: Moscow (capital), St. Petersburg, Nizhniy Novgorod, Nobosibirsk, Kuibyshev, Sverdlovsk
Major Trading Partners: Eastern Europe, other republics of the Commonwealth of Independent States (CIS)

ECONOMIC PROFILE

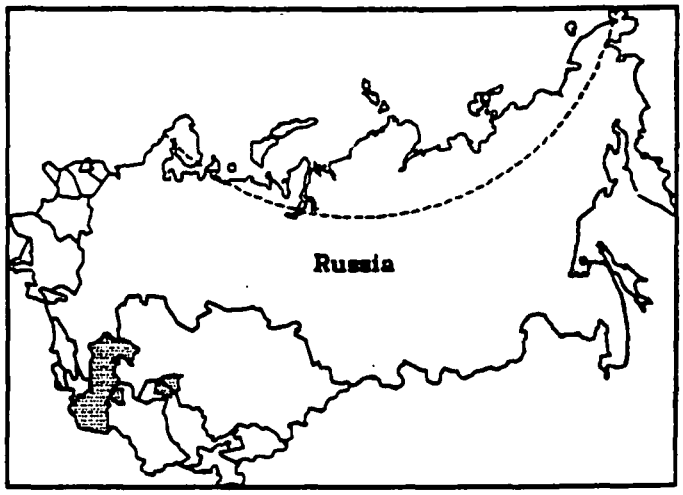
Gross Domestic Product (1991): 1130 billion rubles
Currency: Ruble
Commercial Exchange Rate (10/27/92): US$1 = 393 Rubles
Energy Export Revenues (1991): $13.4 billion
Energy Exports as Percent Merchandise Exports (1991): 36.3%

ENERGY PROFILE

Minister of Oil: Viktor Chernomyrdin
Proven Oil Reserves (1989E): 43 billion barrels
Oil Production (1992E): 7.9 million barrels per day (b/d)
Domestic Oil Consumption (1992E): 5.2 million b/d
Refinery Throughput (1991): 5.7 million b/d
Petroleum Exports (1992E): 2.7 million b/d
Proven Gas Reserves(1989E): 1,200 trillion cubic feet (Tcf)
Natural Gas Production (1992E): 22.7 Tcf
Natural Gas Consumption (1992E): 17.0 Tcf
Natural Gas Exports (1992E): 5.7 Tcf
Coal Production (1992E): 382 million short tons (MST)
Coal Consumption (1992E): 400 (MST)

OIL AND GAS INDUSTRY PROFILE

Organization: Rosneftegas (State oil corporation); Nafta Moskva, formerly Soyuznefteexport (State crude exporter); Transneft (State pipeline company); Gazprom (State gas producer).
Major Customers: Eastern and Western Europe and other republics of the Commonwealth of Independent States (CIS)
Major Oil Fields: Samotlor, Fedorovo, Ust-Balyk, and Mamontovo (West Siberia); Romashkino (Volga-Urals)
Major Gas Fields: Urengoi, Yamburg, Zapolyarnoye, Bovanenko, Medvezh'ye (in Western Siberia), Orenburg (Volga-Urals),
Major Oil Ports: Novorossiysk, Tuapse, St. Petersburg
Oil Export Pipelines (Capacity): Druzhba (Friendship) Pipeline to Eastern Europe (1 million b/d products)
Major Gas Export Pipelines (Capacity): Soyuz, Urengoi (Brotherhood), and Progress (1.0 Tcf each); Northern Lights (0.8 Tcf); Shebelinka-Izmail (0.7 Tcf); West Ukraine (0.1 Tcf)
Major Oil Refineries (1991 throughput): Ufa (600,000 b/d), Kuybyshev-Novokuybyshevsk (560,000 b/d), Omsk (460,000 b/d), Angarsk (440,000 b/d), Novo-Gor'kiy (420,000 b/d), Kirishi (420,000 b/d)



HISTORICAL BACKGROUND

The Russian Republic was formed on November 7, 1917 and joined the Union of Soviet Socialist Republics (USSR) on December 30, 1922. With more than three-quarters of the area of the USSR, half the population, the majority of energy and industrial production, and enormous military power, Russia was the most important of the Soviet republics. The dissolution of the Soviet Union in December 1991 created the need for a new system of economic, political, and military relationships between Russia and the smaller republics.

Russia has since assumed much of the power that was the Kremlin's, and retains a prominent position in the Commonwealth of Independent States (CIS), a loose confederation of former republics. Russia itself is a federation that includes 20 autonomous republics and 49 administrative units known as oblasts, several of which have sought greater independence and control over their resources. In particular, the Tatarstan and Chechen-Ingushetia republics and the Tyumen oblast are significant oil producers.

The dominant concern of the current government under Boris Yeltsin is its economic reform program. The conservative Congress of Peoples Deputies, however, advocates a more gradual transition to a free market system. For this reason, reformers are seeking to postpone the next session of the Congress (scheduled for December 1992) for several months to give reform measures a chance to work.

Some key elements of economic reform are already in place, including:

Privatization - In October, 1992, the government began issuing vouchers for purchasing shares in state-owned factories, stores, and other enterprises. An experimental program for privatization of land was added later.

Price Controls - State price controls on oil were removed in response to pressure from the International Monetary Fund (IMF), resulting in a doubling of domestic oil prices in September 1992. The government promised no further increases until the end of 1992, and included tax provisions which effectively limit how quickly prices will rise.

Exchange Rates - A single, unified market exchange rate was introduced in July 1992. The rate is determined by twice-weekly auctions and replaces several government-set exchange rates. However, full ruble convertibility is not expected to be introduced before the end of 1993.

OIL AND GAS INDUSTRY

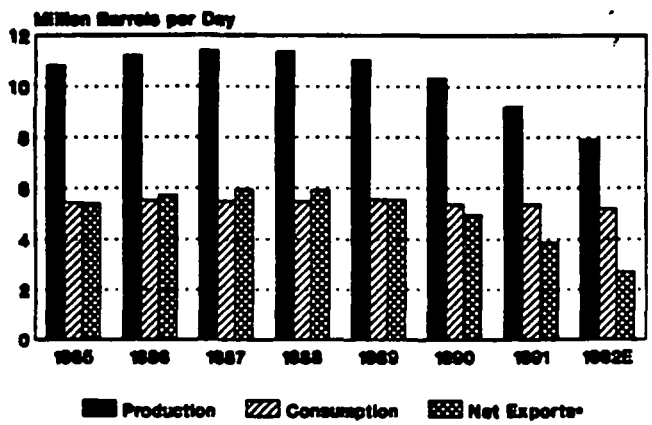
Russian oil production is centered mainly in West Siberia, specifically the Tyumen Oblast. Production in the older Russian oil fields in West Siberia is declining. Russian oil exports to Eastern Europe are transported primarily by pipeline, and to Western Europe via tanker through ports in the Black Sea and the Baltics. In the face of continuing declines in production, and with more than 20,000 oil wells reportedly idle, Russia announced in September it would cut exports to other former Soviet republics by up to 50 percent in 1993, while maintaining hard-currency sales to the West.

Russian natural gas production, like oil production, is concentrated in West Siberia, particularly the giant Urengoi field. Vast amounts of natural gas are also believed to lie beneath the Arctic Ocean. Russian natural gas export capacity is now limited to the area of Europe served by pipelines from western Siberia and the Urals. Future possibilities include links to Japan and Korea. For both oil and natural gas, future production will come largely from relatively inaccessible fields, necessitating a major exploration and development effort requiring huge investments of capital. The World Bank estimates between $17 and $24 billion in capital will be needed over the next 8 years just to maintain current Russian oil output, and is negotiating a $500 million loan for rehabilitating three western Siberian oil fields.

Russian refineries are relatively antiquated and technically unsophisticated, operating at a much lower capacity utilization rate than their counterparts in the United States. In addition, Russian refineries have much less reforming and cracking capacity than U.S. refineries, meaning that a much lower percent of distilled crude can be turned into light products. Most Russian refineries rely on western Siberian crude delivered by pipeline. Most refined products are transported by train, although several refineries in the Volga-Urals region are connected to the Druzhba (Friendship) product pipeline.

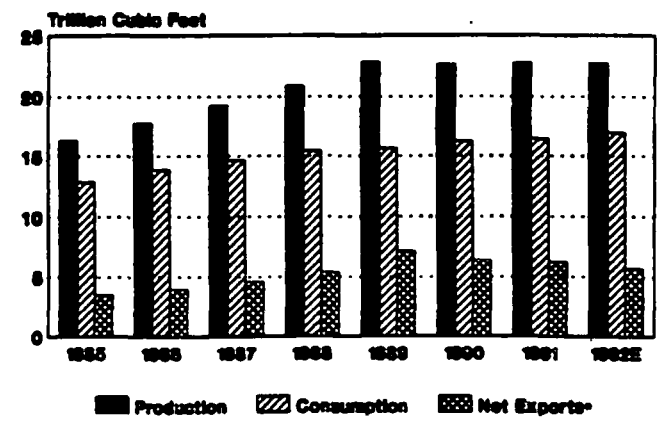
The energy sector is a top priority in the government's reform efforts, largely because oil and gas exports are the primary source of hard currency. An energy policy approved in September 1992 encompasses new energy

Petroleum
Production, Consumption and Exports



*including inter-Republic trade

Natural Gas
Production, Consumption and Exports



*including inter-Republic trade

legislation; reequipment of the industry; a fiscal structure approximating market conditions; and state regulation of finances, industry development, and environmental protection. The policy is to be implemented in three stages. An initial 10-to-15-month crisis management program to stop the annual decline in production will be followed, at the end of 1993, by a regulated market in which the industry will be "de-monopolized". The final stage will focus on developing industries which are less energy-intensive.

Under a draft decree to restructure the oil industry, the existing oil-producing associations would be reorganized into joint-stock, integrated oil companies under a newly created holding company outside the Fuel and Energy Ministry.

Investment from abroad has proceeded cautiously so far, in part because petroleum legislation, which would define ownership of natural resources and the basis on which Western companies can do business, has not yet been approved. In addition, exporters are currently required to register with the Foreign Economic Relations Ministry and to pay export tariffs many argue are frustrating their efforts to aid the ailing industry. Nevertheless, as of October 1992, companies from the United States, Canada, Europe, the Middle East, and elsewhere were operating 12 joint ventures in Russia's oil and gas industry and had signed many more agreements for future investments. Most of these projects are in the relatively mature European region of Russia and are heavily oriented towards fields that have been underdeveloped. They include well workovers; horizontal drilling; enhanced oil recovery; and upgrading of refineries, pipeline grids, and other downstream infrastructure.

In July 1992, Russia joined the Caspian Pipeline Consortium with Kazakhstan, Azerbaijan, and Oman to construct a pipeline to transport Caspian Sea crude to world markets.

ECONOMIC DEVELOPMENT

Russia is seeking a $24 billion aid package from the West to assist its transition to a free-market economy and establish a ruble stabilization fund. Progress to date includes:

-Humanitarian and medical loans from the European Community totaling almost 550 million ECUs have been approved.

-A $1 billion International Monetary Fund (IMF) credit was approved in August 1992 (Russia is negotiating a standby IMF credit of up to $4 billion and a $6 billion ruble stabilization fund)

-A $1.15 billion package of U.S. agricultural credit guarantees ($900 million) and food aid ($250 million) was announced in September 1992, plus $417 million in cash assistance for economic reform under the Freedom Support Act.

Other countries have been less forthcoming with aid. Japan's reluctance is linked to territorial disputes over the Kuril Islands, while a German study argues that Russia does not yet meet the political and economic conditions necessary for any major aid program to succeed.

Saudi Arabia

COUNTRY PROFILE

Head of State: King Fahd ibn Abdul Aziz as-Sa'ud
Population (1990): 14.9 million
Language: Arabic
Religion: Muslim
Location/Size: Persian Gulf/830,000 square miles
Defense: Army 72,300; Air Force 16,500; Navy 7,800; National Guard 10,000 (+20,000 reserves, 26,000 tribal levies)
Major Cities: Riyadh, Jeddah, Mecca
Major Import Products: Industrial goods (25%), metal (16%), food (15%)

FINANCIAL PROFILE

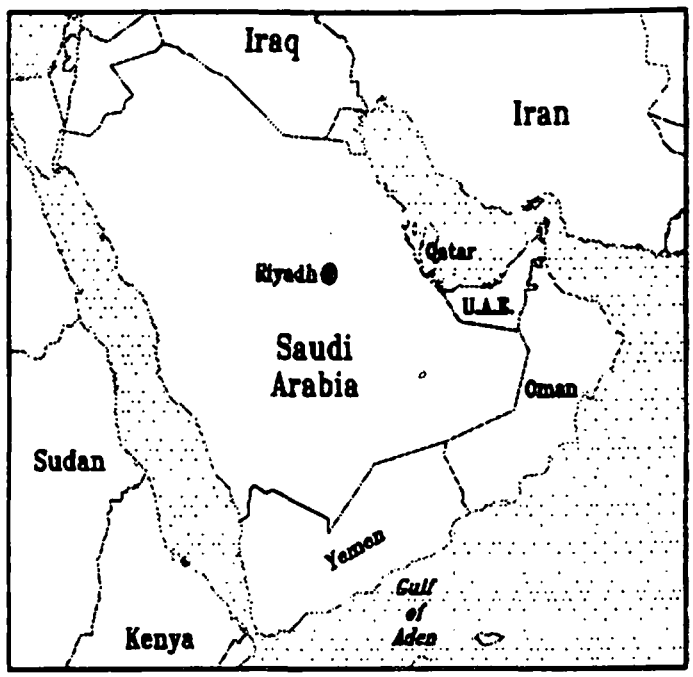
Monetary Reserves (Non Gold, 1991): $11.7 billion
Gross Domestic Product (1991): $101.5 billion
Currency: Riyal (SR)
Exchange Rate (1/93): US$1 = SR3.745
Current Account Balance (1991): -$22.81 billion
Petroleum Export Revenues (1991): $47 billion
Petroleum Exports/Total Export Revenues: 94%

ENERGY PROFILE

Minister of Petroleum and Mineral Resources: Sheikh Hisham Mohi ed-Din Nazer
Proven Oil Reserves (1/1/93E): 258 billion barrels
Oil Production Capacity (1992E): 9.5 million b/d
Oil Production* (1992E): 9.2 million b/d (8.6 million b/d crude)
OPEC Quota* (1Q93): 8.395 million b/d (crude only)
Domestic Oil Consumption (1991): 1.1 million b/d
Refining Capacity (1/1/93): 1.6 million b/d
Petroleum Exports (1992E): 8.1 million b/d
U.S. Imports (1992E): 1.7 million b/d
Natural Gas Reserves(1/1/93E): 183 trillion cubic feet
Natural Gas Production/Consumption (1991E): 1.2 Tcf
Major Customers: Japan, Western Europe, United States
* *Including 1/2 Neutral Zone*

OIL INDUSTRY PROFILE

Organization: The Supreme Petroleum Council governs the nationalized oil industry, which includes: *Saudi Arabian Oil Co. (Saudi Aramco)* - crude production; *Saudi Arabian Marketing and Refining (SAMAREC)* - refining and marketing; *Saudi Basic Industries Corp. (SABIC)* - petrochemicals; *Star Enterprise* - 50/50 joint venture with Texaco (U.S.); *Han-Saudi Oil Refining Co.* - 35/65 joint venture with Ssangyong (South Korea)
Major Oil Fields: Ghawar, Abqaiq, Safaniya, Barri
Export Refineries (Capacity): Ras Tanura (265,000 b/d) Jubail/Shell (284,000 b/d), Yanbu/Mobil (300,000 b/d), Rabigh/Petrola (332,500 b/d)
Export Pipeline: East-West Pipeline (Petroline), 3.2 million b/d
Ports: Dammam, Gizan, Jeddah, Jubail, Ras Tanura, Yanbu



RECENT DEVELOPMENTS

Saudi Arabia has maintained relatively high oil production levels since it brought excess capacity online in response to Iraq's invasion of Kuwait in August 1990. The Kingdom is pursuing programs to expand production capacity, upgrade refineries, expand its tanker fleet, and make downstream investments with foreign partners that will ensure future markets for its crude production. Aramco's ongoing maintenance and drilling program has added capacity through infill drilling, flow-line expansions, and facility refurbishment. By the end of 1993, new output facilities are expected to add 1 million b/d or more from expansion of the offshore Marjan field and from water injection at Hawiya, part of the onshore Ghawar structure.

During 1992, Saudi Aramco began a joint feasibility study with a consortium of Japanese companies for a 50-percent joint venture for refineries in Saudi Arabia (300,000 b/d) and Japan (450,000 b/d). Saudi Arabia also became involved in the manufacture of the fuel additive methyl tertiary butyl ether (MTBE). The first MTBE unit within a Saudi refinery began operating at the joint venture Mobil refinery at Yanbu in August 1992. SABIC also has several projects already built or under construction.

With the dissolution of the Soviet Union in December 1991, Saudi Arabia became the world's largest oil producer. Already the largest

exporter and holder of the majority of the world's excess production capacity, the Kingdom has a major influence on the world oil market. Saudi Arabia maintains a moderate oil price policy, generally opposing price increases of the magnitude that would trigger demand cutbacks. It also opposes the European Community's carbon tax proposal on the grounds it would unfairly siphon off revenue from oil exporters.

Since 1988, Saudi Arabia has been the largest single source of oil imports for the United States, providing 27 percent of U.S net imports in 1991 (1.7 million b/d in the first 10 months of 1992). Since August 1990, the United States has agreed to sell Saudi Arabia $25 billion in defense equipment. Recent Saudi investments in the United States include acquisition of United Press International and significant shares in Citicorp and Chase Manhattan.

During 1992, border disputes with Yemen and Qatar strained Saudi relations with its Persian Gulf neighbors. The dispute with Qatar was resolved in December, while discussions with Yemen are continuing. In March 1992, Saudi Arabia had sent warning letters to international oil companies exploring in disputed areas of northern Yemen. In response, BP temporarily suspended its offshore Red Sea operations, but other companies continued operating without incident.

OIL PRODUCTION

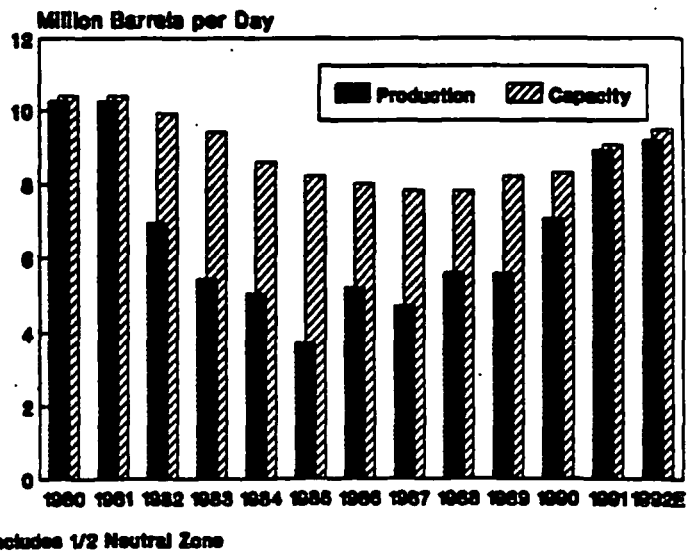
Saudi Arabia is the world's largest exporter of crude oil, and there is no reason to expect a change in this position in the foreseeable future. It has relatively low domestic petroleum consumption, its crude production levels exceed that of every other country on earth, it has an aggressive production capacity expansion program, and its proven oil reserves account for more than a quarter of the world's total. Saudi Arabia's planned development of natural gas reserves for the domestic market is designed to fuel economic growth with minimal impact on oil export revenues.

Most of Saudi Arabia's oil is produced on behalf of the Saudi Government by the Saudi Arabian Oil Company (Saudi Aramco). Saudi crude is currently produced exclusively in the coastal area of the Eastern Province. More than half of Saudi Arabia's current production capacity is located in the giant Ghawar field, the largest oil-producing field in the world. Arab Light oil from the Ghawar field, the Abqaiq field, and other smaller fields in the area is processed at Abqaiq, Saudi Arabia's main processing center. Arab Heavy is produced primarily at Safaniya, the largest offshore field. The Barri field produces Extra Light crude oil, and the Zuluf field is the main producer of Arab Medium. Saudi Arabia also shares production from the Neutral Zone with Kuwait. Crude production is routed either to shipping terminals (Ras Tanura and Jubail on the Persian Gulf, Yanbu on the Red Sea) or to refineries for processing. The major export refineries are located in Rabigh, Ras Tanura, Yanbu and Jubail. There are also domestic refineries at Yanbu, Jeddah and Riyadh.

Recent exploration activity has identified reserves in the Central region, coastal areas of the Red Sea, and along its southern borders. Although exploration traditionally has not been a high priority, Saudi Aramco increased its exploration activities in the early 1990s. Its focus is on light crude, delineation of resources, and identification of natural gas along the Red Sea. The Kingdom is also pursuing exploration and development of frontier areas bordering Yemen, Jordan, and Qatar and plans to expand or sustain production from existing areas such as the Abqaiq, Ghawar, and Safaniya fields.

Although seven discoveries made in Central Arabia during 1989-90 are now estimated to contain much less oil than originally expected, they do include some high-quality (48-gravity, 0.06% sulfur) crude oil in the Hawtah field

Total Liquids Production* and Capacity



*Includes 1/2 Neutral Zone

(planned for development by 1994). Saudi Arabia is planning a pipeline network to link the smaller fields with a trunkline running from Hawtah south of Riyadh to the East-West Pipeline, and has begun a construction project to expand the capacity of the East-West Pipeline from 3.2 million b/d to 4.7 million b/d. The new field configuration would produce a high-quality blend named Arab Ultra Light. Longer-term projects include expansion of the lighter reservoir at the offshore Zuluf field and development of the Shayba field on the border with the United Arab Emirates.

Saudi Aramco conducted its first-ever international borrowing in March 1992, with two loan agreements totalling $2.9 million (a $2.0 million general purpose loan for 4 years and a $900,000 loan to finance tanker purchases over 10 years).

DOWNSTREAM ACTIVITIES

Saudi Arabia is in the process of overhauling its refineries, with work concentrated on Samarac's domestic refineries and Aramco's export refinery at Ras Tanura, whose output was cut significantly as a result of a fire in late 1990. In later phases of the program, the three joint venture export refineries will also be upgraded and expanded.

Saudi Arabia is vertically integrating its petroleum industry through downstream investments on a global scale. Its long-term target is to acquire up to 3 million b/d in overseas refining capacity and outlets. Its first venture - Star Enterprise of Houston - was formed as a 50-percent joint venture with Texaco in 1988. Star Enterprise controls Texaco's U.S. refining and marketing in 23 southern and eastern states and has contracts to buy up to 600,000 b/d of Saudi crude oil. In 1991, Saudi Arabia entered into another joint venture - this time with South Korean company Ssangyong. Saudi Arabia holds a 35 percent share of the company and a crude supply contract for up to 300,000 b/d.

Saudi Arabia maintains stocks near consuming markets in the Caribbean, Northwest Europe, and the Mediterranean. In 1992, it owned or leased storage capacity totalling 20-25 million barrels and reached an agreement on a plan for 40 million barrels of storage in South Korea.

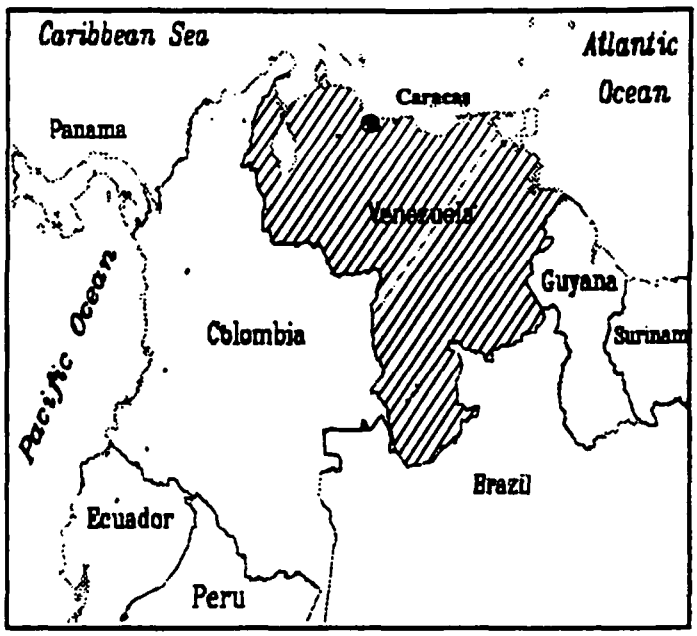
ECONOMIC AND POLITICAL DEVELOPMENTS

Saudi Arabia drew heavily on its monetary reserves to finance its share of Operation Desert Shield/Desert Storm and, for the first time in its history, had to seek external borrowing and issue domestic treasury instruments. The Persian Gulf crisis cost the Kingdom about $55 billion between August 1990 and the end of 1991 (according to Saudi government estimates). In November 1992, Saudi Arabia contributed $30 million to a United Nations escrow account to pay for U.N. operations in Iraq and Kuwaiti war reparations.

Saudi Arabia is developing a broader and more diversified economic base to reduce its reliance on oil revenues. The Saudi Government's 5-year economic development plan (1990-1995) stresses growth in the non-oil sectors. Under this plan, the country has increased petrochemical production and expanded its agricultural and industrial sectors (including fertilizers, steel, cement, glass, and plastics).

As an absolute monarchy, Saudi Arabia has no Western-style legislature, political parties, or constitution. In March 1992, King Fahd issued decrees that would establish a 61-member Majlis al-Shura (or Consultative Council), a "Basic System of Government" analogous to a constitution, and Provincial Councils. These political reforms are modest in that they formalize the existing system of government under Islamic law, provide only limited advisory roles for the councils, and include no provisions for the election of council members. These reforms are nevertheless the most profound in Saudi history. As of the end of 1992, however, there has been little progress in implementation.

Venezuela



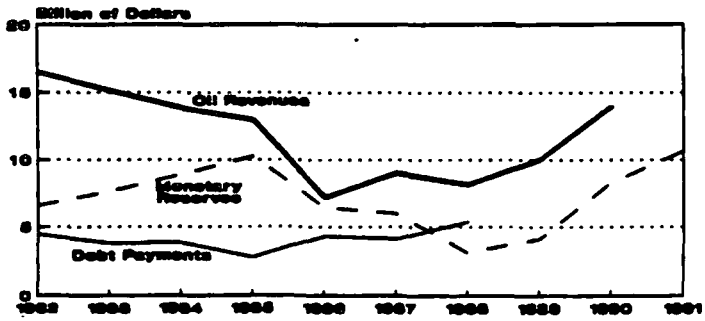
COUNTRY PROFILE

President: Carlos Andres Perez
Population(1991E): 20.4 million
Languages: Spanish
Defense: Army: 34,000; Air Force: 5,000; Navy: 10,000
Religion: Roman Catholic
Location/ Size: South America / 352,143 sq. mi.
Major Cities: Caracas, Maracaibo, Valencia
Major Import Products: Capital and consumer goods, and raw materials

FINANCIAL PROFILE

Monetary Reserves (6/92 Non Gold): $8.9 billion
Gross Foreign Debt (1991): $28.9 billion
Gross Domestic Product (1991E): $52.7 billion
GDP per capita (1991E): $2,579
Currency: Bolivar
Exchange Rate (8/92): US $1 = 66 bolivars
Current Account Balance (1991) $1.1 billion
Petroleum Export Revenues (1991E) $14 billion
Oil Export Revenues / Total Export Revenues: 90%

Financial Statistics



ENERGY PROFILE

Minister of Energy and Mines: Alirio Parra
Proven Oil Reserves (1992): 59 billion barrels
Oil Production Capacity (1992): 2.7 million b/d
Oil Production (1991): 2.4 million b/d
Oil Production Quota (7/92): 2.1 million b/d
Domestic Oil Consumption (1991E): 450,000 b/d
Domestic Refining Capacity (1992): 1.2 million b/d
Major Refineries: Amuay, Cardon, El Palito, Puerto La Cruz
Petroleum Exports (1991E): 2 million b/d
U.S. Net Oil Imports (1991): 1 million b/d
Natural Gas Reserves (1992): 106 TCF
Oil Terminals: Puerto Miranda, La Salina, Bajo Grande
Oil Fields: Lagunillas, Bachaquero, Tia Juana, Centro
Orimulsion Reserves(1992): 270 billion barrels

OIL INDUSTRY

President of PDVSA: Andres Sosa Pietri
Organization: The nationalized oil industry is governed by the Ministry of Energy and Mines. Petroleos de Venezuela (PDVSA) is the parent company and operates through subsidiaries derived from original private ownership. Subsidiaries include **Lagoven, Maraven, and Corpoven.** Three other companies, **Bitor, Interven, and Pequiven,** have been formed to manage heavy crude oil marketing, foreign investment and the petrochemical industry, respectively. PDVSA's legacy from the majors has given it the reputation of being the best-managed state oil company in the world. Today, PDVSA has developed into an international oil company in its own right, with major refinery, pipeline, and service station networks in Europe and the United States.

Major Customers:
United States, Germany, Canada, and Italy.

Downstream Investment:
Europe - Owns nearly 230,000 b/d in capacity through **Ruhr Oel** joint venture with Germany's **Veba,** and 26,000 b/d through its **Nynas** partnership with Finland's **Neste.**
United States - Owns 4% of U.S. refining capacity (see attached map). Acquired **CITGO,** including its **Lake Charles** refinery (320,000 b/d capacity) as well as its network of U.S. service stations, from the bankrupt Southland

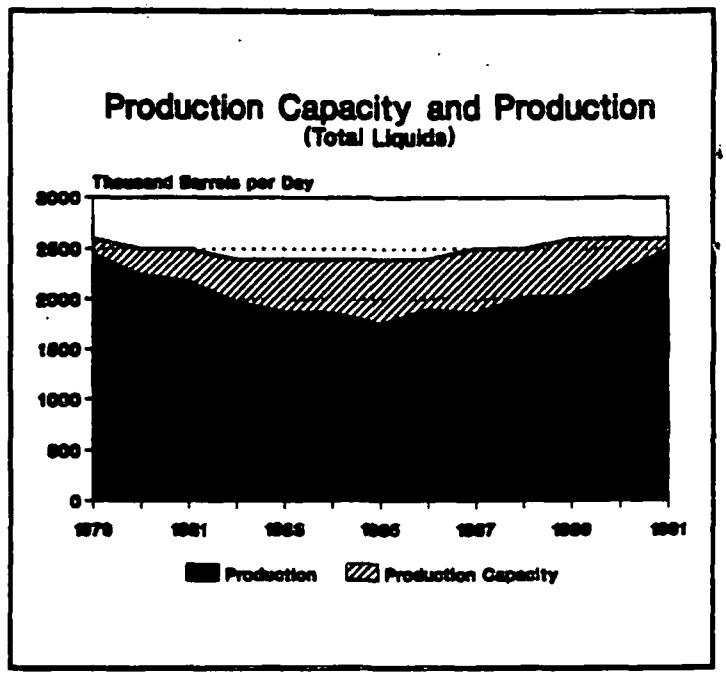
Corporation in 1985-1987; purchased the **Champlin** refinery (160,000 b/d) at **Corpus Christi** in 1985; owns the **Seaview Petroleum Company** and its 84,000 b/d refinery; and holds a 50% share in UNOCAL's 153,000 b/d **Chicago** refinery.

PDVSA also has been active in the **Caribbean** region, leasing the 310,000 b/d **Curacao** refinery, and acquiring extensive storage facilities in the **Bahamas** and **Bonaire**. PDVSA has marketing agreements with **BP** and **Mitsubishi** for Orimulsion, its bitumen-based boiler fuel. Most recently, PDVSA became a partner in the **Schwedt** refinery in the former **East Germany**, giving it a bridgehead in eastern Europe.

RECENT DEVELOPMENTS

An unsuccessful coup attempt in February 1992 followed months of economic problems, including lower oil revenues in the aftermath of the Gulf war, rapid inflation, a sharply reduced trade surplus, and a one-day general strike on November 7, 1991. All of these problems contributed to a lessening of public confidence in President Perez's government. President Perez responded to the coup attempt by promising to rewrite the constitution, as well as freezing prices on staple foods, medicines, electricity and gasoline. He also vowed, however, not to resign or to abandon his free-market economic policies.

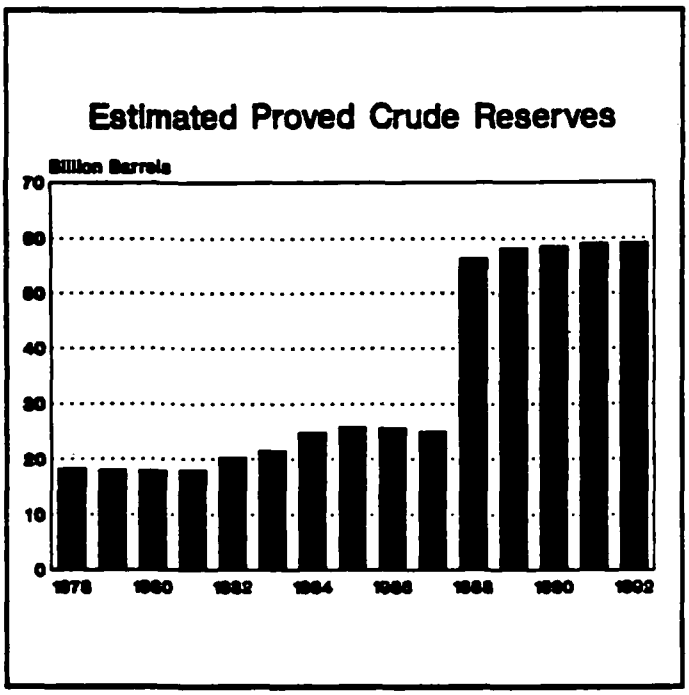
The recent coup attempt was a culmination of problems that beset President Carlos Andres Perez since he took the oath of office on February 2, 1989. Following his inauguration, President Perez quickly enacted new policies to deal with Venezuela's economic problems. The strategy included an austerity program, return to a single market-oriented floating exchange rate, relaxation of import controls, and the freeing of interest rates - all measures to help obtain new loans and restructure debt. The austerity program also included increases in the prices of gasoline and public transportation, which provoked nationwide riots resulting in the death of hundreds of people. To restore order, the Government was forced to suspend various constitutional rights temporarily, to impose a curfew, and to call in troops to patrol Caracas. To quell further protests Perez offered additional concessions, including across-the-board wage increases and a 4-month firing freeze to halt

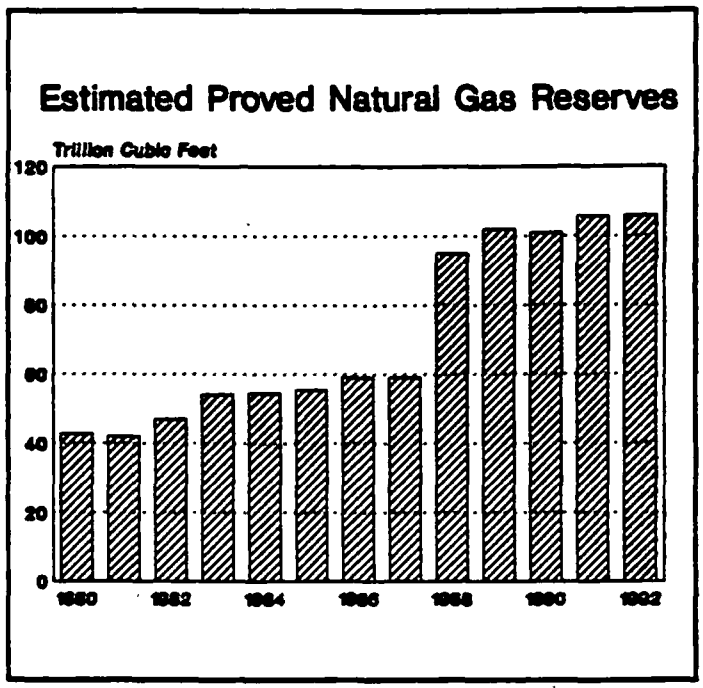


layoffs. Tensions inside Venezuela calmed for a while, but flared up again recently, as evidenced by the failed coup attempt of February 4, 1992.

OIL INDUSTRY

In the wake of the recent coup attempt, the Venezuelan government is faced with an urgent need to raise revenues to help alleviate social and economic discontent. This will undoubtedly affect PDVSA, which is the main source (around 80%) of government revenues, and could even threaten PDVSA's ambitious, $48 billion expansion plan for the period 1992-1997. Already, President Perez has curtailed PDVSA's foreign refinery acquisition program, preferring that emphasis be placed on attracting foreign investment within Venezuela. Overall, Perez is attempting to rein in PDVSA's investment spending, particularly in the development of the country's huge oilsands reserves. As a result of this clampdown on spending, PDVSA's original objective of producing 1 million b/d of under 22-gravity crude oil by 1996 no longer appears realistic. The future outlook for PDVSA's rapid expansion plans is seriously complicated by the government's overwhelming financial dependence on, and control of, the Venezuelan oil industry. PDVSA's investment resources are further constrained by an effective 82% income tax, as well as frequent demands by the government for hundreds of millions of dollars worth of loans and forced bond purchases.





According to the president of PDVSA (Andres Sosa Pietri), the company's long-term oil strategy will not be affected by recent events, including economic changes announced by President Perez. In an effort to keep its expansion program on track, PDVSA is prepared to borrow over $3 billion this year, as well as to maximize its efforts at attracting foreign investment. In this regard, Chevron recently signed a letter of intent with PDVSA to study joint ventures in refining, production, and the potential upgrading of Orinoco heavy crudes. PDVSA is also discussing with Germany's Veba Oel a possible joint venture aimed at producing and upgrading 120,000 b/d of extra-heavy crudes (12-14 degrees API) into more marketable synthetics. Despite these apparent successes, PDVSA's future efforts at attracting additional foreign investment may prove more difficult, however, in the wake of the failed coup, which highlights Venezuela's political and economic uncertainties.

PDVSA's ambitious expansion program is based on three major considerations: 1) world oil demand will increase by the end of the decade; 2) hydrocarbon revenues are essential to the Venezuelan economy; and 3) in order to become a more significant player in OPEC, Venezuela needs to improve its relative standing in terms of oil production capacity and reserves. Based on these assumptions, PDVSA hopes to expand both at home and abroad. Domestically, PDVSA hopes to raise oil production capacity from today's 2.7 million b/d to 3.7 million b/d in 1997, and 4.1 million b/d (excluding 1 million b/d of Orinoco bitumen production) in 2000. Overseas, PDVSA's objective is to move away from crude sales, toward sales of products and petrochemicals, in order to capture more profit from the value added to national resources. PDVSA therefore continues to look for additional downstream opportunities overseas, where it already holds about 1.6 million b/d in foreign refining capacity (700,000 b/d in the United States, 900,000 b/d elsewhere). PDVSA hopes to expand their refinery capacity to roughly 2.3 million b/d by 1997. PDVSA is also looking to open the upstream sector to foreign partners for the first time since the Venezuelan oil industry was nationalized over 15 years ago. With that goal in mind, it has begun to look at formation of "strategic alliances," such as the proposed $3 billion "Cristobal Colon" partnership with Shell, Exxon and Mitsubishi to export liquefied natural gas to US markets.

FORMER YUGOSLAVIA

COUNTRY PROFILE

President (acting): Branko Kostic
Prime Minister: Ante Markovic - resigned Dec. 1991
Population (1990): 23.8 million
Location/ Size: Eastern Europe / 98,766 sq. miles.
Ethnic Divisions: Serb (36.3%), Croat (19.7%), Muslim (8.9%), Slovene (7.8%), Albanian (7.7%), Macedonian (5.9%), Yugoslav (5.4%), Montenegrin (2.5%), Hungarian (1.9%), other (3.9%)
Religion: Eastern Orthodox (50%), Catholic (30%), Muslim (9%), Protestant (1%), and other (10%)
Major Cities: Belgrade, Zagreb, Osijek and Nis

ECONOMIC PROFILE

Monetary Reserves(1/92, Non Gold US): $2.2 billion
Gross Domestic Product 1990 (1980 US): $58.1 billion
GDP Per Capita Income (1990): $2,439
Gross Foreign Debt (1990): $20.8 billion
Exchange Rate (1/91): 105 Dinars = $1 US
Currency: Dinar; Slovenia converted to Tolars 10/91; Croatia converted to Croatian Dinars 12/91

ENERGY PROFILE

Oil Consumption (1991): 311,000 b/d
Crude Oil Production (1991): 58,200 b/d
Crude Oil Reserves (1991): 240 million barrels
Crude Oil Imports (1991): 239.5 thousand barrels
Gas Production (1991): 75.5 billion cubic feet (BCF)
Gas Consumption (1991): 213 BCF
Gas Reserves (1991): 2.9 trillion cubic feet
Coal Production (1991): 78.6 million short tonnes
Total Refining Capacity (1991): 615,000 b/d
Republic Refining Capacity: Croatia, 310,000 b/d; Serbia, 168,000 b/d; Bosnia-Hercegovina, 110,000 b/d; Slovenia, 15,000 b/d; Macedonia, 15,000 b/d; Montenegro, none.

The Adria Pipeline: The Adria Pipeline, which is not currently operating, had carried 193,000 b/d from the Adriatic Sea to various destinations inland. Of these, 27,000 b/d went to supply Hungary and Czechoslovakia. With the pipeline not operating, Hungary and Czechoslovakia must find supplies elsewhere. The Friendship (Druzhba) pipeline out of the former Soviet Union could be that source. The former Soviet Union had been Yugoslavia's primary supplier of crude oil as well as natural gas, followed by Iraq, a distant second (Table 2). This, despite that during the second half of 1990 the Soviets fell behind on their delivery schedule, and Iraq was cut off by the U.N. trade embargo.

Croatia's continued blockade of the Adria pipeline, has forced Serbia's state NIS to build a new crude pipeline from the Adriatic port of Bar in Montenegro to the Serbian refineries at Novi Sad and Pancevo. An additional branch is planned to supply the Macedonian refinery at Skopje. The project is scheduled to be completed by the end of 1993 at a cost of $300 million.

Profile of the Major Republics (Table 1)

	Serbia	Croatia	Slovenia	Bosnia-Herzegovina
Population (1990)	9.3 million Includes 1.7 million ethnic Albanians	4.5 million Includes 600,000 Serbs	2 million Ethnically homogeneous	4 million 20% Croatian 30% Serbian 40% Muslim
President	Slobodan Milosevic	Franjo Tudjman	Milan Kucan	Alija Izetbegovic
Political Summary	Socialist Party (Formerly Communist) Party). Wants centrally ruled Federation	Center-right Croatian Democratic Union. Wants alliance of sovereign states	Center-right coalition. Wealthiest Republic.	
Petroleum Consumption (1991)	63 MBD	80 MBD	35 MBD	25 MBD

RECENT DEVELOPMENTS

Since the civil war in Yugoslavia began, the European Community(EC) has tried to negotiate a sustainable cease-fire that would allow the break-away republics of Croatia, Slovenia, Macedonia and Bosnia-Hercegovina to gain sovereignty. After numerous failed attempts, the EC looked to the United Nations for help. On May 30, 1992, the United Nations imposed sanctions on Serbia and Montenegro, in hopes of forcing a cease-fire. These sanctions include an oil embargo, a trade ban, and a freeze on foreign assets and airline flights.

OIL INDUSTRY OVERVIEW

Industrija Nafta (INA) directs refining and refined product marketing in Croatia. **Petrol** distributes petroleum products in Slovenia.

In Serbia, state owned **Nafta Industrija Serbija** (NIS), a union between Belgrade based Yugopetrol and Naftagas, oversees most oil related activities while Yugopetrol operates product distribution.

Slovenia finalized a barter agreement with Russia in December of 1991. The deal includes the 1992 deliveries of natural gas, metals, and textiles by Russian suppliers in return for commercial goods. Specific quantities have not been disclosed.

Production and Consumption

Croatia's prewar crude production of 50,000 b/d has been slashed to about 30,000 b/d. INA had to evacuate the three fields in eastern **Slavonia** (a region of Croatia near the borders of Serbia and Hungary) because of the fighting. INA managed to export 16,000 b/d to Austria's OMV the first 11 months of 1991.

Domestic Refining

Crude runs at most of the refineries in Yugoslavia have been reduced substantially, either by the loss of supply or by direct damage as a result of the civil war.

In Croatia, the 150,000 b/d **Sisak** refinery, 35 miles south of Zagreb, which provided about 50% of Croatia's refining capacity was set on fire by Serbian troops. The 160,000 b/d refinery at **Rijeka**, the only operating refinery in Croatia, has been receiving crude in small amounts. INA put December 1991 runs at about 36,000 b/d, made up of spot imports and local production.

In Bosnia-Hercegovina the 110,000 b/d refinery at **Bosanki Brod**, closed due to lack of crude, was attacked by Serbian troops. Bosanki Brod is run by Energoinvest. Damage was limited to external installations only, including a storage tank that caught fire. Bosanki Brod is the republic's only refinery.

Much of Serbia's 170,000 b/d refining capacity has been idled since the closure of the Adria pipeline. The 108,000 b/d **Pancevo** and 60,000 b/d **Novi Sad** refineries have received little crude since the closure. The only foreign crude they have taken delivery on has been imported from the Black Sea via the Danube.

Yugoslavian Oil Consumption and Production, 1987–1991

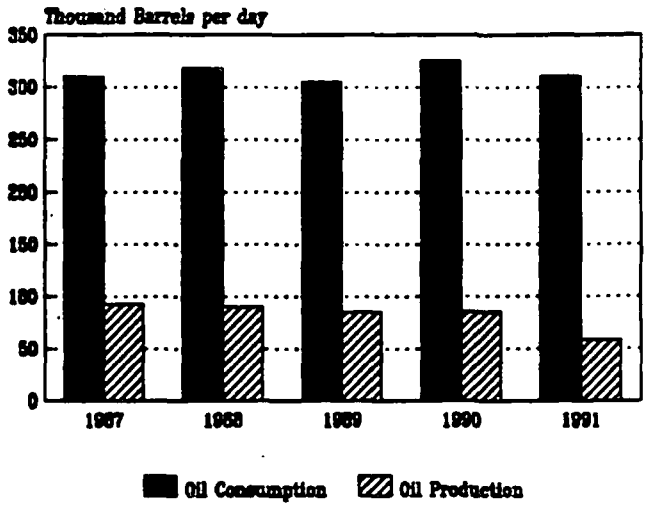


Table 2: 1990 Yugoslavian Crude Oil Imports

	b/d
U.S.S.R.	119,500
Iraq	37,700
Iran	27,600
Libya	26,200
Angola	12,300
United Kingdom	5,700
Saudi Arabia	4,600
Egypt	4,300
Norway	1,600
Total	239,500

In Macedonia the 20,000 b/d refinery at **Skopje** is running at normal levels. It is receiving crude, as well as some products, through the Greek port of Thessaloniki.

In Slovenia the 10,000 b/d refinery at **Lendava** has not been able to produce any gasoline for either state distributor Petrol or Austria's OMV.

NATURAL GAS

Natural Gas looks to have the brightest future in Yugoslavia. Finds in the Adriatic sea have increased reserves to 2.9 TCF. Gas fields in the northern Adriatic have produced commercial quality gas fields whereas discoveries in the south are of a questionable quality.

The country's largest gas field, **Molve**, is located in northern Croatia. Molve provides about one third of all domestic gas production.

EIA ANALYSIS BRIEF:
THE FORMER SOVIET REPUBLICS

- Armenia
- Azerbaijan
- Belorussia
- Estonia
- Georgia
- Kazakhstan
- Kirghizia
- Latvia
- Lithuania
- Moldavia
- Russia
- Tadzhikistan
- Turkmenistan
- Ukraine
- Uzbekistan

Energy Information Administration

12-Feb-92

ERRATA SHEET - Former Soviet Republics

Areas of Former Soviet Republics

	('000 Sq. Km)	('000 Sq. Miles)
Armenia	29.8	11.5
Azerbaijan	86.6	33.4
Belarus	207.6	80.1
Estonia	45.1	17.4
Georgia	69.7	26.9
Kazakhstan	2717.3	1048.9
Kyrgyzstan	198.5	76.6
Latvia	64.6	24.9
Lithuania	65.2	25.2
Moldova	33.7	13.0
Russia	17075.4	6591.1
Tajikistan	143.1	55.2
Turkmenistan	488.1	188.4
Ukraine	603.7	233.0
Uzbekistan	447.4	172.7
Total	22275.8	8598.5

Notes:

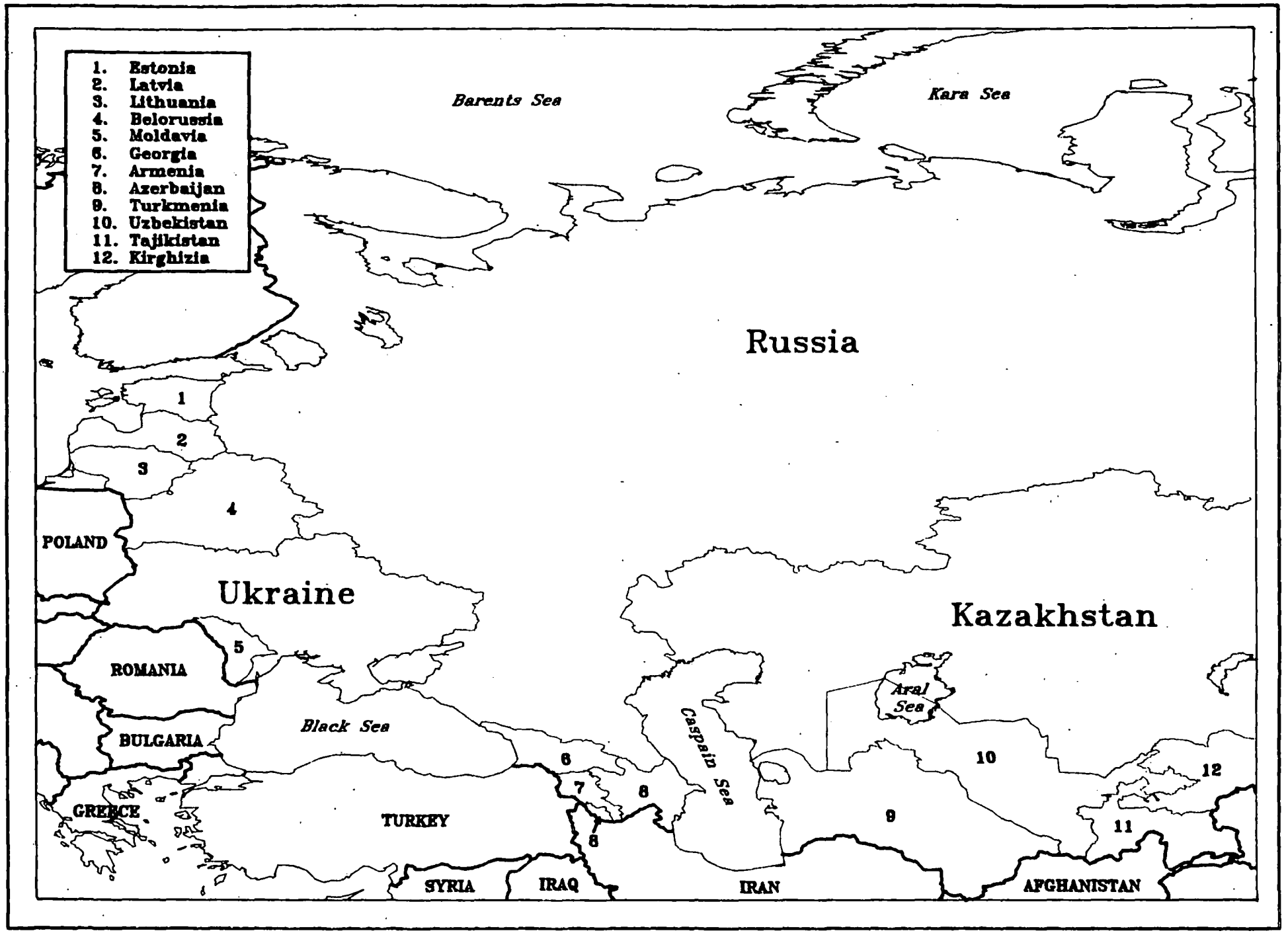
Uzbekistan's net material product in 1989 was 25.06 billion rubles.

Belorussia is now Belarus; Kirghizia is Kyrgystan; Moldavia is Moldova; and Tadzhikistan is Tajikistan.

Contacts:

General questions about this report may be referred to Derriel Cato (202/586-6574), Chief of the Short-Term Forecasting Branch, Energy Markets and Contingency Information Division, Office of Energy Markets and End Use, Energy Information Administration.

Specific questions about this report may be referred to Lowell Feld (202/586-9502) or Erik Kreil (202/586-6573) of the same Branch.


1. Estonia
2. Latvia
3. Lithuania
4. Belorussia
5. Moldavia
6. Georgia
7. Armenia
8. Azerbaijan
9. Turkmenia
10. Uzbekistan
11. Tajikistan
12. Kirghizia
Barents Sea
Kara Sea
Russia
POLAND
Ukraine
Kazakhstan
ROMANIA
BULGARIA
Black Sea
Caspain Sea
Aral Sea
GREECE
TURKEY
SYRIA
IRAQ
IRAN
AFGHANISTAN

Armenia

REPUBLIC PROFILE

President: Levon Ter-Petrosyan
Population (1989): 3.3 million
Size/Location: 11,500 square miles. Situated in the southern part of Transcaucasia, surrounded by Georgia on the north, Azerbaijan on the east, and Turkey on the west.
Ethnic Groups: Armenian(93%), Azeris (6.1%)
Major Cities: Yerevan (capital), Leninakan

ECONOMIC PROFILE

Net Material Product (1989): 6.95 billion rubles
NMP Growth Rate (1989): 9.9%

ENERGY PROFILE

SUPPLY:

Armenia possesses no indigenous fossil fuel resources, and is therefore totally dependent on imports for its oil, gas, and coal demand. Most of these imports come through Azerbaijan, with which Armenia has strained relations, thus making Armenian energy supplies potentially vulnerable. Armenia's sole nuclear power plant at Metsamor was closed in early 1989, reducing the republic's output of electric power by about 40%.

CONSUMPTION:

Oil (1989E): 80,000 barrels per day
Natural Gas (1989E): 184 billion cubic feet
Coal (1989E): 500,000 short tons
Electricity (1989E): 11 billion kilowatt hours
Total (1989E): 0.39 quadrillion BTUs

ECONOMIC CONDITIONS

Armenia's economy centers around subtropical agriculture, mining, and some manufacturing. Armenia is heavily dependent upon trade, with exports to other republics accounting for 63.4% of Armenia's NMP produced, and imports from other republics accounting for 79% of Armenia's consumption of goods. Armenia's trade consists primarily of light industrial goods, machinery, chemicals, and petrochemicals. It also imports significant amounts of oil and natural gas.

HISTORY AND RECENT EVENTS

The Armenians have been dominated by the Arabs and the Turks with only brief periods of independence. In 1920, Turkey and the Soviet Union divided up Armenian lands and in December of that year an Armenian Soviet Republic was declared. Armenia declared sovereignty on August 23, 1990, and is scheduled to vote on independence on September 21, 1991. President Levon Ter-Petrosyan favors independence with economic ties to other republics. Ethnic conflict between Christian Armenians and Shiite Muslim Azeris poses a serious and chronic problem for the republic.


Georgia
Alaverdi
Amasiya
Kirovakan
Dilizhan
Leninakan
Azerbaijan
Razdan
Ozero
Sevan
Yerevan
Vardenis
Armenia
TURKEY
Dzhermuk
Goris
IRAN
Azerbaijan
Kadzharan
Nuclear Power Plant
Thermal Power Plant
Export Point
Capital City
Refinery
Hydropower Plant
Natural Gas Pipeline
Crude Oil Pipeline
Electric Power Line
Petroleum Products Pipeline

Azerbaijan

REPUBLIC PROFILE

President: Ayza Mutalibov
Population (1990): 7,145,600
Size/Location: 86,600 square miles. Occupies the eastern part of Transcaucasus region with the Caspian Sea on the east, Russia and Georgia to the north, Armenia to the west, and Iran to the south
Ethnic Groups: Azeris (78%), Russian (8%), Armenians (8%),
Major Cities: Baku(capital), Gyandzha, Sumgait
Major Import Products: Grain and other agricultural products, machinery and equipment, steel products

ECONOMIC PROFILE

Net Material Product (1989): 11.95 billion rubles
NMP Growth Rate (1989): -1.8%

ENERGY PROFILE

SUPPLY:
Oil (1990E) 244,000 barrels per day
Natural Gas (1989E): 318 billion cubic feet
CONSUMPTION:
Oil (1989E) 225,000 barrels per day
Natural Gas (1989E) 610 billion cubic feet
Coal (1989E): 300,000 short tons
Electricity(1989E): 19.6 billion kilowatthours
Total (1989E): 1.07 quadrillion BTUs

OIL INDUSTRY

ORGANIZATION:
Azerbaijan Production Association (Azneft) and **Kaspmorneftegaz** share responsibility for the oil and gas industries.

OIL PRODUCTION:
Azerbaijan is one of only four republics that is a net exporter of petroleum. During 1990, Azerbaijan accounted for about half of the decline in oil production of 380,000 barrels per day in the other oil-producing republics outside Russia. The decline was due to an offshore oilwell fire in 1989 that devastated the No. 2 platform in the April 28 field. The damaged platform was repaired, and the April 28 field received a new platform and new pumping station in early 1991.

Offshore oil production represents 72 percent of Azerbaijan's oil production. An oil discovery in the Caspian Sea, about 65 miles south of Baku, was reported in September 1990.

Onshore, 36 oil and gas fields are being operated by **Azneft**. A recent development has been the successful redrilling of old wells to increase production levels. Reservoirs are believed to still hold 40 percent of their original reserves because of past development practices.

REFINERIES:
Azerbaijan has almost 800,000 barrels per day of crude oil refining capacity at the refinery center in Baku. The recent unrest in Baku reduced the output of these refineries, which typically run at only half of their capacity under normal circumstances.

Azerbaijan's refineries are supplied from three sources: western Siberian crude delivered by pipeline; Iranian crude received in exchange for refined petroleum product; and local production. Refined petroleum products are sent by barge and train to the Ukraine and central Russia.

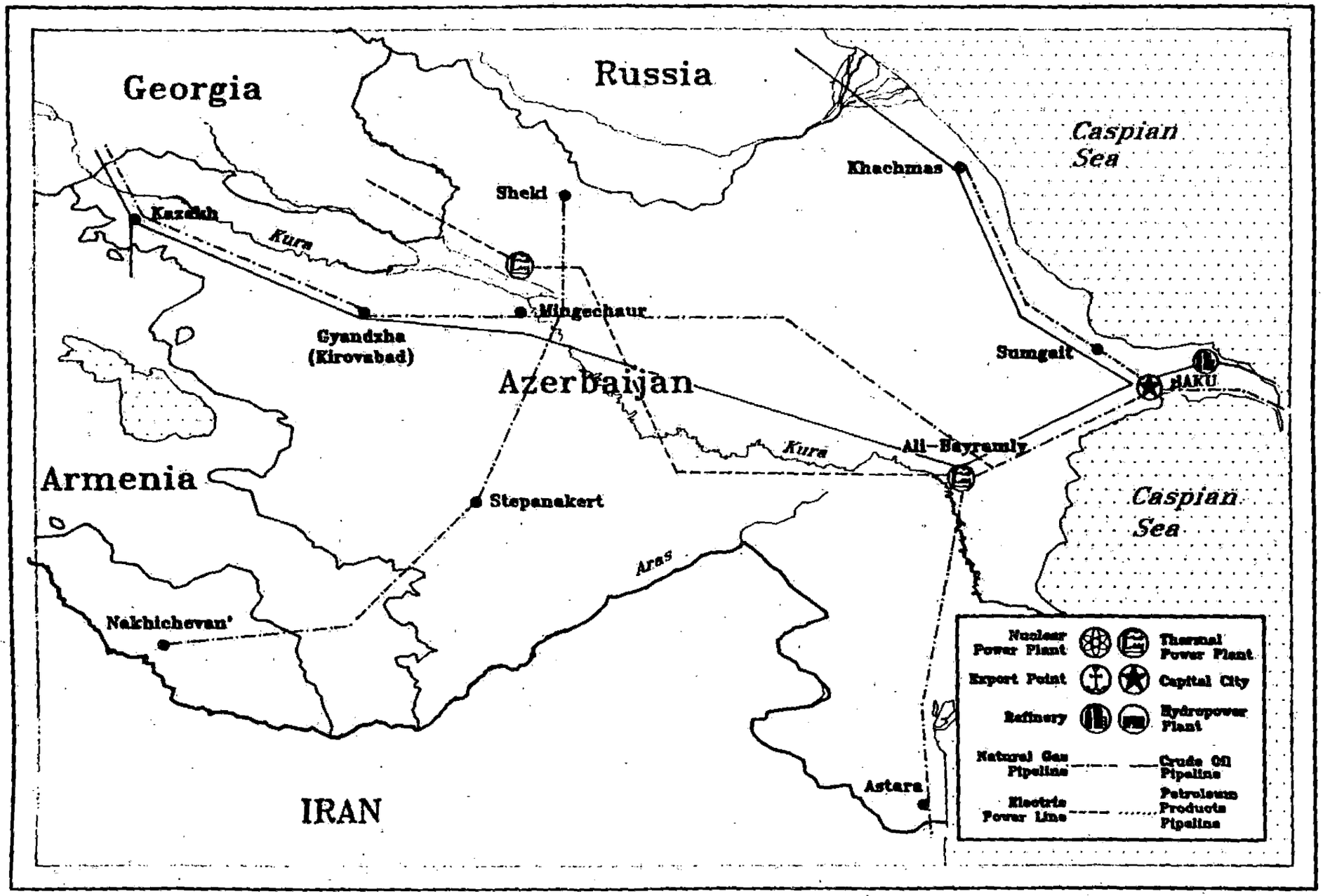
ECONOMIC CONDITIONS

Azerbaijan is rich in natural resources, especially crude oil, and is an important supplier of oil industry equipment and other machinery. It has substantial metal, chemical, petrochemical, and agricultural (grain and cotton) industries.

To exercise its claim of sovereignty, Azerbaijan established a foreign trade association for marketing oil abroad. Known as **Daniz**, its members are *Kaspmorneftegaz*, *Azneft*, and the *Caspian Sea Fleet*.

HISTORY AND RECENT EVENTS

The Azerbaijan Republic was formed on April 28, 1920, joined the USSR on December 30, 1922, and declared its independence in September, 1991.


Georgia
Russia
Caspian Sea
Khachmas
Sheki
Kazakh
Kura
Mingechaur
Gyandzha (Kirovabad)
Azerbaijan
Sumgait
HAKU
Kura
Ali-Bayramly
Armenia
Stepanakert
Caspian Sea
Aras
Nakhichevan'
Astara
IRAN
Nuclear Power Plant
Thermal Power Plant
Export Point
Capital City
Refinery
Hydropower Plant
Natural Gas Pipeline
Crude Oil Pipeline
Electric Power Line
Petroleum Products Pipeline

Belorussia

REPUBLIC PROFILE

President: N/A
Population (1989): 10,200,000
Size/Location: 207,600 square miles.
Lithuania and Latvia to the northwest, Russia to the northeast, the Ukraine to the south, and a short border with Poland to the west.
Ethnic Groups: Belorussian (79.4%), Russian (11.9%), Polish (4.2%),
Major Cities: Minsk (capital), Bobruysk, Brest
Major Industries: Machine tools and machinery, grain and fodder

ECONOMIC PROFILE

Net Material Product (1989): 27.48 billion rubles
NMP Growth Rate (1989): 5.7%

ENERGY PROFILE

SUPPLY:
Belorussia produces only a small portion of its energy requirements. Around 40,000 barrels per day of oil, along with peat and a small volume of natural gas, consitute the only domestic energy sources. All domestic electricity generation is from four thermal plants. All nuclear and hydro-generated electric power is imported.

CONSUMPTION:
Oil (1989E) 579,000 barrels per day
Natural Gas (1989E) 323 billion cubic feet
Coal (1989E): 4.0 million short tons
Electricity (1989E): 39 billion kilowatthours
Total (1989E): 1.7 quadrillion BTUs

OIL REFINING:
Belorussia has a total of almost 800,000 barrels per day of crude oil refining capacity located at two refineries in Mozyr' and Polotsk. These refineries operate at about 80 percent of capacity and have little capability to upgrade residual oil into the lighter products used in the transportation sector.

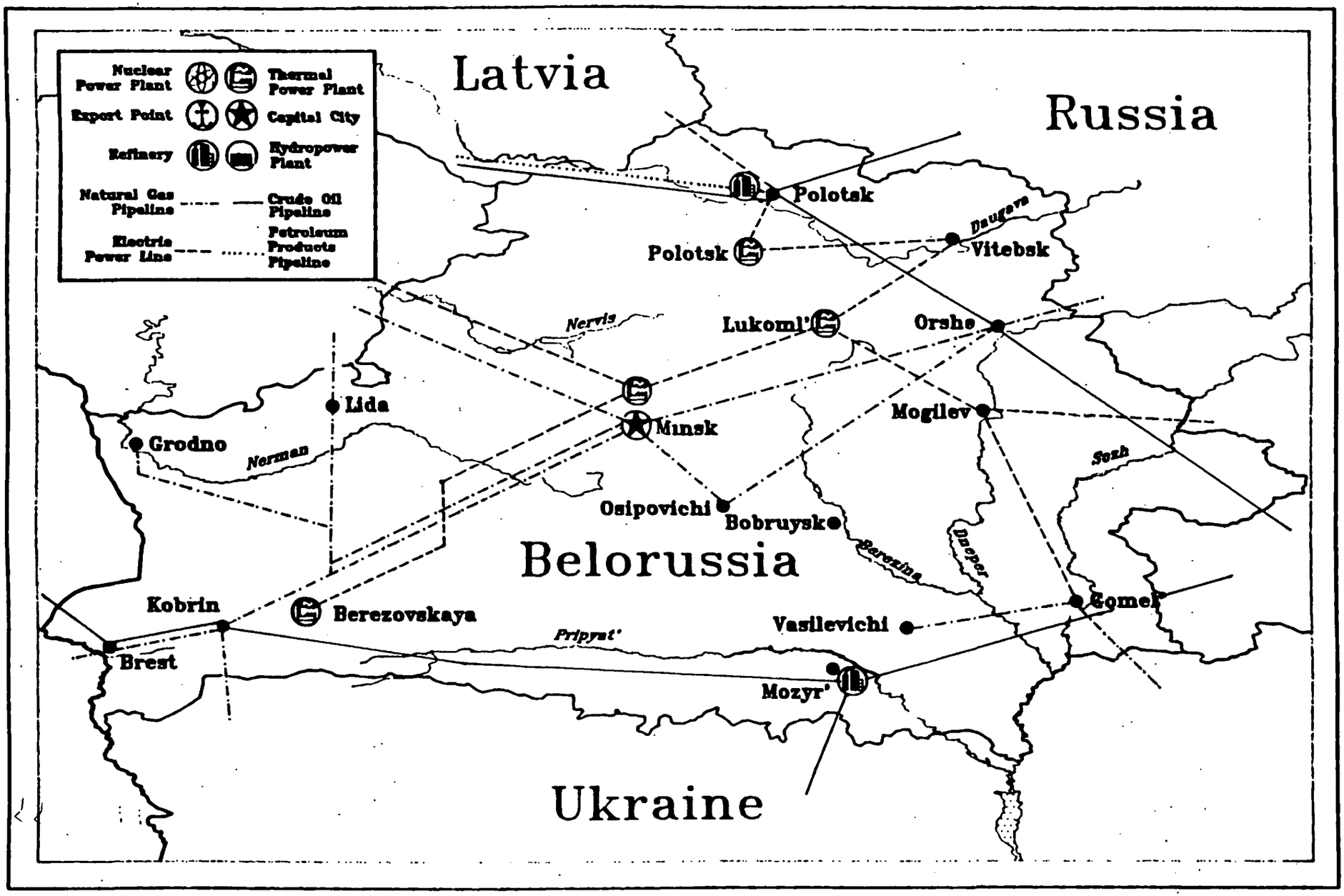
The Belorussian refineries are supplied from three sources: Western Siberian crude delivered by pipeline; Volga-Urals crude delivered by pipeline; and local production. The petroleum products produced in the Belorussian refineries are supplied to local markets and to markets in the Ukraine.

ECONOMIC CONDITIONS

Belorussia's major industries are chemicals, machine-building and light industrial. Most of the economic development has occurred since the end of World War II.

HISTORY AND RECENT EVENTS

The Belorussian republic was formed on January 1, 1919, and joined the USSR on December 30, 1922. Belorussia declared its sovereignty on July 27, 1991 and recently declared independence. On August 25, 1991, President Nikolai Dementei resigned under pressure for not opposing the coup. Belorussia is a member of the United Nations in its own right.


Nuclear Power Plant
Thermal Power Plant
Export Point
Capital City
Refinery
Hydropower Plant
Natural Gas Pipeline
Crude Oil Pipeline
Electric Power Line
Petroleum Products Pipeline
Latvia
Russia
Belorussia
Ukraine
Polotsk
Polotsk
Vitebsk
Daugava
Nerva
Lukoml'
Orsha
Lida
Minsk
Mogilev
Grodno
Nerman
Sozh
Osipovichi
Bobruysk
Berezina
Dnepr
Kobrin
Berezovskaya
Vasilevichi
Gomel'
Pripyat'
Brest
Mozyr'

Estonia

COUNTRY PROFILE

Head of State: Arnold F. Ruutel
Population (1989): 1.57 million
Location/ Size: Baltic / 12,252 square miles
Ethnic Groups: Estonian(61.5%), Russian (30.3%), Ukrainian (3.1%), Finn (1.1%), and Belorussian (1.8%)
Major Cities: Tallinn (capital) and Tartu
Major Port: Tallinn

ECONOMIC PROFILE

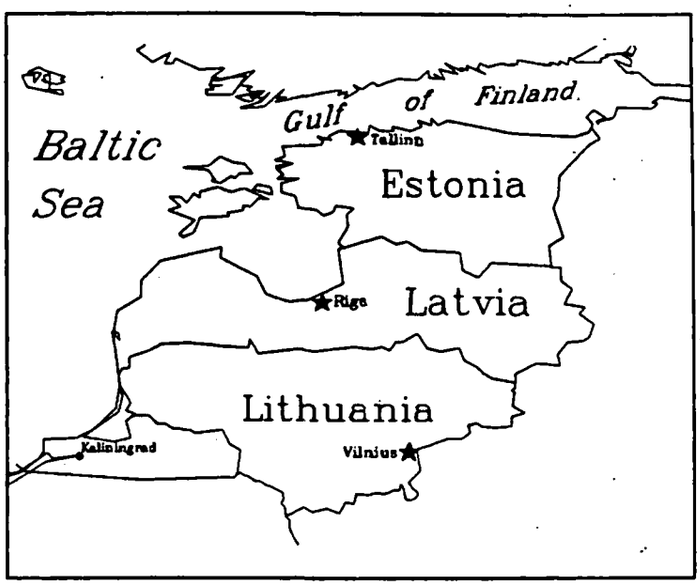
Net Material Product (1989E): 4.4 billion rubles (0.7% of USSR total)
NMP Growth Rate (1989E): 5.2%

ENERGY PROFILE

SUPPLY:

Oil shale is produced domestically and is used to generate electricity. Estonia is highly dependent, however, on gas, coal, and oil imports from Soviet republics, particularly Russia.

Electricity (1989): 17.6 terawatthours
Peat (1989): 229,000 short tons
CONSUMPTION:
Oil (1989E): 64,000 barrels per day
Natural Gas (1989E): 56 billion cubic feet
Coal (1989E): 500,000 short tons
Electricity(1989E): 9 terawatthours
Total (1989E): 0.36 quadrillion BTUs



ECONOMIC CONDITIONS

Primarily an agricultural and dairy region, Estonia also has textile, shipbuilding, timber, paper, mining equipment and oil shale industries. Estonia is relatively rich, possessing the second highest per capita income among the former Soviet republics. Estonia is highly dependent on trade, with imports from other former Soviet republics accounting for 65 percent of Estonian NMP.

HISTORY AND RECENT EVENTS

Estonians, who are closely related to the Finns, were dominated by the Germans, Danish, Scandinavians, and Russians until independence in 1918. Estonia remained independent until the Hitler-Stalin pact of 1940, which led to its annexation by the USSR. President Arnold F. Ruutle declared independence in August 1991. Following the failed coup, the Republics of Georgia and Russia recognized Estonia's independence. On September 2, 1991, the United States formally recognized Estonia's independence.


FINLAND
Helsinki
Gulf of Finland
Baltic Sea
Tallinn
Hiiumaa
Estonia
Lake Peipus
Saaremaa
Pärnu
Tartu
Gulf of Riga
Latvia
Riga
Nuclear Power Plant
Thermal Power Plant
Export Point
Capital City
Refinery
Hydropower Plant
Natural Gas Pipeline
Crude Oil Pipeline
Electric Power Line
Petroleum Products Pipeline

Georgia

REPUBLIC PROFILE

President: Zviad Gamsakhurdia
Population (1989): 5.4 million
Size/Location: 18,950 square miles. Situated in west and central Trancaucasia, with Russia to the north, Armenia to the south, and Azerbaijan to the west.
Ethnic Groups: Georgian(68.8%), Armenian(9%), Russian(7.4%), Azeri(5.1%), Ossetian(3.2%), and Abkhazian(1.7%)
Major Cities: Tbilisi (capital) and Batumi

ECONOMIC PROFILE

Net Material Product (1989): 10.79 billion rubles
NMP Growth Rate (1989): -3.6%

ENERGY PROFILE

SUPPLY:

Georgia is dependent upon imports for most of its fossil energy needs, although it does produce over 1 million short tons of coal per year. Georgia also has significant hydroelectric power resources, producing around 16 billion kilowatthours in 1989. Production of oil and gas is negligible.

CONSUMPTION:

Oil (1989E): 135,000 barrels per day
Natural Gas (1989E): 208 billion cubic feet
Coal (1989E): 1.6 million short tons
Electricity (1989E): 15.6 billion kilowatthours
Total (1989E): 0.62 quadrillion BTUs

OIL REFINING:

Georgia has a single, 120 thousand barrels per day capacity refinery, with no real capability to upgrade residual oil into the lighter products used in the transportation sector. Locally produced crude oil, along with supplemental supplies from Azerbaijan, is refined in the facility at Batumi. The refined petroleum products are then distributed within Georgia.

ECONOMIC CONDITIONS

Georgia grows most of the Soviet Union's tea, as well as citrus fruits, grapes, silk, bamboo and tobacco. It is famous for its wineries. The republic contains the largest manganese mines in the world, and is rich in timber and coal. Its major industries include mining, metallurgy and textiles.

HISTORY AND RECENT EVENTS

A Georgian empire arose in the 13th century, was crushed by the Mongol invasion, and fell subsequently under Turkish and Persian overlords. Russia annexed most of Georgia in the early 19th century. Georgia declared independence in 1918 and was recognized by the Allies. But in 1921, the Red Army entered Tblisi and a Soviet republic was formed under Stalin, himself a Georgian. Georgia declared full independence in April 1991, and has annulled the autonomous status of some ethnic groups wishing to stay in the USSR. Ethnic conflicts in the republic exist between Georgians and Ossetians in the north and between Georgians and Azeris in the south.


Russia
Nuclear Power Plant
Thermal Power Plant
Export Point
Capital City
Refinery
Hydropower Plant
Natural Gas Pipeline
Crude Oil Pipeline
Electric Power Line
Petroleum Products Pipeline
Sukhumi
Dzhvari
Poti
Black Sea
Georgia
Kutaisi
Kazbegi
Zhinvani
Kura
Borzhomi
TBILISI
Batumi
Bustavi
Gardabani
Azerbaijan
TURKEY
Armenia

Kazakhstan

REPUBLIC PROFILE

President: Nursultan Nazarbayev
Population (1990): 16,500,000
Size/Location: 1,050,000 square miles. Second largest Soviet republic; borders Russia to the north, China to the east, Uzbekistan, Turkmenia, and Kirghizia to the south.
Ethnic Groups: Russian (41%), Kazakh (36%), Ukrainian (6%), Tatar (2%)
Major Cities: Alma-Ata(capital), Karaganda
Major Import Products: Machinery, light industrial goods, chemicals and petrochemicals, oil and gas

ECONOMIC PROFILE

Net Material Product (1989): 27.8 billion rubles
NMP Growth Rate (1989): 1.3%

ENERGY PROFILE

Oil Industry Organization

Kazahkstan, as the largest oil-producing republic after Russia, has four oil production enterprises - *Embaneft'*, *Mangyshlakneft'*, *Aktyubinskneft'*, and *Tengizneftegaz*.

SUPPLY

Oil (1990E): 490,000 barrels per day (b/d)
Natural Gas (1989E): 250 billion cubic feet (bcf)
Refining Capacity (1991E): 600,000 b/d

CONSUMPTION

Oil (1989E): 470,000 b/d
Natural Gas (1989E): 400 billion cubic feet
Coal (1989E): 88 million short tons
Electricity (1989E): 91 terawatthours
Total (1989E): 3.08 quadrillion BTUs

OVERVIEW

Kazakhstan is a resource-rich producer of primary products, especially coal, but also oil and gas. The Ekibastuz and Karaganda basins in northeast Kazakhstan comprise the third largest coal-producing area in the USSR. Kazakhstan is one of only four republics that is a net exporter of energy.

OIL AND GAS PRODUCTION

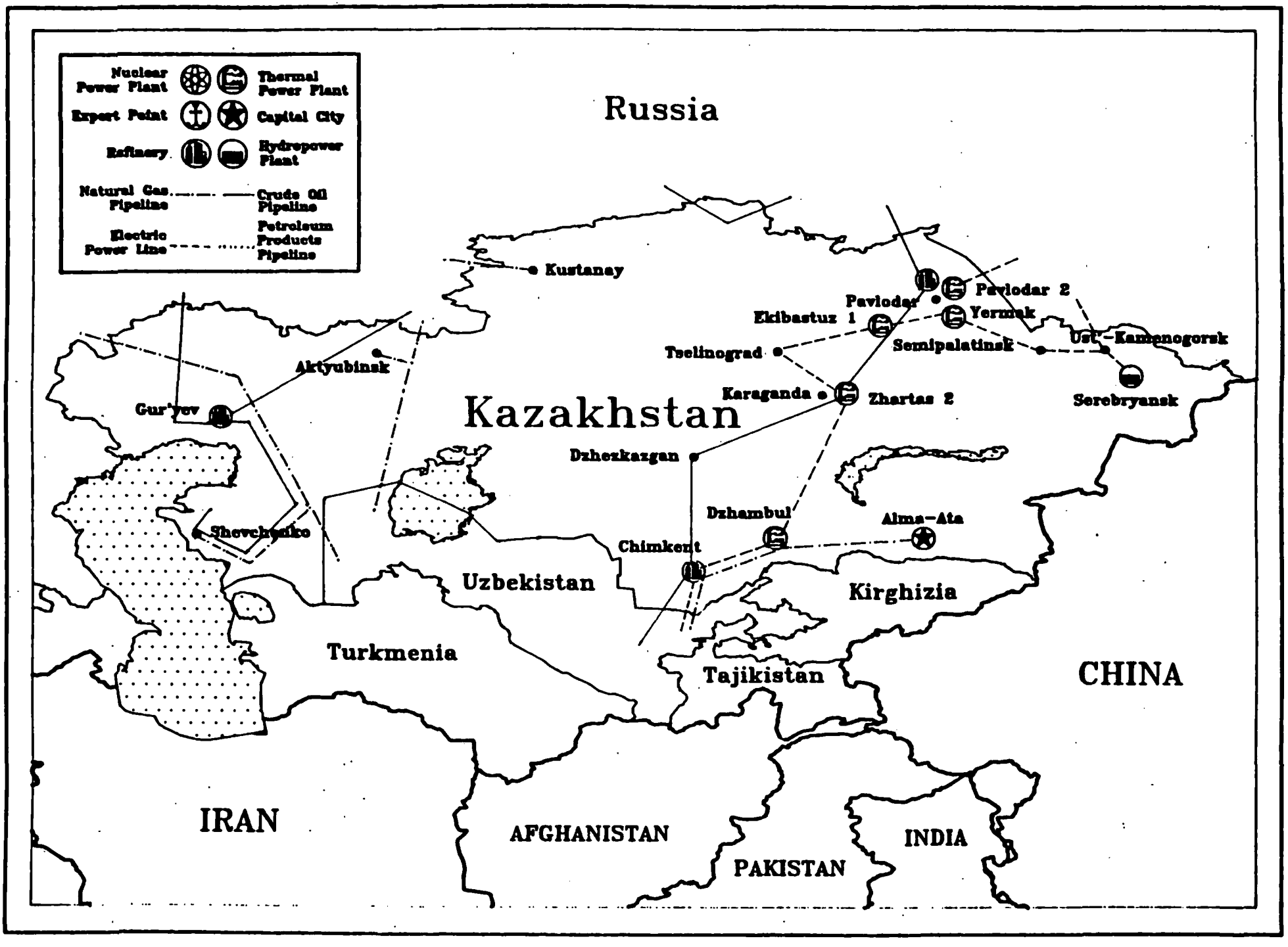
Significant amounts of oil and natural gas are produced in the northwest part of the republic near the Caspian Sea. Future oil production potential depends largely on the development of the relatively deep, high-sulphur deposits of the remote and inhospitable Guryev region of northwest Kazakhstan, particularly the Tengiz field. Although Tengiz was discovered in 1979, and may contain 20 billion barrels of oil, test production began only in April 1991. Soviet drilling and production equipment has proven unsuitable for handling either the highly corrosive sour crudes or the abnormally high downhole pressure of the Tengiz field. The involvement of foreign oil companies in providing technology and expertise for the development of Tengiz thus seems inevitable and potentially advantageous to both sides. Chevron currently is heavily involved in finalizing an exploration and production deal for the area.

OIL REFINING

Kazakhstan has three refineries - in Chimkent, Gur'yev, and Pavlodar - which supply population centers in Kazakhstan, Kirghizia and southern Siberia. Chimkent and Gur'yev operate near capacity levels and have throughputs of about 150 and 120 thousand barrels per day, respectively. Pavlodar operates at only half of its 360 thousand barrel per day capacity. All three refineries are supplied by Western Siberian crude transported by pipeline.

HISTORY AND RECENT EVENTS

The Kazakh Republic was formed as an autonomous republic within the Russian Federation on August 26, 1920, and reconstituted as a Union Republic on December 5, 1936. Conservative Kazakhstan declared its sovereignty on October 25, 1990, but only after 13 other republics had done so.


Nuclear Power Plant
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Petroleum Products Pipeline
Russia
Kustanay
Pavlodar
Pavlodar 2
Yermak
Ekibastuz 1
Tselinograd
Semipalatinsk
Ust'-Kamenogorsk
Aktyubinsk
Karaganda
Zhartas 2
Serebryansk
Gur'yev
Kazakhstan
Dzhezkazgan
Dzhambul
Alma-Ata
Shevchenko
Chimkent
Uzbekistan
Kirghizia
Turkmenia
Tajikistan
CHINA
IRAN
AFGHANISTAN
PAKISTAN
INDIA

Kirghizia

REPUBLIC PROFILE

President: Askar Akayev
Population (1990): 4,372,000
Size/Location: 76,640 square miles. Borders Russia to the north, China to the southeast, Uzbekistan to the west, and Tajikistan to the southwest.
Ethnic Groups: Kirghiz (52.4%), Russian (21.5%), Uzbeks (12.9%)
Major Cities: Frunze(capital), Osh
Major Import Products: Machinery, light industrial goods, food, chemicals and petrochemicals, oil and gas

ECONOMIC PROFILE

Net Material Product (1989): 5.97 billion rubles
NMP Growth Rate (1989): 5.3%

ENERGY PROFILE

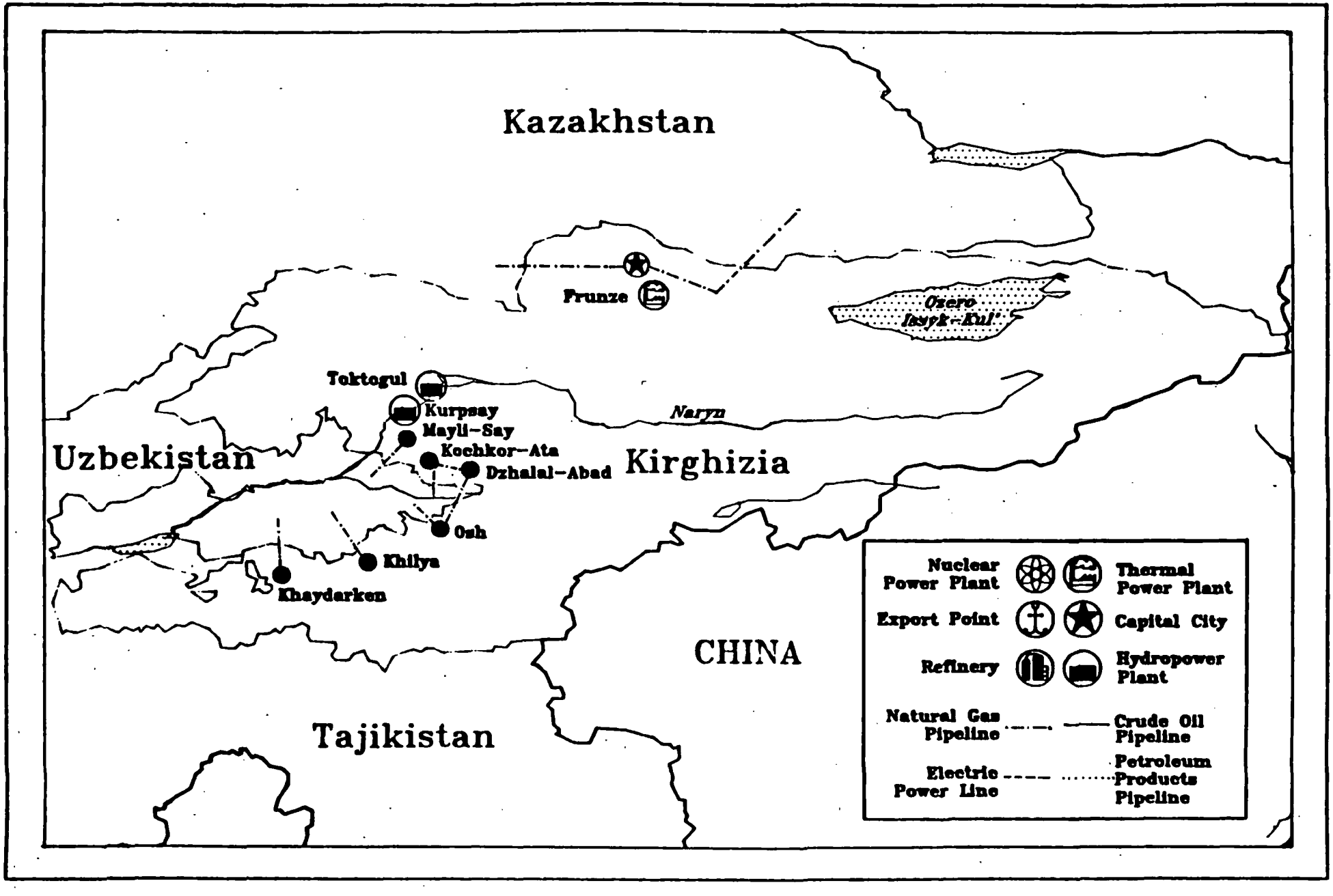
SUPPLY:
Oil (1990E) 4,000 barrels per day
Coal (1989E): 4 million tons
Natural Gas (1989E): 4 billion cubic feet
CONSUMPTION:
Oil (1989E) 60,000 barrels per day
Coal (1989E): 4.8 million short tons
Natural Gas (1989E): 64 billion cubic feet
Electricity (1989E): 7.5 billion kilowatthours
Total (1989E): 0.3 quadrillion BTUs

ECONOMIC CONDITIONS

The republic is a major producer of wool, livestock, and other agricultural goods. Light industries include machine and instrument making. Domestic coal resources and hydroelectric generation make Kirghiz self-sufficent in electric power. A liberalization drive was launched in October 1990 by President Akayev, with the the goal of initiating market oriented reforms. However, the republic remains mired in proverty, with high unemployment, land shortages, and ethnic conflicts.

HISTORY AND RECENT EVENTS

Kirghizia was made an Autonomous Republic within the Russian Federation on February 1, 1926, and reconstituted as a Union Republic on December 5, 1936. Kirghizia declared its sovereignty on December 12, 1990, and its independence on September 7, 1991.


Kazakhstan
Frunze
Ozero Issyk-Kul'
Toktogul
Kurpsay
Mayli-Say
Kochkor-Ata
Dzhalal-Abad
Naryn
Uzbekistan
Kirghizia
Osh
Khilya
Khaydarken
CHINA
Tajikistan
Nuclear Power Plant
Thermal Power Plant
Export Point
Capital City
Refinery
Hydropower Plant
Natural Gas Pipeline
Crude Oil Pipeline
Electric Power Line
Petroleum Products Pipeline

Latvia

COUNTRY PROFILE

Head of State: Anatolijs V. Gorbunovs
Population(1989): 2.68 million
Location/ Size: Baltic. 17,547 square miles
Ethnic Makeup: Lett (51.8%), Russian (33.8%), Ukrainian (3.4%), Polish (2.3%), and Belorussian (4.5%)
Major Cities: Riga (capital), Ventspils, and Liepaja
Major Port: Ventspils

ECONOMIC PROFILE

Net Material Product (1989E): 8.14 billion rubles (1.3% of USSR total)
NMP Growth Rates (1989E): 5.0%

ENERGY PROFILE

SUPPLY:

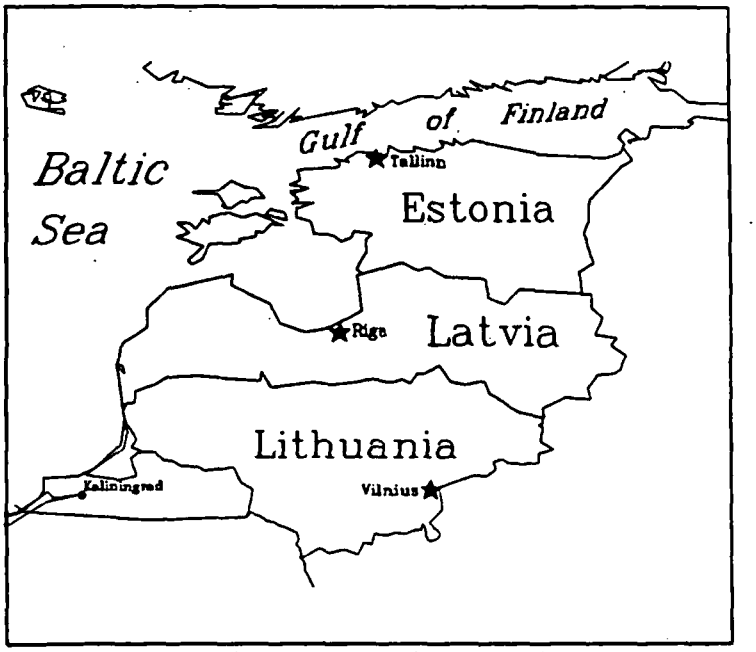
Latvia is almost totally dependent on imports to satisfy its energy demand, producing only small amounts of hydroelectricity and peat.

CONSUMPTION:

Oil (1989E): 116,000 barrels per day
Natural Gas (1989E): 109 billion cubic feet
Coal (1989E): 80,000 short tons
Electric Power (1989E): 9 terawatthours
Total (1989E): 0.46 quadrillion BTUs

ECONOMIC CONDITIONS

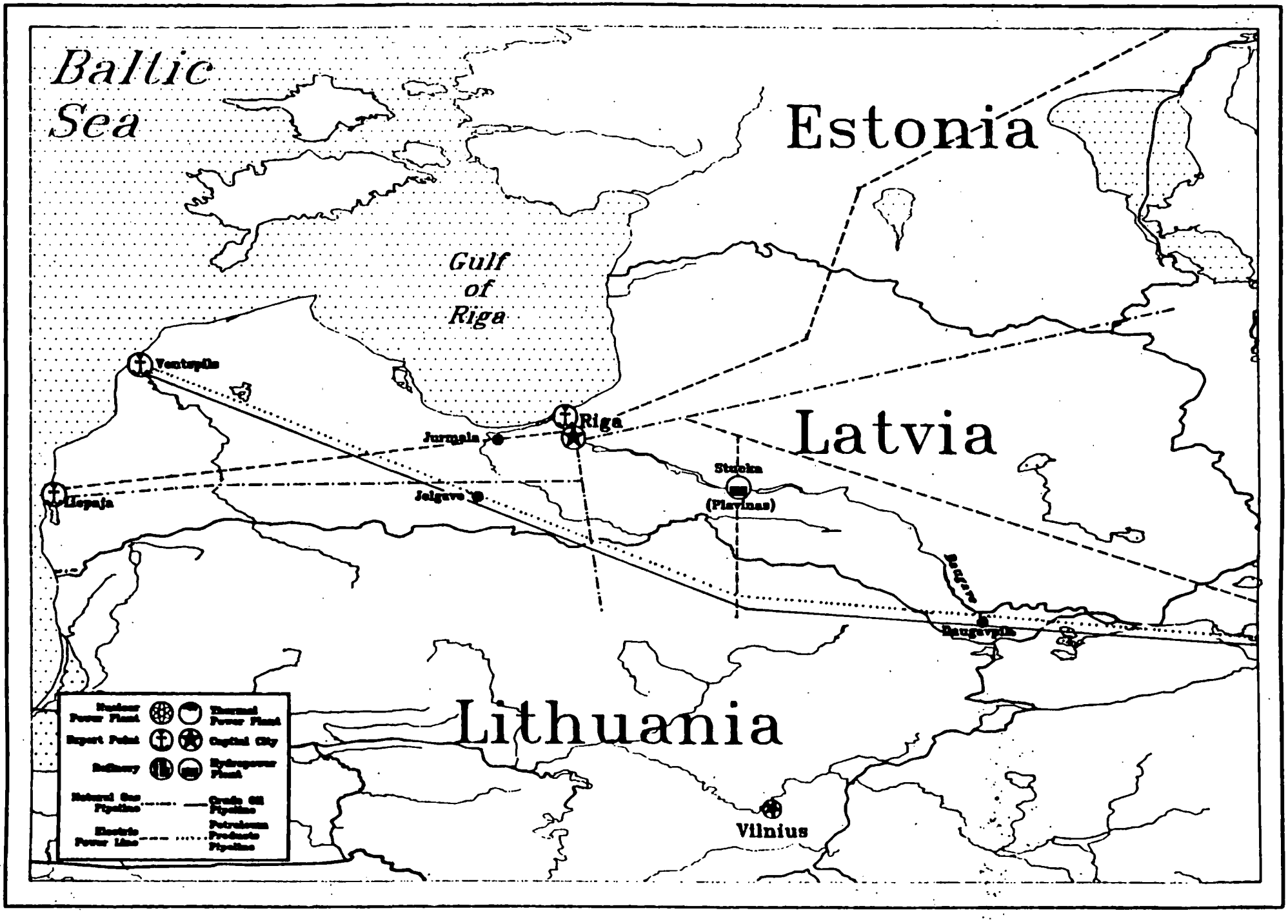
Latvia's primary industries are machine-building and metalworking, food, and light manufacturing. Major products include radio receivers and washing machines. Other industries include glass, wood, paper, chemicals, and petrochemicals. The Riga area is a major manufacturing region, which historically has supported a diversity of industries.



Latvia is an active trader, primarily with other Soviet republics. It exports about 70 percent of its production while importing about three-quarters of its consumption. Latvia imports and exports machinery. It also exports food products and small volumes of electric power, and imports coal from neighboring Poland.

HISTORICAL AND RECENT EVENTS

Latvia was annexed by the Soviet Union in 1940 under the Hitler-Stalin pact, after a 20-year period of independence. Although it had originally favored a step-by-step break with Moscow, Latvia declared full independence from the Soviet Union during the August 1991 coup attempt. Soon after, Denmark sent the first ambassador to a Baltic country in 50 years. This was followed by U.S. recognition of Latvia's independence on September 2, 1991.


Ballic Sea
Estonia
Gulf of Riga
Ventspils
Riga
Jurmala
Latvia
Liepaja
Jelgava
Stucka
(Plavinas)
Daugava
Daugavpils
Lithuania
Vilnius
Nuclear Power Plant
Thermal Power Plant
Export Point
Capital City
Refinery
Hydropower Plant
Natural Gas Pipeline
Crude Oil Pipeline
Electric Power Line
Petroleum Products Pipeline

Lithuania

COUNTRY PROFILE

Head of State: Vytautas Z. Landsbergis
Population (1989): 3.69 million
Location/ Size: Baltic / 17,700 square miles
Ethnic Makeup: Lithuanian (80.1%), Russian (8.6%), Polish (7.7%), and Byelorussian (1.5%)
Major Cities: Vilnius (capital), Klaipeda, Kaunas, and Siauliai
Major Port: Klaipeda

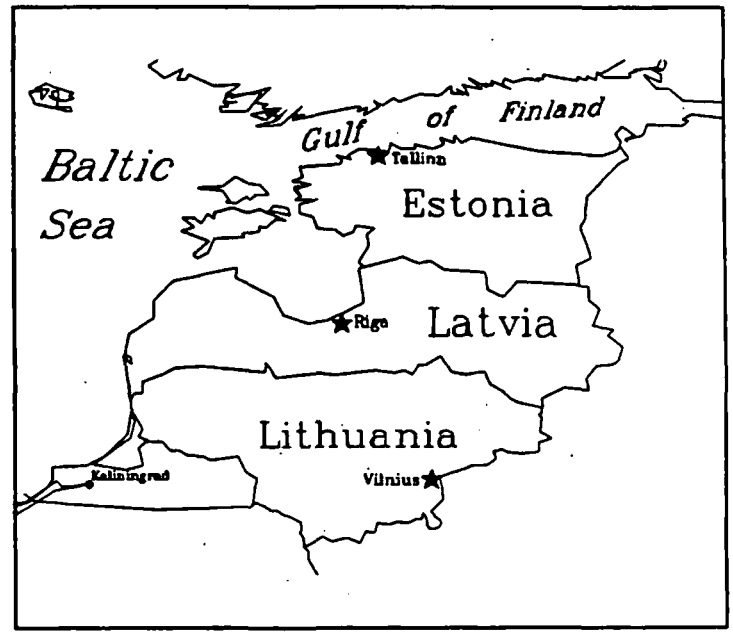
ECONOMIC PROFILE

Net Material Product (1989): 9.8 billion rubles (1.5% of total USSR)
NMP Growth Rate (1989): 2.9%

ENERGY PROFILE

SUPPLY
Electricity Production (1989E): 29.2 terawatthours
CONSUMPTION
Oil (1989E): 180,000 barrels per day
Natural Gas (1989E): 194 billion cubic feet
Coal (1989E): 1.5 million short tons
Total (1989): 0.64 quadrillion BTUs
OIL REFINING:
Lithuania has a 270,000 barrel per day refinery in Mazeikiai which operates close to peak capacity. The refinery receives oil by pipeline from Western Siberia and provides product to the Baltics republics. In addition, the Mazeikiai refinery is able to produce distillate fuel oil for export.
OVERVIEW:
Lithuania is nearly totally dependent on imports for its fossil fuel demands. Oil accounts for nearly 60 percent of Lithuania's energy consumption, while natural gas supplies around 28 percent.

The Ignalina nuclear power plant provides electric power to Lithania and to neighboring republics.

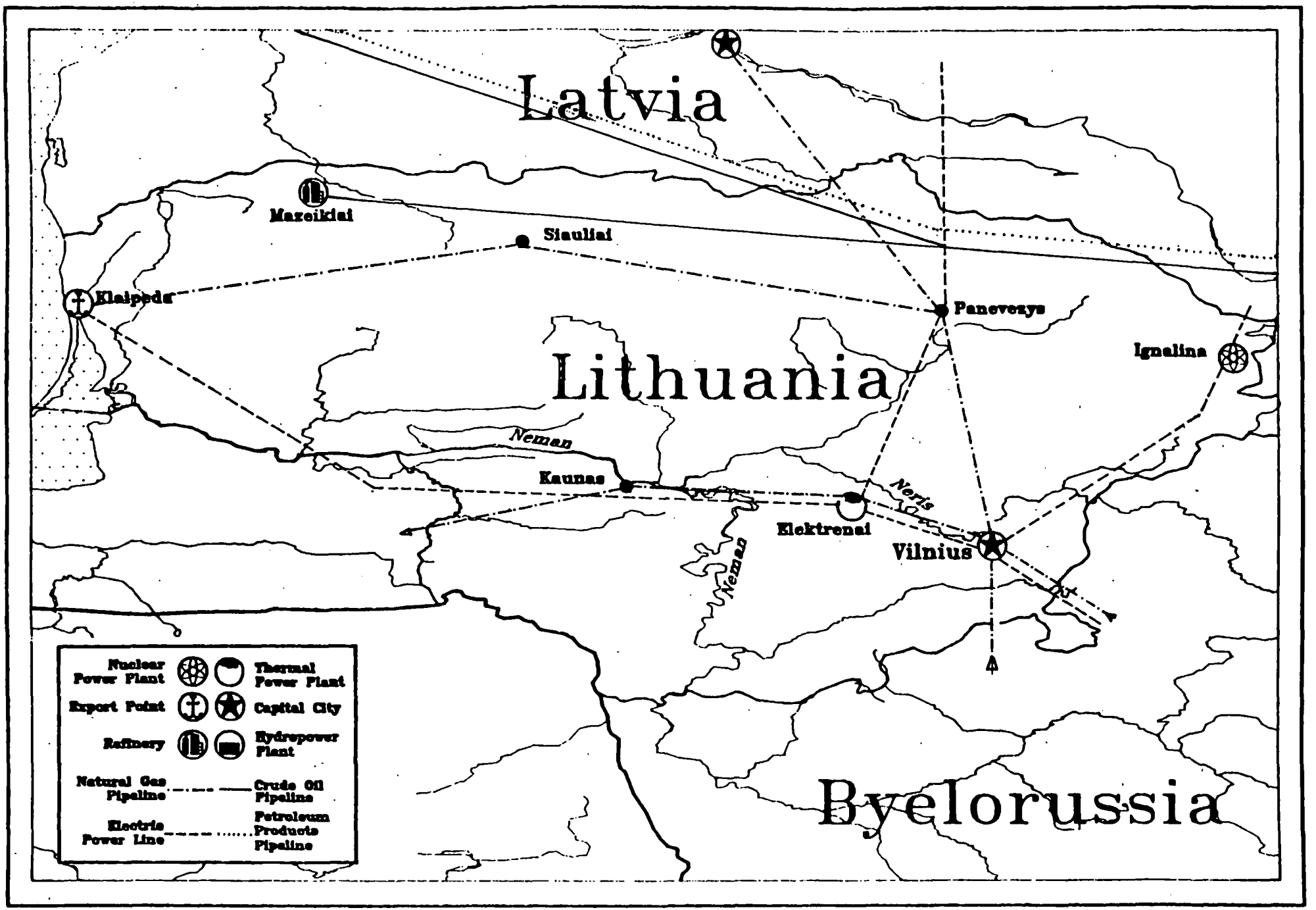


ECONOMIC CONDITIONS

Traditionally an agricultural region, Lithuania has become increasingly industrialized since World War II. As a Soviet republic, Lithuania has been a producer of machine tools, appliances, and televisions. Lithuania is a relatively rich republic, ranking fourth in per capita income.

HISTORY AND RECENT EVENTS

In 1918 an independent state was proclaimed as the defeat of the then-occupying Germans drew near. In 1940, the Hitler-Stalin pact resulted in Lithuania's annexation by the Soviet Union. In March, 1990, Lithania became the first Soviet republic to declare independence. Soviet authorities responded to this by cutting off oil supplies. On September 2, 1991, in the aftermath of the failed coup, the United States formally recognized Lithuania as an independent state.


Latvia
Lithuania
Byelorussia
Mazeikiai
Siauliai
Klaipeda
Panevezys
Ignalina
Neman
Kaunas
Elektrenai
Neris
Vilnius
Neman
Nuclear Power Plant
Thermal Power Plant
Export Point
Capital City
Refinery
Hydropower Plant
Natural Gas Pipeline
Crude Oil Pipeline
Electric Power Line
Petroleum Products Pipeline

Moldavia

REPUBLIC PROFILE

President: Mircea Snegur
Population (1990): 4,340,000
Size/Location: 9,155 square miles.
Situated in the southwestern part of the Soviet Union, with Romania to the west and the Ukraine to the east.
Ethnic Groups: Moldavian (64%), Ukrainian (14%), Russian (13%)
Major Cities: Kishinev (capital)
Major Import Products: Machinery, light industrial goods, chemicals and petrochemicals, oil and gas

ECONOMIC PROFILE

Net Material Product (1989): 8.2 billion rubles
NMP Growth Rate (1989): 3.9%

ENERGY PROFILE

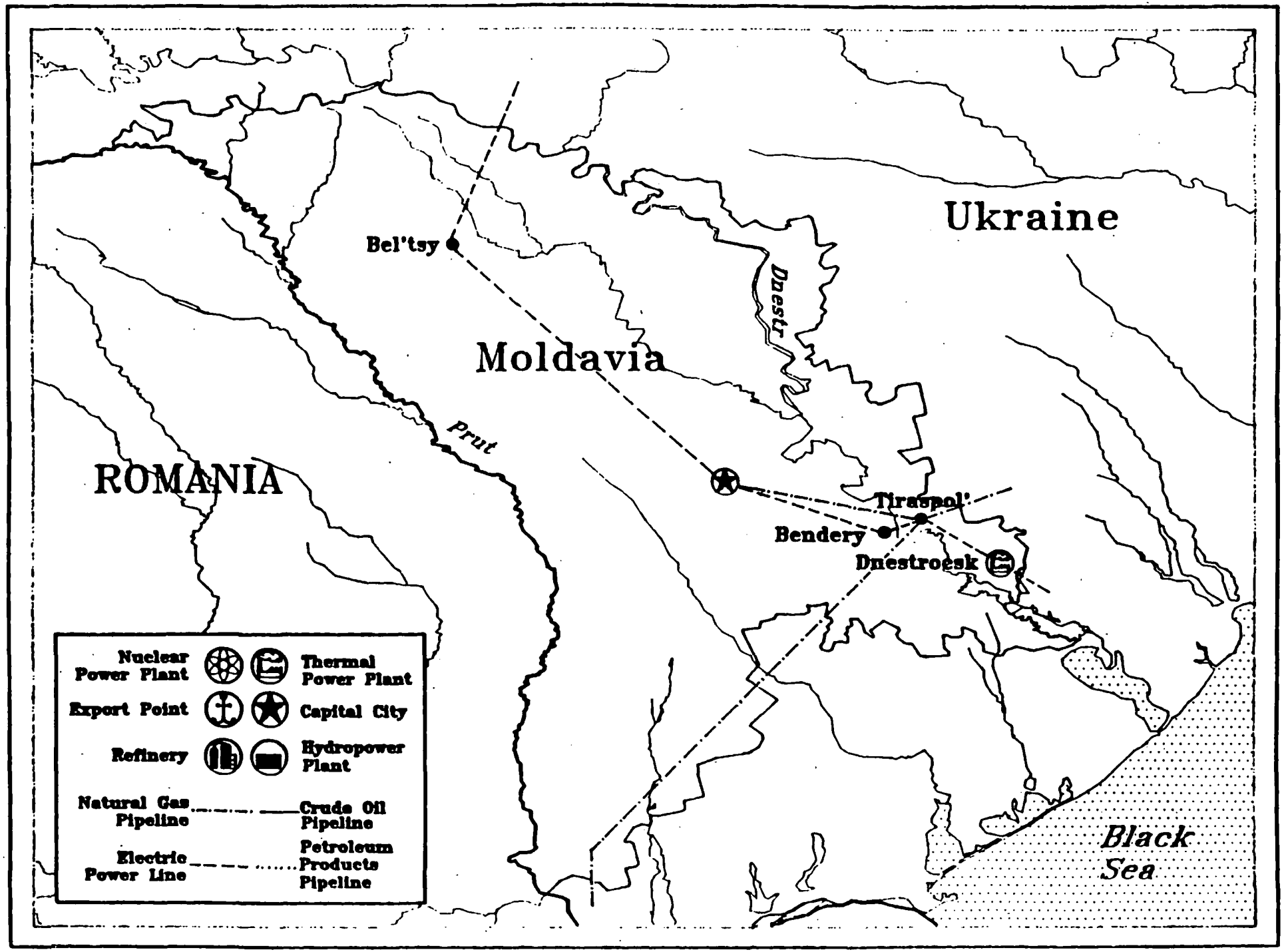
Supply:
No indigenous fossil fuel resources.
Consumption:
Oil (1989E): 100,000 barrels per day
Natural Gas (1989E): 136 billion cubic feet
Coal (1989E): 6 million short tons
Electricity (1989E): 10.2 terawatthours
Total (1989E): 0.38 quadrillion BTUs

ECONOMIC CONDITIONS

Primarily an agricultural region with rich vineyards and tobacco fields, Moldavia imports nearly all of its energy needs from Russia and the Ukraine. However, Moldavia is a net exporter of electricity.

HISTORY AND RECENT EVENTS

The Moldavian Republic was formed as an autonomous republic on October 12, 1924, and joined the USSR on August 2, 1940. Moldavia has close cultural links to Romania, with which it was joined before 1940. Parliament voted for independence in early September.


Ukraine
Bel'tsy
Dnestr
Moldavia
Prut
ROMANIA
Tiraspol'
Bendery
Dnestrovsk
Black Sea
Nuclear Power Plant
Thermal Power Plant
Export Point
Capital City
Refinery
Hydropower Plant
Natural Gas Pipeline
Crude Oil Pipeline
Electric Power Line
Petroleum Products Pipeline

Russia

REPUBLIC PROFILE

President: Boris Yeltsin

Population (1989): 147 million (51% of the USSR)

Size/Location: 4,618,000 square miles (76% of the USSR). Between the Baltic Sea and Arctic Ocean in the north, China and Mongolia in the south, and the Pacific Ocean in the east.

Ethnic Divisions: Russian (82.6%), Tatar (3.6%), Ukrainian (2.7%), Chuvash (1.2%), and 100 other nationalities (9.9%)

Major Cities: Moscow(capital), St. Petersburg, Arkhangelsk, Vladivostok

ECONOMIC PROFILE

Net Material Product (1989) :
381 billion rubles (59% of USSR total)

Sectoral Share in USSR Output: Agriculture (18% of USSR total); Industry (62% of USSR total); Foreign Exports (71% of USSR total); Foreign Imports (69% of USSR total).

ENERGY PROFILE

Organization
The Russian Energy Ministry oversees the management of energy resources.

Energy Minister
Anatoliy Dyakov

CONSUMPTION

Oil (1989E): 5.2 million barrels per day (MMBD)

Gas (1989E): 16.8 trillion cubic feet (TCF)

Coal (1989E): 475 million short tons (MST)

Electricity (1989E): 906 terawatthours (TWh)

Total (1989E): 38.4 quadrillion BTU

SUPPLY

Oil (1990): 10.3 MMBD (91% of USSR total)

Gas (1990): 22.6 TCF (79% of USSR total)

Coal (1990): 435 MST (56% of USSR total)

Electric (1990): 1082 TWH (63% of USSR total)

Overview

By itself, Russia would be the world's largest oil producer, and would contain the largest natural gas reserves, and one of the largest coal reserves. Russia contains between 80 and 90 percent of total Soviet oil reserves of 58 billion barrels, and a similar share of Soviet natural gas reserves of 1500 trillion cubic feet. Russia accounts for over half of total Soviet coal production.

Oil and Gas Production

Russian oil production is centered mainly in West Siberia, specifically the Tyumen Oblast. Production in the older Russian oil fields in West Siberia is declining. Russian oil exports to Eastern Europe are transported primarily by pipeline, and to Western Europe via tanker through ports in the Black Sea and the Baltics. Russian oil exports dropped 36 percent in the first quarter of 1991 from the first quarter of 1990.

Russian natural gas production, like oil production, is concentrated in West Siberia, particularly the giant Urengoi field. Vast amounts of natural gas are also believed to lie beneath the Arctic Ocean. Russian natural gas export capacity is now limited to the area of Europe served by pipelines from western Siberia and the Urals. Future possibilities include links to Japan and Korea.

For both oil and natural gas, future production will come largely from relatively inaccessible fields, necessitating a major exploration and development effort requiring huge investments of capital.

Refineries

Total Russian crude oil refining capacity is about 8 million barrels per day, constituting two-thirds of total Soviet refining capacity. Russian refineries are relatively antiquated and technically unsophisticated, operating at only 75 percent capacity utilization (compared to 91 percent in the United States). In addition, Russian refineries have much less reforming and cracking capacity than U.S.

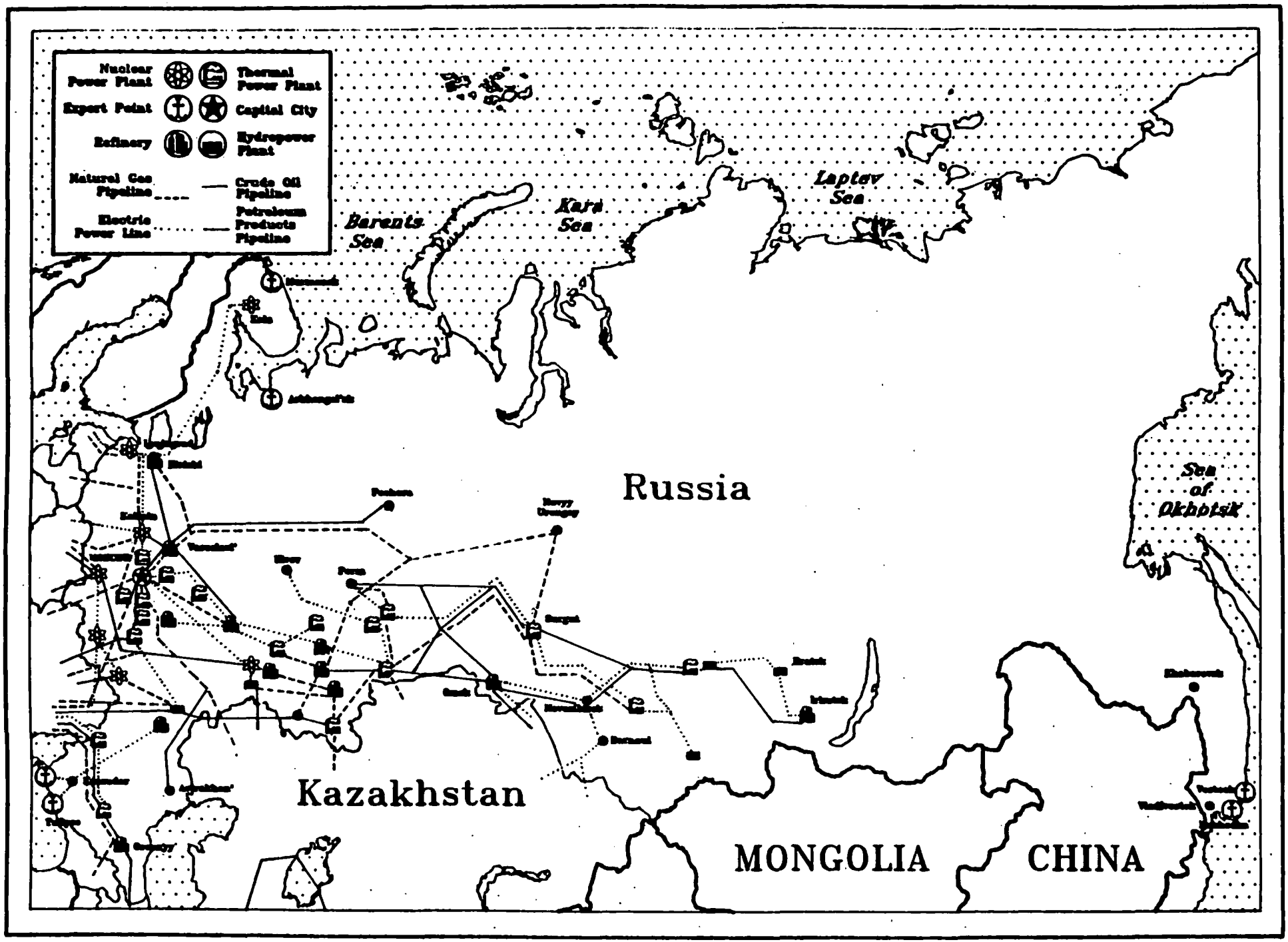
refineries, meaning that a much lower percent of distilled crude can be turned into light products.

Most Russian refineries rely on western Siberian crude delivered by pipeline, although the Groznyy refinery, one of the larger and more advanced refineries, supplies the Ukraine by pipeline. Most refined products are transported by train, although several refineries in the Volga-Urals region are connected to a pipeline that carries product to the central continent.

HISTORY AND RECENT EVENTS

The Russian Republic was formed on November 7, 1917 and joined the USSR on December 30, 1922. With 76% of the area, 51% of the population, a majority of Soviet energy and industrial production, and enormous military power, Russia is by far the most important Soviet republic. In the aftermath of the recent coup attempt, Boris Yeltsin, as president of Russia, appears for now to be the dominant political figure in the USSR, having assumed much of the power that was the Kremlin's.

It is obvious, however, that a new system of economic, political, and military relationships between Russia and the smaller republics will need to be hammered out in coming months. Whether this will take the form of a commonwealth of independent states, a modified Union, or some other form remains to be seen. It also remains to be seen whether this transformation can be accomplished without a deterioration into ethnic conflict as in Yugoslavia. Already, Russia has warned other Soviet republics, particularly Ukraine and Kazakhstan, that it would not allow them to secede from the union taking areas with heavy Russian populations with them.


Nuclear Power Plant
Thermal Power Plant
Export Point
Capital City
Refinery
Hydropower Plant
Natural Gas Pipeline
Crude Oil Pipeline
Electric Power Line
Petroleum Products Pipeline
Barents Sea
Kara Sea
Laptev Sea
Sea of Okhotsk
Russia
Kazakhstan
MONGOLIA
CHINA

Tadzhikistan

REPUBLIC PROFILE

President: Kakhar Makhamov
Population (1989): 5,112,000
Size/Location: 55,250 square miles. Part of the Central Asia region, with Kirgizia to the north and east, China to the east, Uzbekistan to the north and west, and Afghanistan to the south.
Ethnic Groups: Tadzhiks (59%), Uzbeks (23%), Russians (10%). Tadzhiks are Aryans and speak a Persian language. Tadzhikistan is a predominately Muslim republic.
Major Cities: Dushanbe(capital)

ECONOMIC PROFILE

Net Material Product (1989): 5.5 billion rubles (0.8% of Soviet Union). Per capita income of $2,340 is the lowest in the Soviet Union.
NMP Growth Rate (1989): 0%; volatile from year to year reflecting the performance of the agricultural base.

ENERGY PROFILE

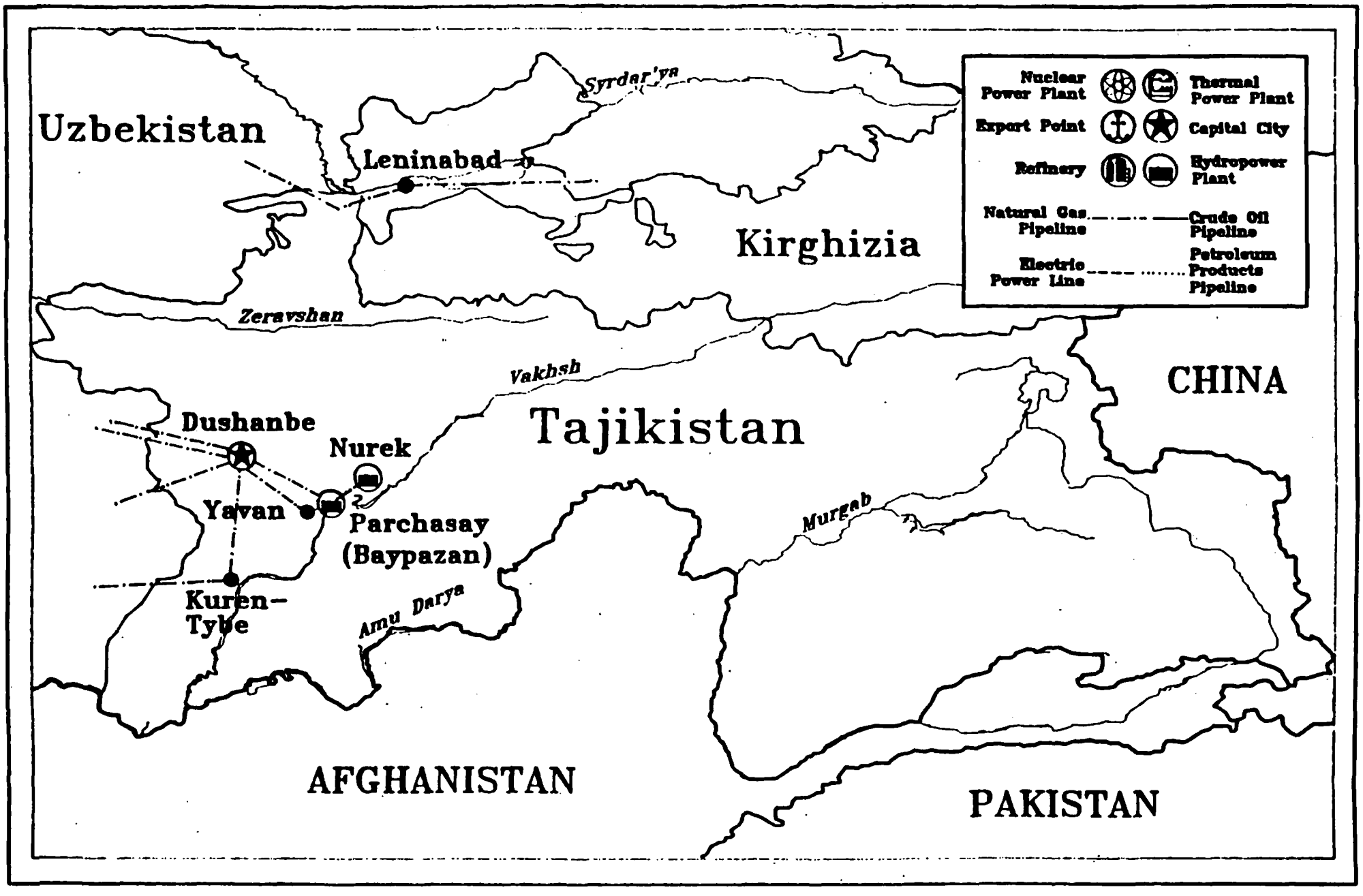
Supply:
Oil (1990E): 4,000 barrels per day (b/d)
Natural Gas (1989E): 7 billion cubic feet
Coal (1989E): 800,000 short tons
Consumption
Oil (1989E): 50,000 barrels per day
Natural Gas (1989E): 64 billion cubic feet
Coal (1989E): 1,100,000 short tons
Electricity (1989E): 15.4 terawatthours
Total (1989E): 0.37 quadrillion BTUs

ECONOMIC CONDITIONS

The republic is mainly agricultural, specializing in fruit, cattle, and sheep. Some cotton, grain, and rice is also grown. Hydroelectric power is plentiful, and dams are especially important in the dry climate of Central Asia for both irrigation and power. The 2,700 MW Nurek power station on the Varksh river is complete, and construction of the 3,600 MW Rogun station on the same river is underway. The presence of cheap hydropower has attracted an aluminum industry.

HISTORY AND RECENT EVENTS

The Tadzhik republic was formed as an autonomous republic on October 14, 1924, and became a Union republic on October 16, 1929. The republic declared its sovereignty on August 25, 1990, and its independence in early September 1991.


Uzbekistan
Syrdar'ya
Leninabad
Kirghizia
Zeravshan
Vakhsh
CHINA
Tajikistan
Dushanbe
Nurek
Yavan
Parchasay
(Baypazan)
Kuren-
Tybe
Amu Darya
Murgab
AFGHANISTAN
PAKISTAN
Nuclear Power Plant
Thermal Power Plant
Export Point
Capital City
Refinery
Hydropower Plant
Natural Gas Pipeline
Crude Oil Pipeline
Electric Power Line
Petroleum Products Pipeline

Turkmenistan

REPUBLIC PROFILE

President: Saparmurad Niyazov
Population (1990): 3,621,700 (1.3% of the USSR)
Size/Location: 188,455 square miles. Occupies the southwest part of Central Asia with the Caspian Sea on the west, Uzbekistan to the east, Kazakhstan to the north, Iran to the south, and Afghanistan to the southwest
Ethnic Groups: Turkmen (68%), Russian (13%), Uzbek (9%). The republic is predominately Muslim, with ethnic ties to Iran.
Major Cities: Ashkhabad (capital)

ECONOMIC PROFILE

Net Material Product (1989): 5.47 bil. rubles (0.7% of Soviet Union). Per capita GNP of $3,370 is fourth lowest in the Soviet Union
NMP Growth Rate (1989): 3.2%; volatile from year to year reflecting the performance of the agricultural base.

ENERGY PROFILE

SUPPLY

Oil (1990E): 100,000 barrels per day (b/d)
Natural Gas (1989E): 3,101 billion cubic feet (11% of Soviet Union)
Oil Refining Capacity (1991E): 240,000 b/d

CONSUMPTION

Oil (1989E): 100,000 barrel per day
Natural Gas (1989E) 376 billion cubic feet
Coal (1989E): 0.8 million short tons
Electricity (1989E): 7 terawatthours
Total (1989E): 0.55 quadrillion BTUs

OIL INDUSTRY

The republic is considering establishing an independent energy company (Turkmenneftegazprom) to end the Russian dominance of the republic's gas industry. There are currently no joint ventures with foreign companies operating in the republic. However, the republic has taken the step of offering western companies the opportunity to bid on tracts in the South Caspian and Amu-Dar'ya basins.

Oil and Natural Gas Production

Oil output has been stable, with most of the production coming from the Chelken district that includes the Kotur-Tepe supergiant field (discovered 1956) and the Nebit-Dag giant field (discovered 1934). There is a small amount of offshore production in the Caspian Sea. Most of the republic's hydrocarbon production is from the Kopet Dag Trough that extends along the mountains that form the border between Iran and the Soviet Union. The Trough contains mostly gas, helping make Turkmenistan the second largest gas producing republic in the Soviet Union, after Russia. The Amu-Dar'ya district contains two supergiant fields and 9 giant fields. Coal production is negligible.

Refineries

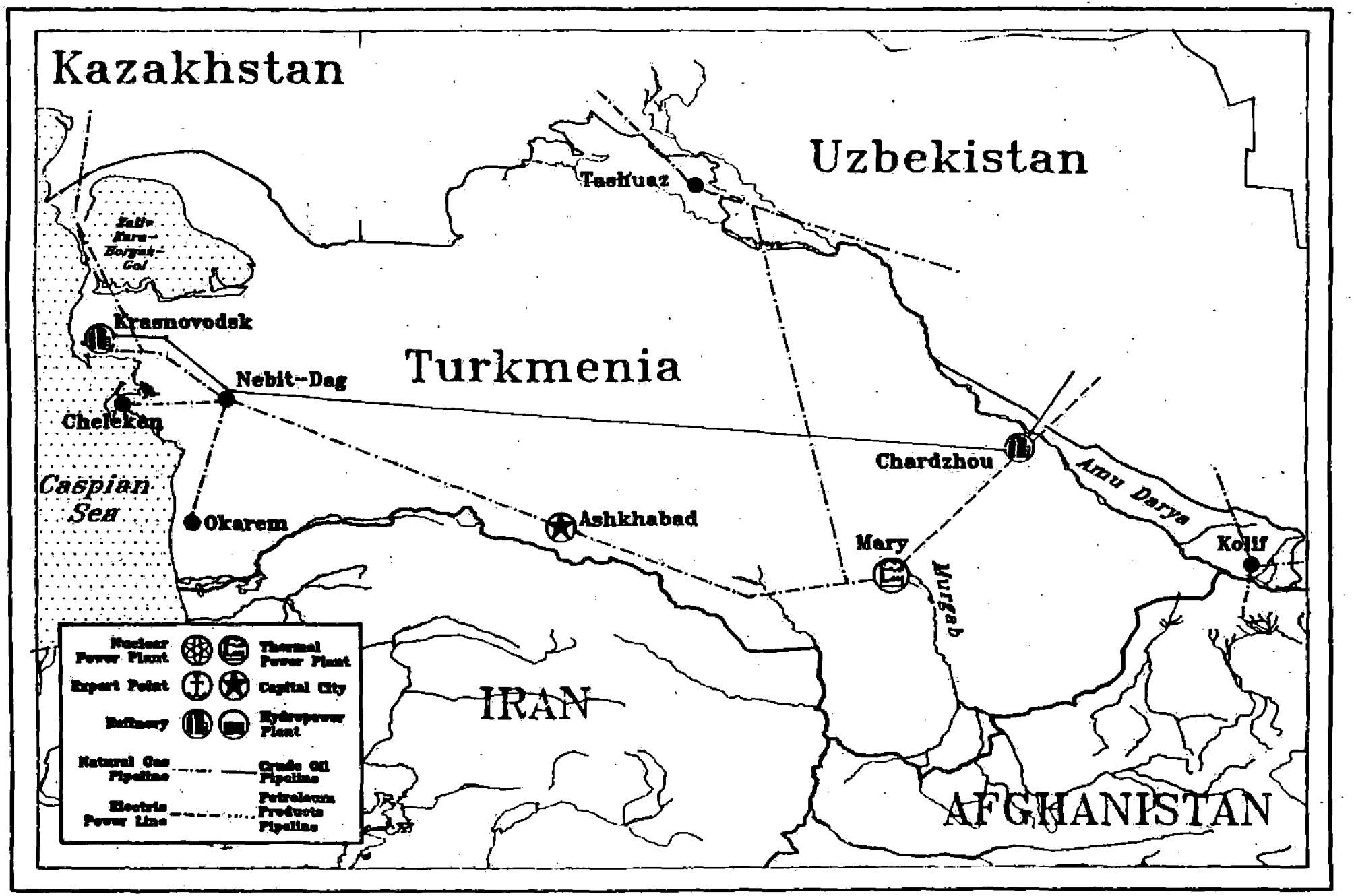
Turkmenistan had one refinery currently operating. This refinery, located in Krasnovodsk, has the capacity to process 240 thousand barrels per day of crude oil, but typically refines little more than half that amount. The cracking facilities at the Krasnovodsk refinery allow for greater production of light petroleum products. The refinery relies on local production. Recent shortages in crude oil shipments to the refinery have resulted in product shortages in Turkmenistan and other republics surrounding the Caspian Sea. Neftezavodsk is the site of another Turkmenistan refinery, but has yet to open after 15 years of construction. This refinery is to be supplied by pipeline from Western Siberia.

ECONOMIC CONDITIONS

Turkmenistan is mainly agricultural, producing cotton, dates, olives, figs, and sesame. The republic is known for carpets, horses, and sheep, although chemicals and minerals are also produced.

HISTORY AND RECENT EVENTS

The Turkmenistan Republic was formed on October 27, 1924, and declared its sovereignty on August 22 ,1990. As of the end of August 1991, however, it had not yet declared its independence.


Kazakhstan
Uzbekistan
Tashkuz
Zaliv Kara-Bogaz-Gol
Krasnovodsk
Turkmenia
Nebit-Dag
Cheleken
Caspian Sea
Okarem
Ashkhabad
Chardzhou
Amu Darya
Mary
Kelif
Murgab
IRAN
AFGHANISTAN
Nuclear Power Plant
Thermal Power Plant
Export Point
Capital City
Refinery
Hydropower Plant
Natural Gas Pipeline
Crude Oil Pipeline
Electric Power Line
Petroleum Products Pipeline

Ukraine

REPUBLIC PROFILE

President: Leonid Kravchuk
Population (1989): 52 million (18% of the USSR - the second largest Soviet Republic)
Size/Location: 164,000 sqare miles. Bordered by Poland, Czechoslovakia, Hungary, and Romania to the West, Russia to the East, Belorussia to the North, and the Black Sea to the South.
Ethnic Groups: Ukrainian(70%); Russian(20%) Belorussian, Moldavian and Polish (10%)
Major Cities: Kiev (capital)

ECONOMIC PROFILE

Net Material Product (1989):
109 billion rubles (17% of USSR total)
Exports to Other Republics (% of Republic NMP): 39%
Foreign Exports (% of Republic NMP): 7%
Foreign Imports (% of Republic NMP): 14%
Sectoral Share in USSR Output:
Agriculture (23% of total); Industry (18% of total); Foreign Exports (14% of total); Foreign Imports (15% of total).

ENERGY PROFILE

CONSUMPTION:
Oil (1989E): 1.2 million barrels per day (MMBD)
Gas (1989E): 4,086 billion cubic feet (BCF)
Coal (1989E): 198 million short tons (MST)
Electricity (1989E): 245 terawatthours (Twh)
Total (1989E): 11.38 Quadrillion BTU (Quads)
SUPPLY:
Oil Production (1990): 0.1 MMBD (1% of USSR)
Gas Production (1990): 1 TCF (4% of USSR)
Coal Production (1990): 182 MST (24% of USSR)
Electric Power Production (1990): 305 TWH (18% of USSR)

Overview

The Ukraine plays a significant role in the Soviet energy picture. First, the Ukraine possesses the Donets Basin, which is the USSR's largest coal producing area. Second, the republic is the Soviet Union's major source of iron and steel, based on Donets coal and iron ore from Krivoy Rog. Third, the Ukraine is a major center for heavy machinery and industrial equipment, producing around one third of the Soviet Union's steel pipes, and nearly 17% of its oil production machinery. Finally, although the Ukraine is a net energy importer, the republic serves an important function as the major export route for energy exports (mainly from Russia) to Eastern and Western Europe. For instance, although the Ukraine produces only about 17% of Soviet electricity, it accounts for nearly 70% of Soviet electric power exports.

The Ukraine also contains a heavy concentration of nuclear power plants, with 15 of the Soviet Union's 43 nuclear generating units situated in the republic. Overall, nuclear power makes up about 20% of the Ukraine's electric generating capacity.

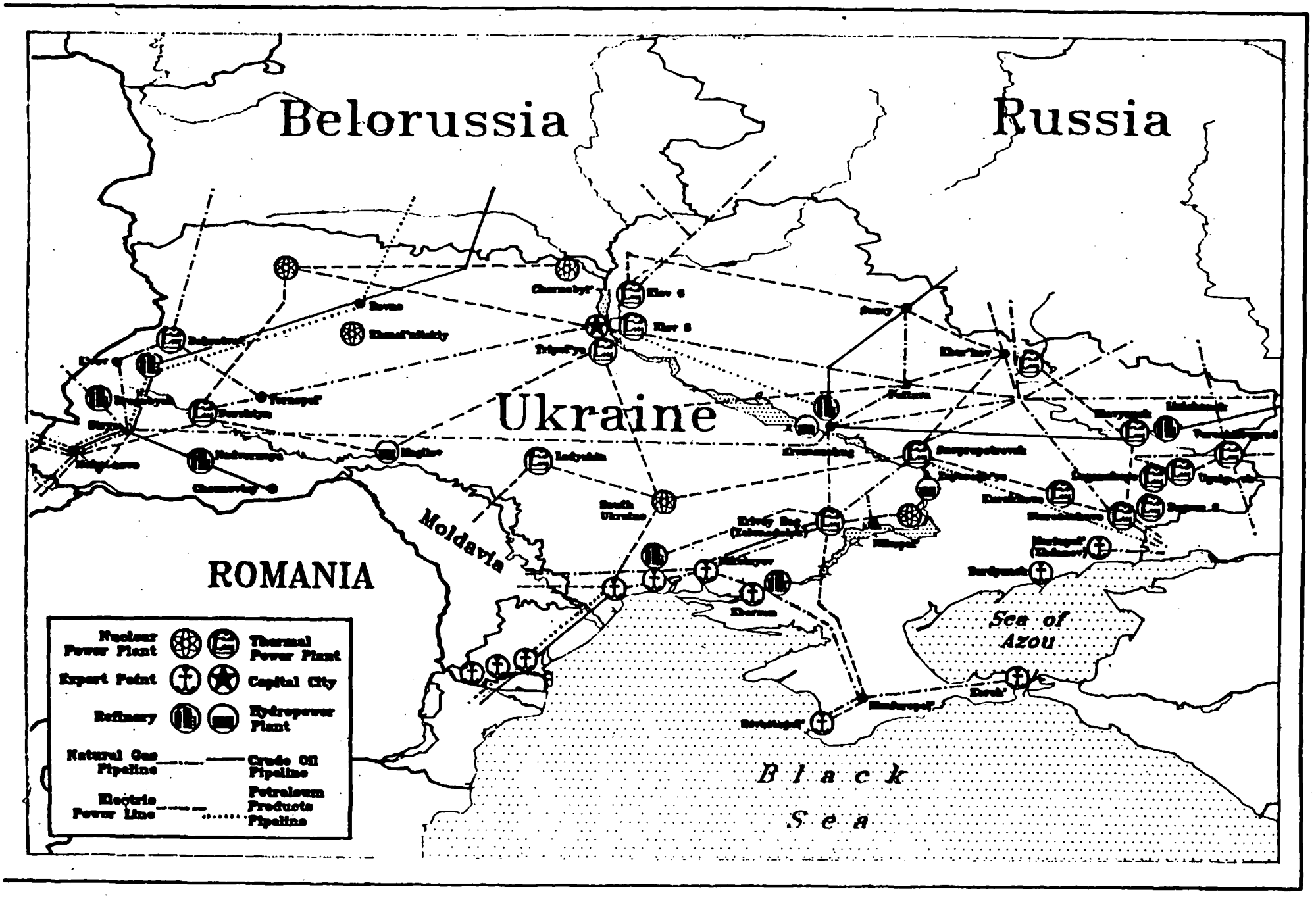
Refineries

The Ukraine has 1.1 million barrels per day crude oil refining capacity, or 10% of total Soviet refining capacity. Although Ukrainian refineries are relatively modern compared to Russia's, they are still technically unsophisticated, containing far less capacity than comparable U.S. refineries for production of light products. Most Ukrainian refineries receive crude oil by pipeline from western Siberian oil fields in the Russian republic. Much of Ukrainian refined petroleum products are sent by train to other areas of the Ukraine. In addition, the Ukraine receives refined petroleum products from referineries in Azerbaijan, Belorussia and Russia.

HISTORY AND RECENT EVENTS

The Ukrainian Republic was formed on December 25, 1917 and was incorporated into the USSR on December 30, 1922. The Ukraine is critical to the USSR, serving both as the "breadbasket of the USSR" and as an industrial powerhouse in its own right, and ranking second in importance only to Russia.

Along with Russia and Belorussia, the Ukraine comprises one of three Slavic republics which can be considered as forming the core of the Soviet Union. The Ukrainian parliament declared independence from the Soviet Union in the immediate aftermath of the August 1991 coup attempt; a referendum on the issue is scheduled for December 1, 1991. On August 29, the Ukraine agreed with Russia to form a temporary economic and military alliance. Despite this agreement, however, disagreement exists between the two sides on many issues, particularly borders and the ultimate status of nuclear forces on Ukrainian territory.


Belorussia
Russia
Ukraine
ROMANIA
Moldavia
Sea of Azou
Black Sea
Nuclear Power Plant
Thermal Power Plant
Export Point
Capital City
Refinery
Hydropower Plant
Natural Gas Pipeline
Crude Oil Pipeline
Electric Power Line
Petroleum Products Pipeline

Uzbekistan

REPUBLIC PROFILE

President: Islam Karimov
Population (1989): 19,906,000 (6.9% of USSR)
Size/Location: 172,740 square miles (2.0% of Soviet Union), occupies the southern part of the Soviet Union, in Central Asia with Kirgizia on the east, Kazakhstan to the north, Turkmenia to the southwest, and Afghanistan and Tadzhikistan to the south
Ethnic Groups: Uzbeks (69%), Russians (11%), and Tatars, Kazakhs and Tadzhiks (each about 4%). Uzbek Muslims are the third largest Soviet nationality, and there is a strong nationalist movement.
Major Cities: Tashkent (capital), Nukus

ECONOMIC PROFILE

Net Material Product (1989): 11.95 billion rubles (3.3% of Soviet Union). Per capita income of $2,750 is the second lowest in the USSR.
NMP Growth Rate (1989): 3.4%; volatile from year to year reflecting the performance of the agricultural base.

ENERGY PROFILE

SUPPLY:
Oil (1990E): 50,000 barrels per day (b/d)
Natural Gas (1989E): 1,441 billion cubic feet
Coal Production (1990E): 7 million short tons
Oil Refining Capacity (1991E): 180,000 b/d
CONSUMPTION:
Oil (1989E) 227,000 b/d
Coal (1989E): 6.7 million short tons
Natural Gas (1989E) 1,483 billion cubic feet
Electricity (1989E): 46 terawatthours
Total (1989E): 2.04 quadrillion BTUs

OIL INDUSTRY

Uzbekistan currently has 18 joint ventures with foreign companies operating in the republic.

Fossil Fuel Production

Oil output has been rising steadily since 1980, receiving a boost in 1990 from the addition of a new oil producing area in the Karshi Steppe region. The Amu-Dar'ya district in western Uzbekistan and eastern Turkmenistan is a major gas bearing area. Production of Angren coal was above plan in 1990 despite problems stemming from poor planning and implementation in expanding open-pit mines of Angren lignite. The availability of fossil fuels has resulted in the development of thermal power stations. The Novo-Angren power plant increased its capacity in January 1991 to 1800 MW, and the Takhiatash power plant added units in 1990 to raise capacity to 730 MW.

Refineries

The two refineries in Uzbekistan are supplied by rail shipments of crude oil from Western Siberia. The refinery in Fergana operates close to its peak capacity of 140 thousand barrels per day, while the Alty-Arky refinery operates at about half its 40 thousand barrel per day capacity. Neither of the two refineries has much capability to upgrade residual oil into the lighter petroleum products used in the transportation sector.
Uzbekistan supplies product for local consumption. Recent shortages in crude oil shipments to the Uzbekistan refineries have resulted in product shortages.

ECONOMIC CONDITIONS

With water from the Aral Sea and a conducive climate, Uzbekistan has become the world's third largest producer of cotton, as well as a producer of rice, silk, and hemp. Industries include iron, steel, tractors, textiles, and television and radio sets. Despite its assets, Uzbekistan is generally poor, with high unemployment, social and ethnic unrest, and enviromental problems.

HISTORY AND RECENT EVENTS

The Uzbek republic was formed on October 27, 1924, and declared its sovereignty on June 20, 1990. Uzbekistan declared its independence on September 7, 1991.


Kazakhstan
Aral Sea
Kungrad
Urgench
Uzbekistan
Turkmenia
Bukhara
Navoi
Mirdesh
Muborek
Samarkand
Dzhizak
Bekabad
Tashkent
Charyak
Angren
Namangan
Andizhan
Fergana
Tajikistan
Sherabad
IRAN
AFGHANISTAN
Nuclear Power Plant
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REVISED UPDATE - GEOTHERMAL POWER PLANTS IN OPERATION WORLDWIDE

COUNTRY	YEAR FIRST UNIT	YEAR LATEST UNIT	NUMBER OF UNITS	TOTAL INSTALLED MWe	PLANNED CAPACITY MWe
U.S.A.	1960	1988	96	2409	1222
PHILIPPINES	1977	1983	23	894	1967.5
MEXICO	1973	1987	16	655	370
ITALY	1913	1986	42	504.2	555
JAPAN	1966	1984	9	237.1	160
NEW ZEALAND	1958	1963	10	167.2	116
INDONESIA	1979	1987	5	142	275
EL SALVADOR	1975	1980	3	95	350
KENYA	1981	1985	3	45	50
ICELAND	1969	1980	5	39	-
NICARAGUA	1982	1982	1	35	35
TURKEY	1974	1984	1	20.6	12
CHINA	1970	1986	15	15	50
SOVIET UNION (Pauzhetka)	1967	1967	1	11	80
FRANCE (Guadeloupe)	1983	1983	1	4.2	-
PORTUGAL (Azores)	1979	1979	1	3	10
GREECE (Milos)	1985	1985	1	2	15
AUSTRALIA	1987	1988	2	<1	
ARGENTINA (Neuquen)	1988	1988	1	.6	10
TOTALS			236	5,279.9	5,278.5

COUNTRY	PLANNED CAPACITY MWe
BOLIVIA (Andes)	--
BRAZIL	--
CANADA (British Columbia)	--
CHILE	15
COSTA RICA	55
COLUMBIA	--
DOMINICA	--
FRANCE (Mount Dove)	--
GUATEMALA	55
HONDURAS	50
INDIA	1
IRAN	--
KENYA	--
PAKISTAN	--
PANAMA	--
PERU	--
ROMANIA (Oradea)	1
ST. LUCIA	25
SPAIN (Canary Islands)	--
THAILAND	--
TAIWAN	50
VENEZUELA	--
	252

TOTAL PLANNED: 5,530.5

TOTAL P + I: 10,810.4

Your comments, corrections and suggestions for updating and more accurately presenting this data on a continuous basis are earnestly requested.

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August 22, 1988

REVISED UPDATE - GEOTHERMAL POWER PLANTS IN OPERATION WORLDWIDE

COUNTRY	YEAR FIRST UNIT	YEAR LATEST UNIT	NUMBER OF UNITS	TOTAL INSTALLED MWe	PLANNED CAPACITY MWe
U.S.A.	1960	1988	96	2409	1222
PHILIPPINES	1977	1983	23	894	1967.5
MEXICO	1973	1987	16	655	370
ITALY	1913	1986	42	504.2	555
JAPAN	1966	1984	9	237.1	160
NEW ZEALAND	1958	1963	10	167.2	116
INDONESIA	1979	1987	5	142	275
EL SALVADOR	1975	1980	3	95	350
KENYA	1981	1985	3	45	50
ICELAND	1969	1980	5	39	-
NICARAGUA	1982	1982	1	35	35
TURKEY	1974	1984	1	20.6	12
CHINA	1970	1986	15	15	50
SOVIET UNION (Pauzhetka)	1967	1967	1	11	80
FRANCE (Guadeloupe)	1983	1983	1	4.2	-
PORTUGAL (Azores)	1979	1979	1	3	10
GREECE (Milos)	1985	1985	1	2	15
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TOTALS			236	5,279.9	5,278.5

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GEOTHERMAL R&D IN DEVELOPING COUNTRIES: AFRICA, ASIA AND THE AMERICAS

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Abstract—The first industrial (3.5 MW) geothermoelectric power-plant installed in the developing countries was that of Pathé, Mexico, in 1964. A further 75 MW geothermoelectric were added in 1973, again in Mexico, at Cerro Prieto. Other countries later followed the Mexican example, with the result that the geothermoelectric capacity installed in the developing nations increased rapidly from 462 MW in 1979 to 1495 MW in 1984. At the moment (1988) the total geothermoelectric capacity in the developing countries is 1949.7 MW, distributed as follows

Philippines	894 MW
Mexico	700 MW
Indonesia	142 MW
El Salvador	95 MW
Kenya	45 MW
Nicaragua	35 MW
Turkey	20.6 MW
China	17.3 MW
Argentina	0.6 MW
Zambia	0.2 MW

For the moment there are very few non-electric applications of geothermal heat in the developing countries. The most interesting examples in Africa are found in the circum-Mediterranean countries (Algeria, Tunisia) and in Asia in China and Turkey. There are no known plants for the direct use of geothermal heat in Latin-America.

The progress of geothermal R&D is very satisfactory in the Philippines, Mexico and Indonesia, fairly satisfactory in Kenya, Ethiopia and some Central-American countries such as El Salvador and Nicaragua, but still at very early stages in most of the other countries. Several nations with favourable geological conditions for the development of geothermal resources have just begun, or have still to begin, their reconnaissance work.

INTRODUCTION

The first example of a non-balneological utilization of geothermal fluids in the developing countries would appear to date back to the 1950s. During that period a 220 kW power-plant began operating at Kiabukwa (Katanga), fed by water at 91°C. This small plant supplied electricity to a mining industry for a number of years (Facca, 1970).

Large-scale exploitation of geothermal energy in the developing countries was not to begin until 1964, when a 3.5 MW geothermoelectric plant was put into operation at Pathé in Mexico (Facca, 1970). There were no further developments until 1973, when two 37.5 MW units were put on line, once again in Mexico but this time in the Cerro Prieto field, marking the beginning of a period of rapid growth (Muffler, 1975). In the five years between 1975 and 1979 the geothermoelectric capacity installed in the developing countries rose from 75 to 462 MW and, at the end of the next five years (1984) it had reached 1495 MW (Di Pippo, 1985), increasing during these two five-year periods at a rate of 500% and 223% respectively. At the moment the installed capacity is 1950 MW (about 40% of the world total geothermoelectric installed capacity), showing a further increase of 30%.

This is without doubt an impressive and significant rate of progress, but the situation is not as rosy as would appear from these figures. Of the 1950 MW installed in the developing countries, 82% is in two countries only: Philippines and Mexico. Indonesia and El Salvador account for a further 12%. Only 6% is installed in the other developing countries. Not all countries have, of course, been so well endowed by nature and some are in a far more favourable situation than others. However, the fact remains that the distribution of the installed electric capacity indicates that geothermal projects are at very different stages of development even within regions (such as the African rift valley) that have fairly similar geological features.

Apart from the geographic, geological and political situation of each country, the factors that contribute to accelerating or delaying the start-up and implementation of geothermal projects are as follows, in roughly chronological order rather than order of importance:

(a) information, which is essential for drawing up rational energy programmes;

(b) availability of local qualified scientific and technical personnel. This factor is of crucial importance for a country in order to implement its own reconnaissance programmes, to take an active and influential part in projects given international financing and foreign technical assistance, to continue these projects with its own labour force and to reduce or eliminate altogether the time lapse between one project and the next;

(c) financial aid, from international organizations and/or industrialized countries. This is particularly important in certain phases of a project, such as deep drilling;

(d) good technical–scientific management of the projects. Competence in this sector has a decisive role in the successful development of the projects.

It would be interesting to know how great an influence these factors have in the different countries and how they interact with one another. Unfortunately we do not have enough information at the moment to provide reliable answers to these questions, but these data would be extremely useful for future programmes and to correct any errors that have already been made.

The countries in Africa that already produce geothermoelectric energy are

Kenya	45 MW installed
Zambia	0.2 MW.

The Zambian power-plant is small but of great significance, as an example of how medium–low temperature geothermal fluids can be exploited to produce electric energy in remote areas that would otherwise have little hope of being hooked on to the national electric grid.

Non-electric uses can be found in north Africa (Algeria, Tunisia) and a few other nations. The plants are generally small and often merely pilot schemes.

Ethiopia and the Republic of Djibouti are at an advanced stage of their geothermal exploratory programmes. In all other African countries that probably have geothermal potential (such as Tanzania and Mozambique), exploration is still in the early stages. In some areas worthy of investigation, such as Cameroon, which is an active volcanic zone, no inventory has yet been made of their geothermal manifestations. Need we say that the international and national organizations anxious to promote the development of the third world should be making an extra effort in the African continent, where the energy situation is so dramatic.

In the Asiatic area geothermoelectric power is being produced in

Philippines	894 MW installed
Indonesia	142 MW
Turkey	20.6 MW
China	17.3 MW

Non-electric uses of geothermal energy can be found in China, Turkey, India and, at an experimental level, in Thailand. There may also be other small plants for direct heat uses in other countries, for which we have no information.

Geothermal exploration is at a very advanced stage in the Philippines and Indonesia and quite far advanced in the other countries mentioned above. In the other parts of Asia with favourable geological conditions, an inventory is being made of the manifestations or reconnaissance is already under way.

Numerous countries in Asia should also receive encouragement in utilizing their geothermal resources, at least in direct heat uses. We could mention, for example, the northern provinces of Pakistan and Nepal, both of which have many high temperature thermal springs. In their difficult geographic and climatic conditions, any source of heat acquires considerable importance.

Geothermoelectric power-plants are already in operation in Latin America in

México	700 MW installed
El Salvador	95 MW
Nicaragua	35 MW
Argentina	0.6 MW

There are apparently no known examples of non-electric uses.

Exploration is at an advanced stage in the above producing countries and in others such as Guatemala and Costa Rica. In the other nations of Central America and those of the Andean belt, geothermal research is at various stages. The countries still in the preliminary stage seem to be those of the Caribbean area, with the exception of St. Lucia.

The situation in Latin-America can be considered fairly satisfactory, although much still remains to be done.

This overview of the status of geothermal R&D in developing countries is presented in the form of country profiles and is derived, with a few modifications, from Technical Report No. 1 of the UNITAR/UNDP Centre on Small Energy Resources (Dickson and Fanelli, 1988). The profile for each country consists of:

(a) some statistical geographic and economic data: surface area, population and gross national product (GNP) per capita (De Agostini, 1987), total installed electric capacity and total electric power production (UN 1986), as well as a very short general geothermal description;

(b) status of geothermal research and development and the main results achieved;

(c) list of the electric and non-electric geothermal plants installed so far;

(d) main sources of information.

The data given in these profiles are not always uniform, as they depend on the quantity and quality of the data that were available. They are, however, based on the latest information from these countries, integrated, in some cases, with new, unpublished data given in the form of personal communications. With a few exceptions, each profile is accompanied by one or more maps taken from the papers cited in the sources of information. These maps do not always contain all the geographic references mentioned in the text, as these were obtained from several sources. Hopefully these maps will nevertheless prove useful.

Finally, the various country profiles for each continent are followed by a paragraph on "Other countries". These countries are of known or probable geothermal interest, but the data available are either inadequate or so out-of-date that a separate profile was considered unjustified.

Main sources of information

De Agostini (1987) *Calendario Atlante 1988*. Istituto Geografico De Agostini, Novara, p. 784.

Dickson, M. H. and Fanelli, M. (1988) Geothermal country profiles: Africa, Asia and Latin-America. *UNITAR/UNDP Centre on Small Energy Resources Technical Report* No. 1, p. 95.

Di Pippo, R. (1985) Geothermal electric power, the status of the world—1985. *1985 GRC Int. Symp. on Geothermal Energy, Int. Vol.*, pp. 3–18.

Facca, G. (1970) The status of world geothermal development. *Proc. U.N. Symp. on Development and Utilization of Geothermal Resources, Pisa. Geothermics, special issue 2*, 1, 8–23.

Muffler, L. J. P. (1975) Present status of resources development. *Proc. 2nd U.N. Symp. on Development and Use of Geothermal Resources, San Francisco*, Vol. 1, xxxiii–xliv.
UN (1986) *1984 Energy Statistics Yearbook*. United Nations, New York, LIV + p. 442.

AFRICA

Algeria

Background information

Surface area: 2,381,741 km^2
Population: 20,943,000 (1984)
Gross National Product per capita: 2380 U.S.$ (1984)
Total electric capacity installed: 3436 MW (1984)
Total electricity generated: 11,450,000,000 kWh yr^{-1} (1984)

Algeria (Fig. 1) has numerous thermal springs in the north-western and especially the north-eastern regions. Temperature is above 45°C in 33% of these springs, reaching 98°C at Hammam Meskoutine. Huge reserves of hot waters (50–56°C) are present in the sedimentary basin of the low Sahara.

Geothermal R&D

The surface thermal manifestations have been inventoried and a study made of their main characteristics. The most interesting geothermal areas are in the north-east (Hammam Meskoutine) and north-west (Hammam Righa). According to the National Programme, the hot geothermal waters will be utilized for residential and greenhouse heating.

An experimental geothermal greenhouse, using water at 68°C, is already in operation at Hammam Meskoutine. There are plans to develop other geothermal greenhouses further south at Touggourt and Ghardaia. A residential heating system, fed by 69°C geothermal water, is also planned for Hammam Righa.

Installed geothermal plants

Non-electric

Hammam Meskoutine	Greenhouse

Main sources of information

Bouhdjar, A. (1986) Geothermal resources in Algeria: present status and future prospects. *U.N. Workshop on Development and Exploitation of Geothermal Energy in Developing Countries, Reykjavik*, DTCD/NRED/CTP/8, p. 7.
Fekraoui, A. (1988) Geothermal resources in Algeria and their possible use. *Proc. UNITAR/UNDP Workshop on Small Geothermal Resources, Pisa, 1987. Geothermics* 17, 515–519.

Tunisia

Background information

Surface area: 163,610 km^2
Population: 6,966,173 (1984)
G.N.P. per capita: 1250 U.S.$ (1984)
Total electric capacity installed: 985 MW (1984)
Total electricity generated: 3,590,000,000 kWh yr^{-1} (1984)

There are numerous thermal springs in the southern and central parts of this country (Fig. 2), with temperatures that rarely exceed 60°C. Sedimentary basins containing hot aquifers exist in the southern sectors.

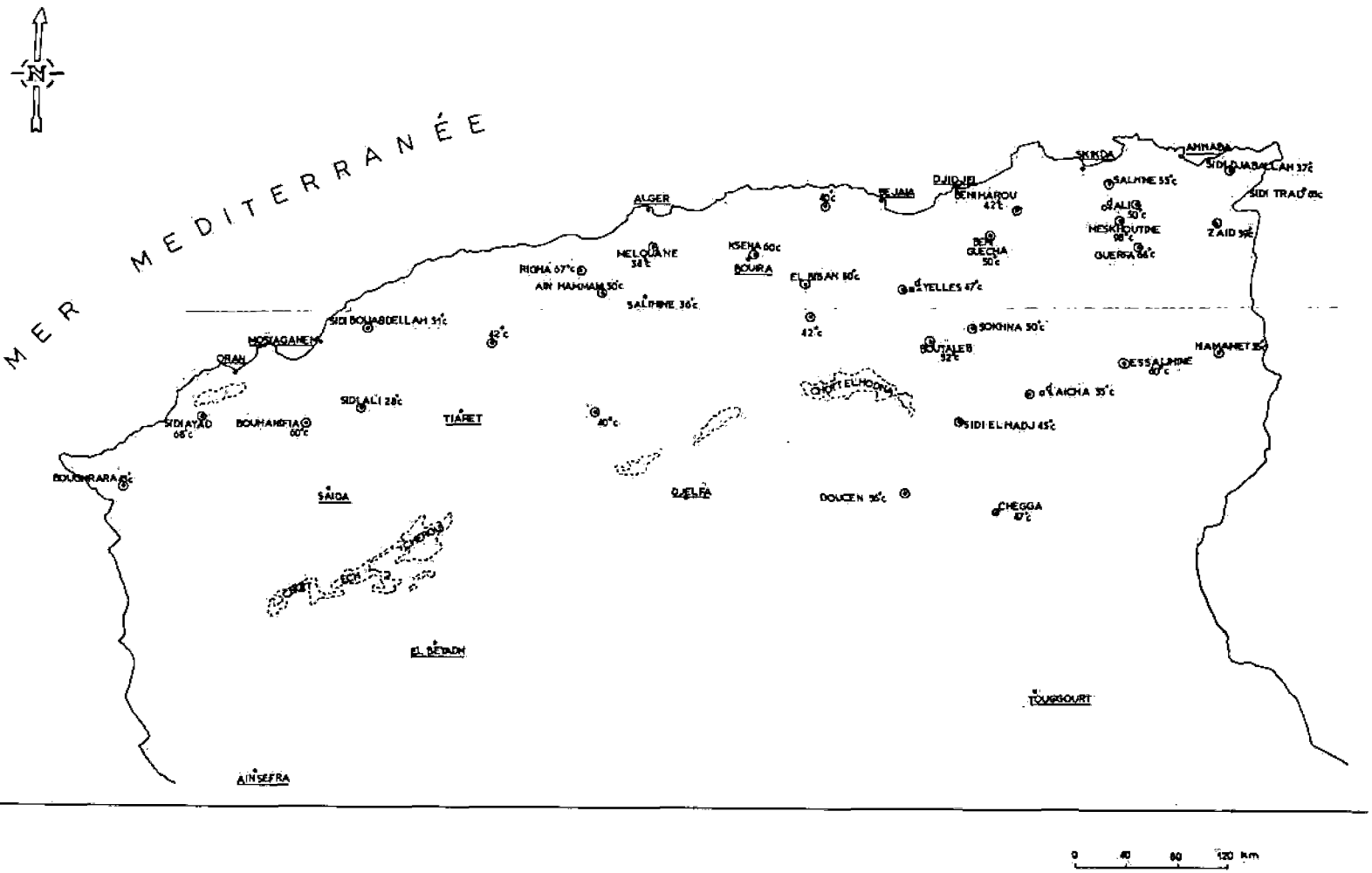

Fig. 1. Main thermal springs in northern Algeria (from Fekraoui, 1988).

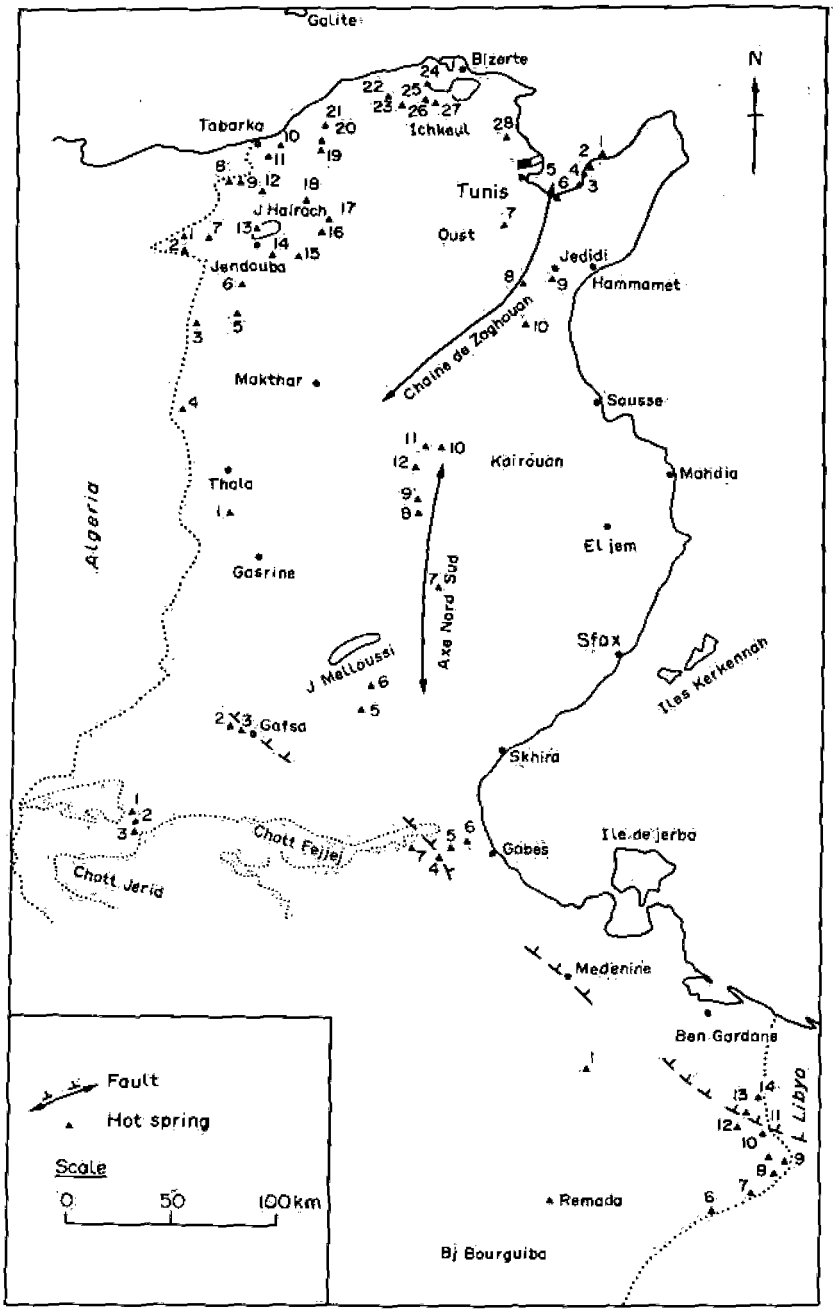

Fig. 2. Main hot springs in Tunisia (from Ben Dhia, 1987, simplified).

Geothermal R&D

The thermal springs have been inventoried (maximum recorded temperature of 73°C) and a detailed study made of several of them. Work has begun on a regional geological survey directed at identifying and investigating deep hot reservoirs, although their temperatures do not seem to be much above 100°C. Several wells have been drilled to exploit these aquifers. The water, ranging from 35–70°C, is generally left to cool and then used for irrigation. Geothermal applications in agriculture include greenhouse heating, which now covers a total of 14,500 m^2. Exploitable geothermal resources of Tunisia are at present estimated at 755 MWt.

Installed geothermal plants

Non-electric

Zerkine	Greenhouse (1000 m^2, 58 kWt)
Chat el Ferig	Greenhouse (1500 m^2, 44 kWt)
Chenchou IRA	Greenhouse (3000 m^2, 70–190 kWt)
Oued Bourzig	Greenhouse (1500 m^2, 120–140 kWt)
Smida	Greenhouse (1500 m^2, 44 kWt)
Tozeur	Greenhouse (4000 m^2, 325–420 kWt)
Gafsa	Greenhouse (2000 m^2, 46 kWt)

Main sources of information

Ben Dhia, H. (1983) Les provinces géothermiques en Tunisie. Thèse de doctorat.
Ben Dhia, H. (1987) Geothermal energy in Tunisia: potential of the southern province. *Geothermics* **16**, 299–318.
Popovski, K. (Ed.) (1988) Geothermal energy resources and their use in European agriculture. *FAO, CNRE Study No. 2*, p. 117.

Ethiopia

Background information

Surface area: 1,223,600 km^2
Population: 42,019,418 (1984)
G.N.P. per capita: 110 U.S.$ (1984)
Total electric capacity installed: 335 MW (1984)
Total electricity generated: 760,000,000 kWh yr^{-1} (1984)

Ethiopia (Figs 3 and 4) is crossed in a roughly NE–SW direction by the East African Rift System, which is one of the most favourable geothermal areas because of its volcano–tectonic features. The whole area is rich in thermal springs with temperatures that in some cases reach boiling point. Commercially exploitable geothermal fields have been identified in the Ethiopian Rift Valley and in the Afar Depression.

Geothermal R&D

Systematic geothermal surveys launched in 1969 have indicated that the most favourable areas for more detailed studies are Dallol in the Danakil Depression, Tendaho in the Northern Afar Depression and the Lakes District in the main Ethiopian Rift.

Surface exploration has been completed in the Tendaho area and deep exploratory wells are programmed for 1988. According to studies conducted in the early 1980s, a 20 MW power-plant would be the most appropriate in the Tendaho field at the beginning. According to the power demand it could be increased to 100 MW.

In the Aluto–North Langano volcanic complex (Lakes District), eight deep exploratory wells

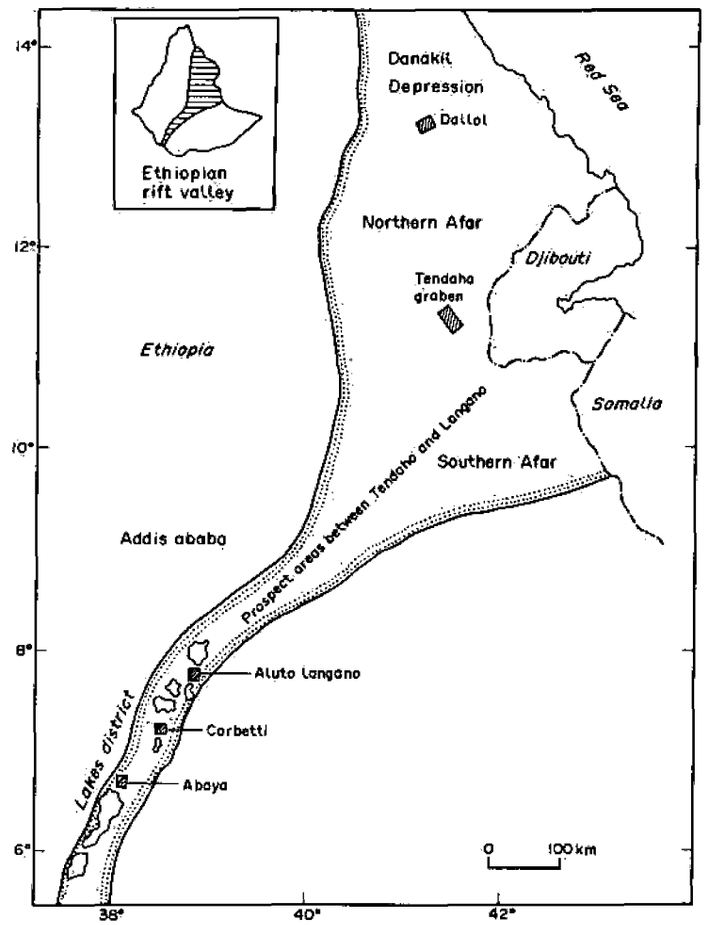

Fig. 3. Location of known geothermal prospects in Ethiopia (from Endeshaw, 1988).

were drilled between 1981 and 1985. Reservoir simulation of field performance indicates that the field is capable of feeding a 30 MW geothermoelectric power-plant for 30 yr. A 3.5 MW back-pressure plant is expected to be installed in the short-term and a 5 MW plant by the end of 1997.

Geological, geochemical and geophysical studies, begun in 1969, suggest that the Corbetti Caldera area, located on the Rift Valley floor about 250 km south of Addis Ababa, is very interesting from the geothermal viewpoint. A few shallow wells were drilled recently (to a maximum depth of 178 m) to measure the geothermal gradient; the results seem to corroborate previous indications.

Several other interesting areas have been identified in the southern Afar between Tendaho in the north and Aluto–Langano in the south. A technical–socio-economic study has shown that the geothermal fluids could be conveniently utilized in this area in the agro-zootechnic and food industries: for instance, at Gedemsa (meat and milk processing, distillation, sugar cane

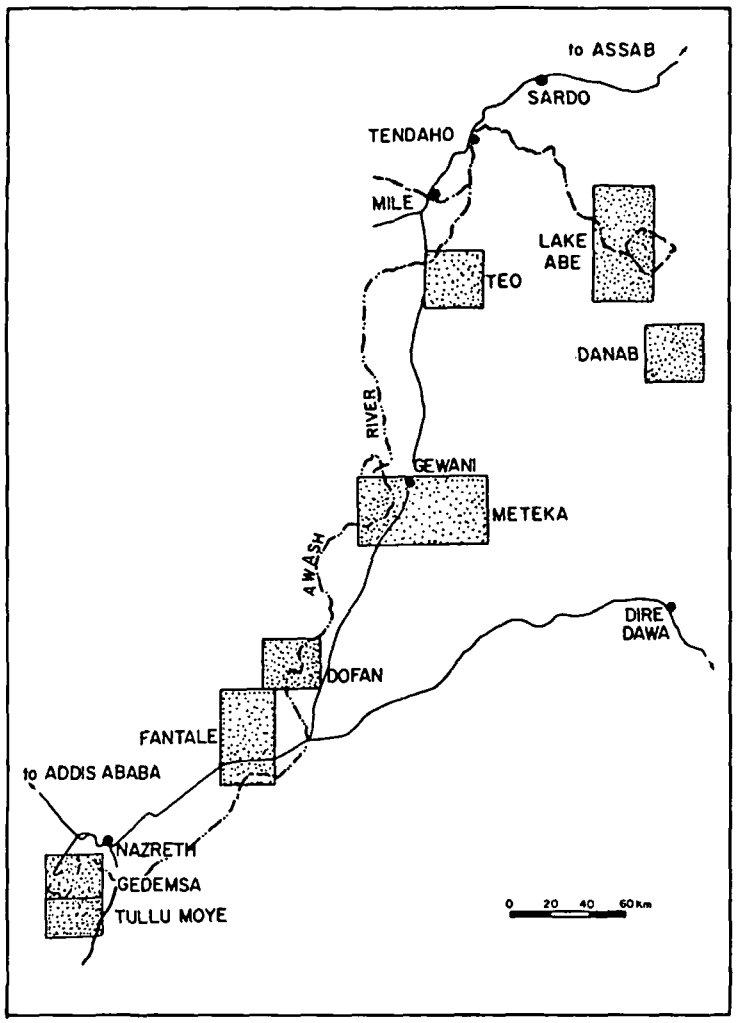

Fig. 4. Location of prospect areas between Tendaho and Langano, Ethiopia (from Endeshaw, 1988).

processing, pulp and paper processing), Fantale (fruit and vegetable peeling, sugar processing, distillery), Dofan (cotton ginning, fruit canning and preserves, vegetable oil production, meat processing, crop drying) and Meteka (various agro-industrial processes). Geothermal areas have also been identified in the Tullu Moye, Danab, Teo and Lake Abe areas, but for geographic reasons they are considered of minor interest at the moment.

Main sources of information

Belaineh, M. (1986) Geothermal energy in Ethiopia. *U.N. Workshop on Development and Exploitation of Geothermal Energy in Developing Countries, Reykjavik*, DTCD/NRED/CTP/1, p. 13.

ELC-Electroconsult (1988) Personal communication.

Endeshaw, A. (1988) Current status (1987) of geothermal exploration in Ethiopia. *Proc. UNITAR/UNDP Workshop on Small Geothermal Resources, Pisa, 1987, Geothermics* 17, 477–488.

Republic of Djibouti

Background information
Surface area: 23,200 km^2
Population: 405,000 (1984)
Total electric capacity installed: 38 MW (1984)
Total electricity generated: 148,000,000 kWh yr^{-1} (1984)

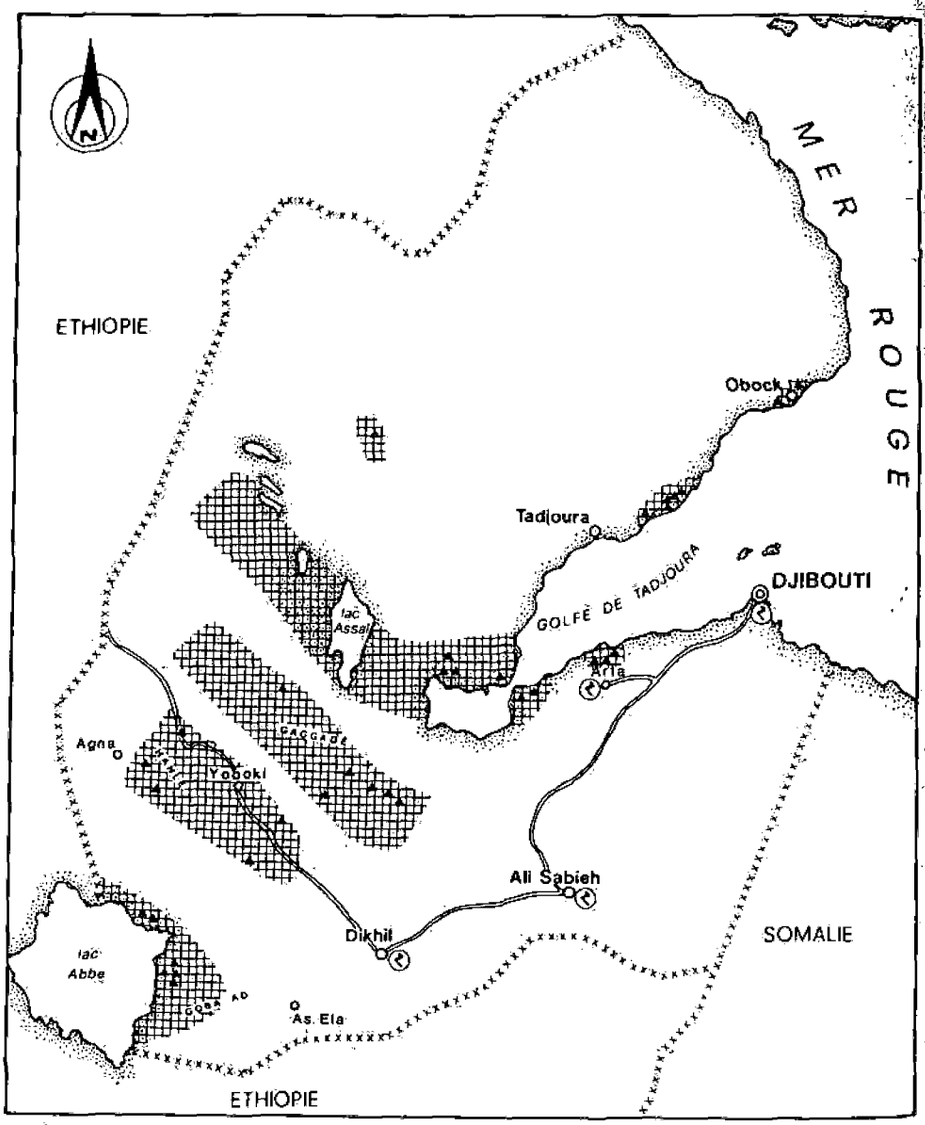

Fig. 5. Main areas of geothermal interest in the Republic of Djibouti (from Abdallah *et al.*, 1985).

The territory belonging to the Republic of Djibouti (Fig. 5) lies in the rift zone, between the East African plate and the Saudi Arabian plate. It extends from the Danakil Depression in Ethiopia through the Lake Assal area towards Tadjoura Bay. The zone is affected by active volcanism and there are many geothermal manifestations in most parts of the country.

Geothermal R&D

Exploration, begun in the 1970s, has led to the identification of several areas of geothermal interest: Lake Abbé area, on the border between Djibouti and Ethiopia; Hanlé plain, near the town of Yoboki; Gaggade plain, about 20 km NE of Hanlé on the other side of the Baba Alou mountains; Assal area, between Lake Assal and Tadjoura Bay, on the active rift zone extending NW through the Alol depressions; Arta area, north of Mount Arta; Tadjoura area, on the northern shores of Tadjoura Bay; Obock area, near the town of Obock; Dorra area, in the mountains about 40 km north of Lake Assal.

The areas investigated in greatest detail are Hanlé and Lake Assal, where surface exploration was followed by exploratory drilling. In 1986–1987 two wells were drilled in Hanlé to depths of almost 2000 m, but only low temperature water was found. As this water has a low salinity it is being considered for irrigation. In the Lake Assal area, five wells have been drilled so far, four of which have encountered very high temperatures (maximum 350°C), but low or inexistent permeability. Well Assal 3, drilled on the south flank of the Assal Rift, found a significant resource. The well was tested for a period of 90 days with the following results: (a) the bottom hole temperature and pressure of the 1316 m deep well registered at 81 bars and 262°C; (b) the flow conditions at the wellhead were 20 bars and 220°C at 315 t h^{-1} of 126,000 ppm brine and (c) the bottom hole pressure was reduced from 81 to 76 bars during the tests. Assal 6 is now being drilled near the latter. The geothermal fluids of the Republic of Djibouti could be utilized for crop and food processing, as well as to generate electricity.

Main sources of information

Abdallah, A., Gandino, A. and Sommaruga, (1985) Technical–economic studies of geothermal projects: the Djibouti case. *Geothermics* **14**, 327–334.
Aquater (1988) Personal communication.
Jonsson, I. (1985) Republic of Djibouti. Country report. *GRC Int. Symp. on Geothermal Energy, Int. Vol.*, pp. 175–178.

Kenya

Background information

Surface area: 580,367 km^2
Population: 19,536,000 (1984)
G.N.P. per capita: 300 U.S.$ (1984)
Total electric capacity installed: 544 MW (1984)
Total electricity generated: 2,253,000,000 kWh yr^{-1} (1984)

There are many geothermal resources in Kenya (Fig. 6), most of them in the rift zone, where high subsurface temperatures are due to young volcanic activity. Olkaria, Eburru, Menengai–Bogoria and Longonot–Suswa are the most promising thermal areas. Only a limited number of thermal centres can be found outside the rift. The Jombo Hills springs (79°C) in the Coastal Region are the most interesting of these.

Geothermal R&D

Investigation of Kenya's geothermal potential first began in the late 1950s, with the sinking of two deep wells at Olkaria that failed to produce fluids of commercial value. When deep drilling

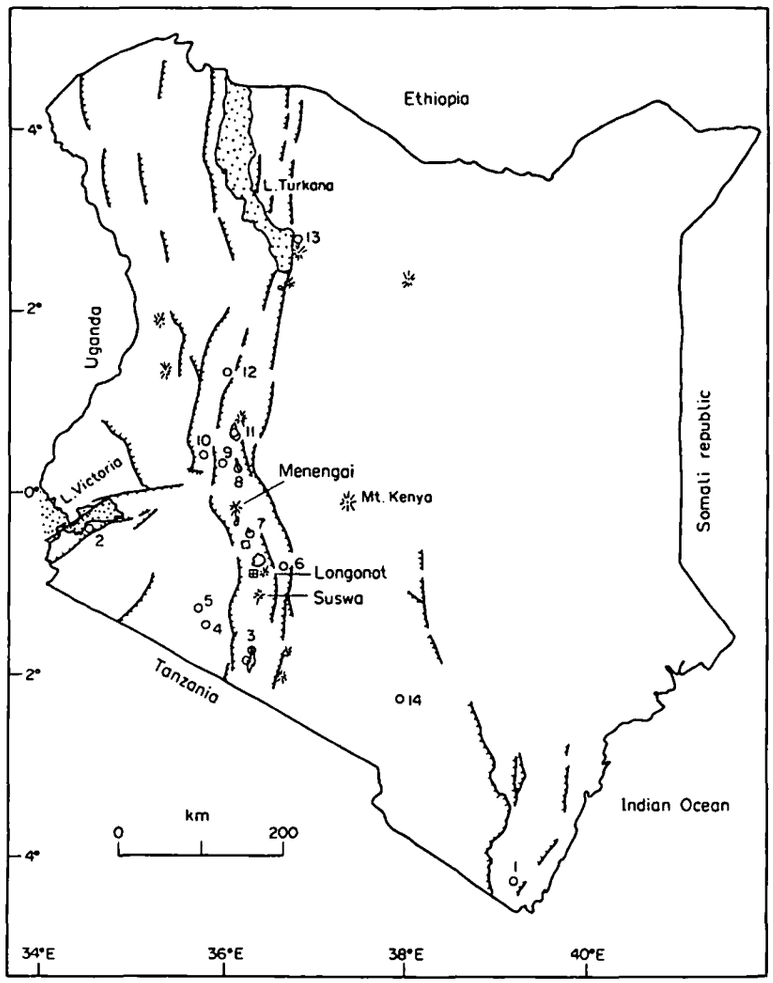

Fig. 6. Distribution of hot springs (circles) and geothermal fields (⊞ Olkaria; □ Eburru) of Kenya (from Kamondo, 1988).

stopped, exploration was continued with the drilling of shallow boreholes to measure the geothermal gradient. However, these studies were also abandoned in 1963. Towards the end of 1970 a major geothermal exploration programme covering an area of about 48,000 km^2 was launched. This programme, ending in 1976, covered the three main geothermal fields in the Kenya Rift Valley, viz. Olkaria, Eburru and Menengai–Bogoria. Olkaria has proved the most promising of the three and led to the commissioning of the first 15 MW geothermal power-plant in Africa, in 1981, followed by a second plant of the same capacity in 1983 and a third of 15 MW in mid-1985. The total of 45 MW installed at Olkaria produces about 11% of the electricity generated in Kenya. Since 1984 investigations have been extended north and west of the productive zone. If the results of these studies are as encouraging as they are expected to be, then a further 45 MW could be installed in the near future. The potential of the 100 km^2 Olkaria field has been estimated at 500 MW.

The overall potential of the Menengai–Bogoria geothermal area, which is in the final stages of

reconnaissance, and of Eburru, has been estimated at roughly 300 MW. A small plant of 1 MWt in the Eburru area now utilizes the steam produced to dry pyrethrum flowers.

A fourth area in the rift valley, Longonot–Suswa, is in the prefeasibility stage.

Apart from the above-mentioned high enthalpy areas, numerous mid or low enthalpy geothermal areas have also been identified as suitable prospects for the production of electricity by small binary cycle plants and/or for a variety of direct heat uses. These geothermal resources could play an important part in the development of rural areas and in limiting the destruction of forests to provide fuel. The geothermal areas belonging to this category are: Jombo Hills, 60 km south-east of Mombasa, where the geothermal fluids could be exploited to generate electricity and in industries such as sugar refining and production of alcohol, vegetable canning and fruit juice processing; Homa Mountain, near Lake Victoria, for electricity generation and various applications in the fish industry; Lake Magadi, for electricity generation; Kureswa, electricity generation; Olkokwe island, in Lake Baringo, for electricity generation for the fish industry; Loyangalani on the banks of Lake Turkana, for use in aquaculture, fish drying and animal husbandry; and various other localities in Kenya.

Installed geothermal plants

Electric		
Olkaria	Units 1–3	3 × 15 MW
Total		45 MW
Non-electric		
Eburru	Pyrethrum flower drying (1 MWt)	

Main sources of information

Kamondo, W. C. (1988) Possible uses of geothermal fluids in Kenya. *Proc. UNITAR/UNDP Workshop on Small Geothermal Resources, Pisa, 1987, Geothermics* 17, 489–501.

Kinyariro, J. K. (1986) Geothermal national policy of Kenya. *U.N. Workshop on Development and Exploitation of Geothermal Energy in Developing Countries, Reykjavik*, DTCD/NRED/CTP/17, p. 8.

Uganda

Background information

Surface area: 236,860 km^2
Population: 12,630,076 (1980)
G.N.P. per capita: 230 U.S.$ (1984)
Total electric capacity installed: 163 MW (1984)
Total electricity generated: 655,000,000 kWh yr^{-1} (1984)

The thermal regime of Uganda (Fig. 7) is controlled by Tertiary tectonics in the west and north-west and by Pleistocene–Recent volcanism. The northern hot springs are aligned perpendicular to the Asswa shear zone.

Geothermal R&D

Geothermal exploration began in the 1950s with a preliminary inventory of major surface manifestations, mainly hot springs. The hottest spring (98°C) is Mumbuga, west of Fort Portal, with a discharge of 500 l min^{-1}. Other springs include Kibiro (89°C), near Lake Albert and Kibito (40°C) south of Fort Portal.

In 1986 the Ugandan Government approved a seven year programme for geothermal exploration and the survey of the manifestations has recommenced.

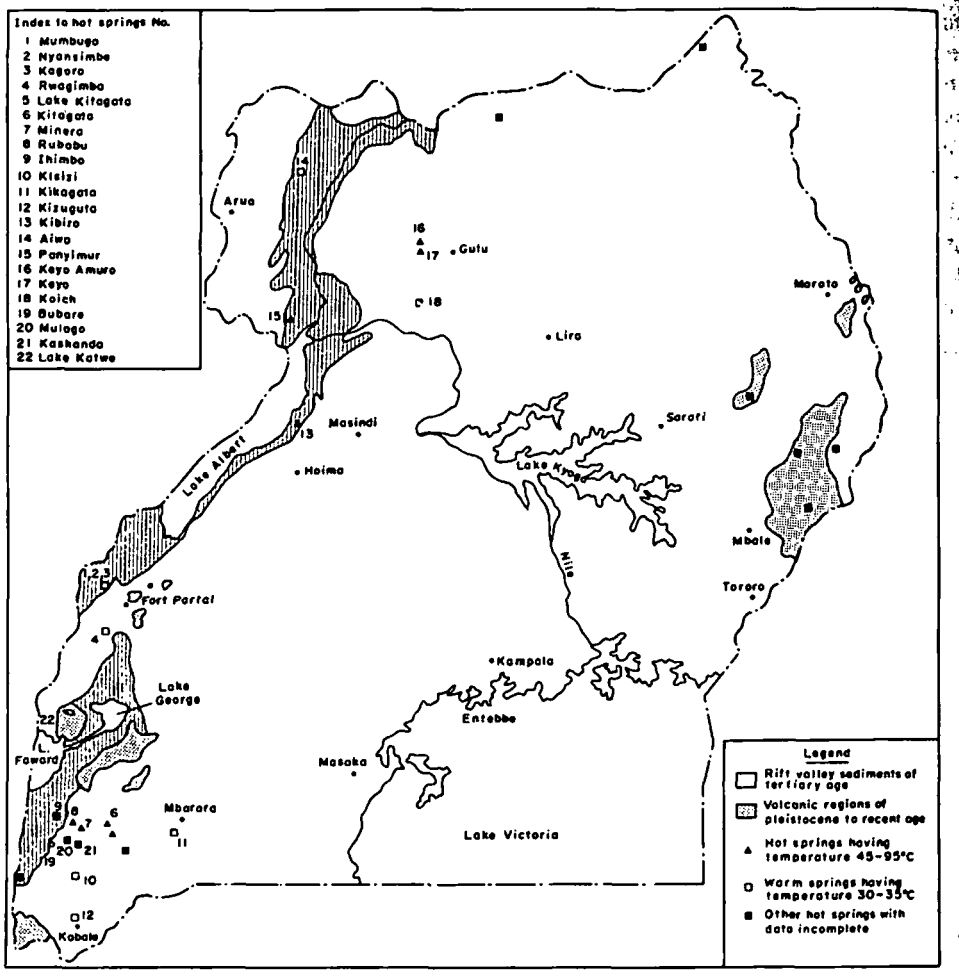

Fig. 7. Main thermal springs in Uganda (from Bazaale-Dolo, 1986).

Main sources of information

Bazaale-Dolo, A. S. (1986) Preliminary interpretation of chemical results of thermal discharges of western and northern Uganda. *Geothermics* 15, 749–758.
Kitakarugire, A. (1988) Personal communication.

United Republic of Tanzania

Background information

Surface area: 939,470 km^2
Population: 17,527,564 (1978)
GNP per capita: 210 U.S.$ (1984)
Total electric capacity installed: 439 MW (1984)
Total electricity generated: 870,000,000 kWh yr^{-1} (1984)

Tanzania, situated in the southern part of the African Rift, appears to have a good potential for geothermal energy exploitation.

Geothermal R&D

Geothermal research has been limited to the identification of some thermal manifestations and a few local studies. In the Songive River Valley, Mbeya Region, a geothermal reservoir has been identified, with average temperatures between 140 and 200°C. A 35 m well drilled in the Musoma area found water at 98°C. Other areas of potential interest are Ngorongoro and Kisaki Tangalala. At the moment no exploration is under way or programmed.

Main source of information

Di Pippo (1985) Geothermal electric power. The state of the world 1985. *GRC Int. Symp. on Geothermal Energy, Int. Vol.*, pp. 3–18.

Zambia

Background information

Surface area: 752,614 km^2
Population: 6,242,000 (1983)
G.N.P. per capita: 470 U.S.$ (1984)

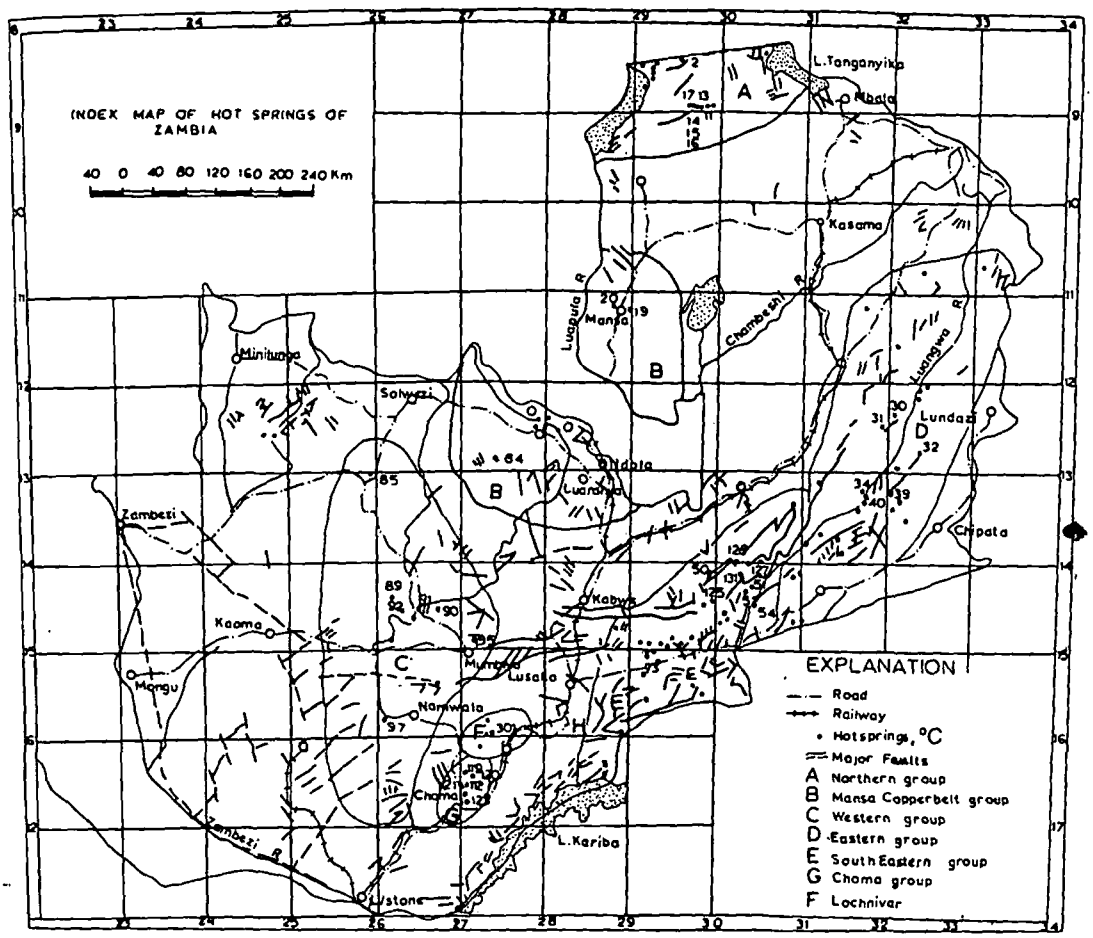

Fig. 8. Geothermal areas in Zambia (from Sakungo, 1988).

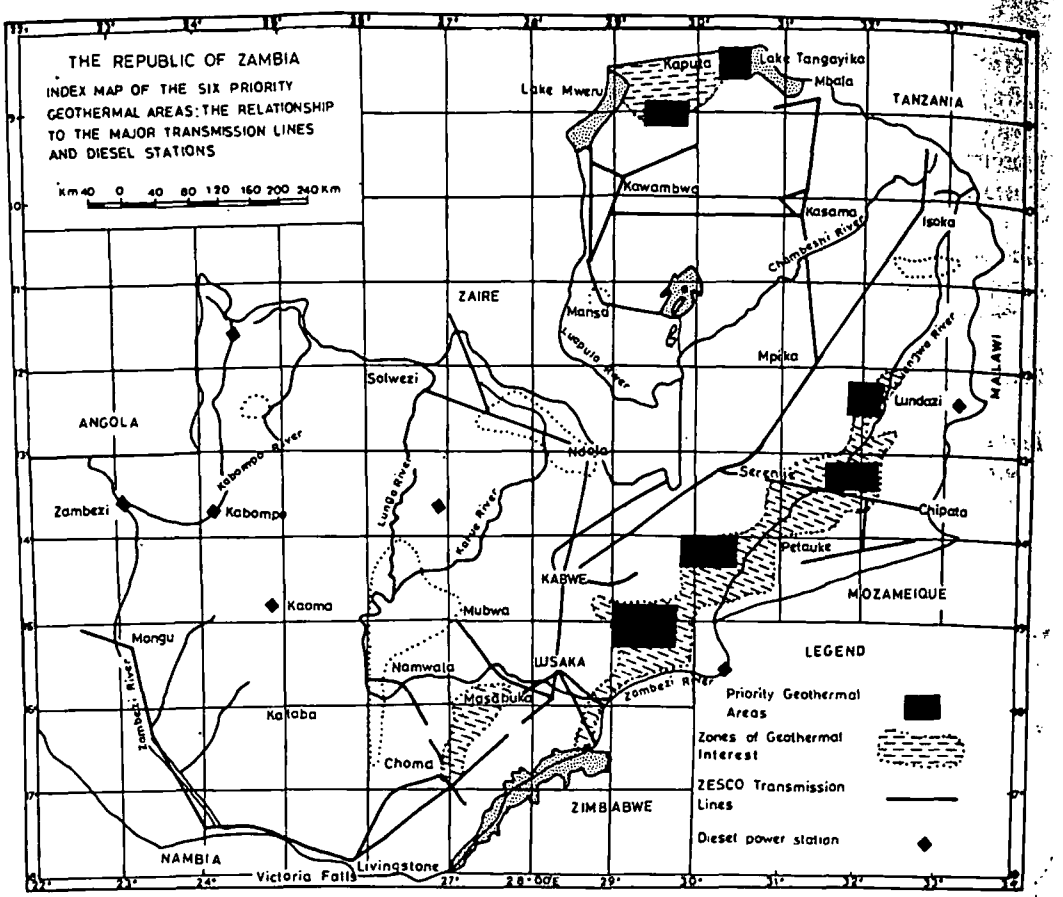

Fig. 9. Location of hot springs in Zambia (from Sakungo, 1988).

Total electric capacity installed: 1728 MW (1984)
Total electricity generated: 10,080,000,000 kWh yr^{-1} (1984)

This country (Figs 8 and 9) is rich in thermal springs associated with zones of major deep-seated fault and fracture systems. Emergence temperature of the springs ranges between 22 and 87°C.

Geothermal R&D

The first systematic studies were launched in the 1960s and directed at compiling an inventory of the surface geothermal manifestations and defining their main characteristics. In 1984 work began on a detailed study of the geothermal potential of the entire country and how the low–medium enthalpy geothermal resources could best be exploited, especially for the electrification of rural areas. The second phase of this study consists of the drilling of shallow exploratory wells in the priority areas identified during the first phase: Kapisya Hot Springs (Northern group), Lubungu (Western group), Casho (Mansa–Copperbelt Group) and Chinyunyu (South-Eastern Group). The results of this study led to the identification of priority areas and a programme for the installation of a binary-cycle pilot power-plant. Two binary-cycle plants totalling 200 kW have already been constructed and work is now under way for their installation at Kapisya (Lake Tanganyika) and entry-into-operation by the summer of 1988. Hot geothermal waters could also be used to some benefit in the fishing industry on the margins of Lake Tanganyika (freezing).

Installed geothermal plants

Electric		
Kapisya	Units 1, 2	2 × 0.1 MW
Total		0.2 MW

Main sources of information

Dominco, E. (1988) Personal communication.
Sakungo, F. K. (1988) Geothermal resources of Zambia. *Proc. UNITAR/UNDP Workshop on Small Geothermal Resources, Pisa, 1987. Geothermics* **17**, 503–514.

Madagascar

Background information

Surface area: 587,041 km^2
Population: 9,600,000 (1984)
G.N.P. per capita: 270 U.S.$ (1984)
Total electric capacity installed: 100 MW (1984)
Total electricity generated: 452,000,000 kWh yr^{-1} (1984)

The eastern part of the country is essentially made up of granite, gneiss and crystalline schist (Fig. 10). There are some volcanic edifices, but no volcanic activity. The western sector consists mainly of sedimentary rocks. Thermal springs, with temperatures that rarely exceed 50–60°C, are found throughout Madagascar.

Geothermal R&D

In the 1970s an inventory was made of the surface geothermal manifestations and a preliminary regional survey carried out. The results of this research led to the exploitation of several spas; more recent studies have focused on the town of Antsirabé, 160 km south of Tananarive. This area appears to be very interesting geothermally, with surface waters at around 50°C and deep temperatures estimated at about 150–170°C. Industrial development is envisaged for the future.

Main sources of information

Sarazin, G., Michard, G., Rakotonindrainy and Pastor, L. (1986) Geochemical study of the geothermal field of Antsirabé (Madagascar). *Geochem. J.* **20**, 41–50.
Waring, G. A. (1965) Thermal springs of the United States and other countries of the world—a summary. *U.S. Geol. Surv. Prof. Pap.* 492, 384.

Cape Verde

Background information

Surface area: 4033 km^2
Population: 295,703 (1980)
Total electric capacity installed: 4 MW (1984)
Total electricity generated: 25,000,000 kWh yr^{-1} (1984)

The Cape Verde archipelago consists of 10 main islands lying about 500 km west of Africa (Fig. 11). The geology of these islands is represented essentially by highly undersaturated alkaline rocks of the Cenozoic. Geothermal investigations have concentrated on the island of Fogo because of its recent volcanism and the presence of fumaroles.

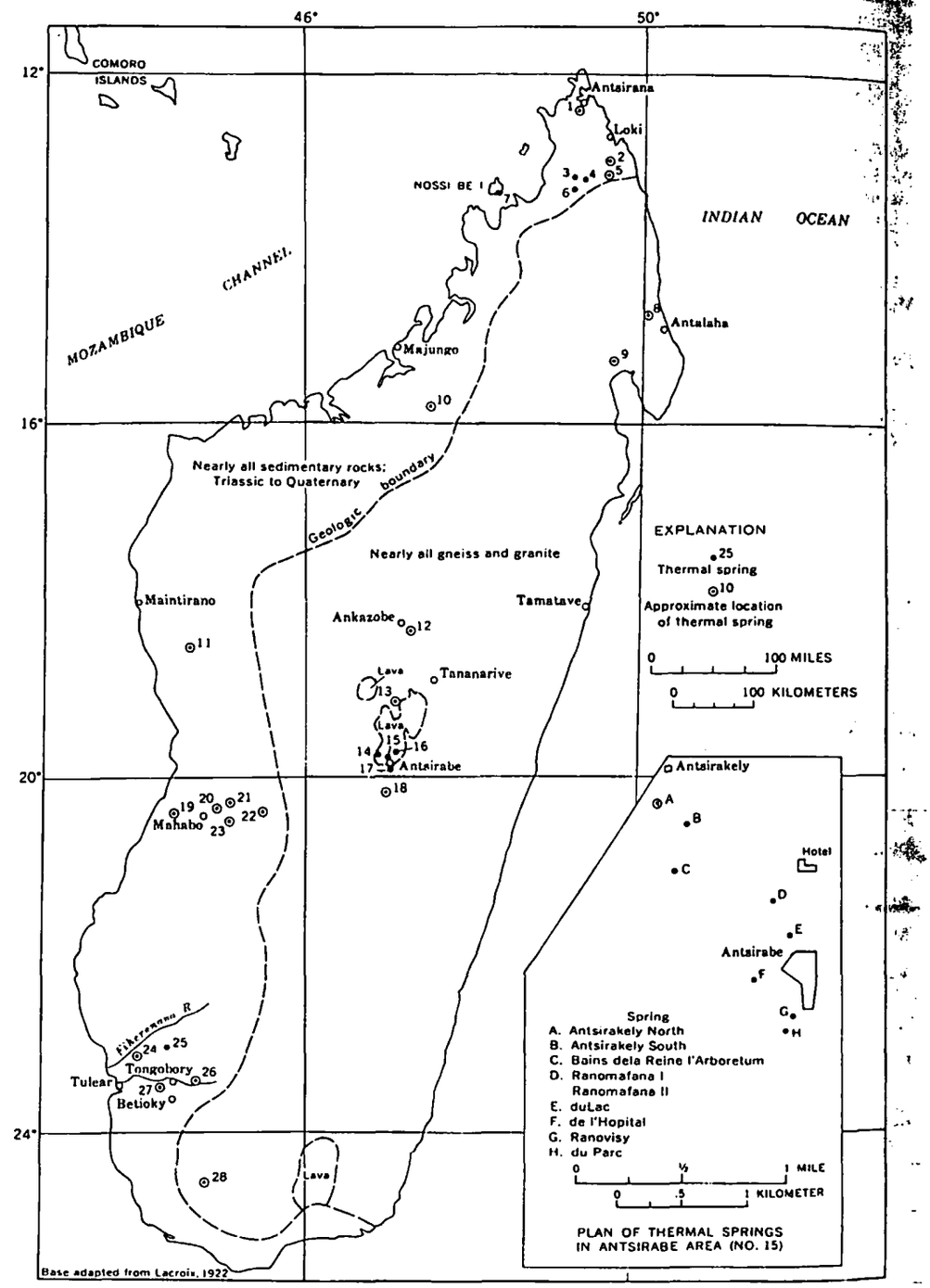

Fig. 10. Main thermal springs in Madagascar (from Waring, 1965).

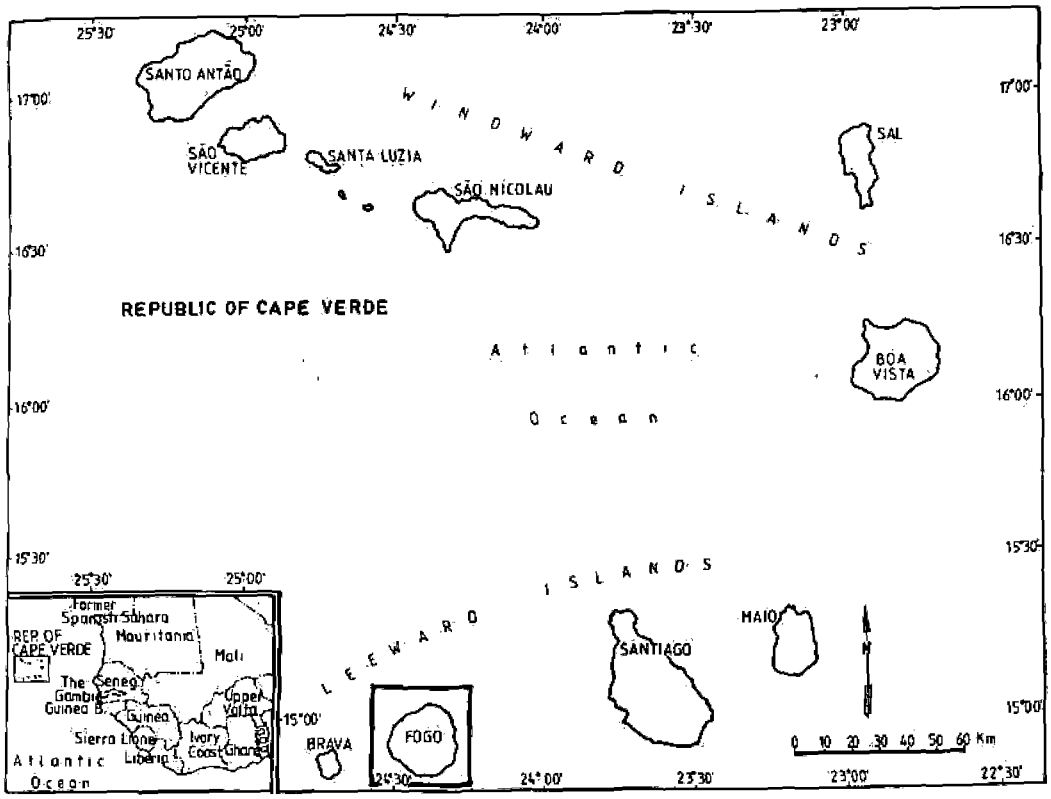

Fig. 11. The archipelago of Cape Verde (from Carvalho Martins, 1988).

Geothermal R&D

Several volcanological and hydrogeological studies were carried out on the main islands of the Cape Verde archipelago in the 1960s and 70s. The results indicated that Fogo was the most interesting for geothermal exploration. The first survey, conducted at the end of the 70s, was directed at confirming whether geothermal exploration should continue on Fogo and at collecting fluid samples. The geothermometry data of this survey indicated that the deep fluids reach temperatures of the order of 200–300°C. A resistivity survey was carried out in 1982 in the area of the caldera, the main feature of Fogo, to investigate the deep structure, identify the main underground aquifers and define some important hydrogeological parameters. Based on this survey, a drilling programme was drawn up in 1983 to obtain further geological and hydrogeological information and, in particular, to define the thermal regime. In 1986 the first well was drilled to 110 m in the caldera, but the results have not yet been made public.

The studies, although at a preliminary stage, seem to indicate that the geothermal resources of Fogo are exploitable. If confirmation is obtained from further studies, the main application will be to generate electricity to drive water pumps for irrigation and domestic supplies.

Main source of information

Carvalho Martins, V. (1988) Preliminary geothermal investigations in Cape Verde. *Proc. UNITAR/UNDP Workshop on Small Geothermal Resources, Pisa, 1987. Geothermics* 17, 521–529.

OTHER COUNTRIES (AFRICA)

Morocco

An inventory of thermal springs has been compiled. Most of these springs are located in the northern part of the country and reach temperatures of around 55°C. Apart from the study of some of these springs, no other research directed at geothermal energy utilization has apparently been conducted in Morocco.

Sudan

Jebel Marra has been identified as an area of possible geothermal interest.

Rwanda

A preliminary reconnaissance study has been carried out in the Birunga Mountains zone and south of Lake Ivu Cyangugu.

Other countries of probable geothermal interest are **Chad, Zaire, Somalia, Burundi, Malawi, Zimbabwe, Mozambique, Sao Tome** and **Principe.**

ASIA

Turkey

Background information

Surface area: 779,452 km^2
Population: 51,420,757 (1985)
G.N.P. per capita: 1200 U.S.$ (1984)
Total electric capacity installed: 8550 MW (1984)
Total electricity generated: 30,630,000,000 kWh yr^{-1} (1984)

Turkey is located on an active Alpine–Himalayan tectonic belt characterized by acidic volcanism, hot springs (more than 600) and fumaroles. Both high and low enthalpy geothermal resources can be found in this country and its geothermal potential is thought to be very high (Fig. 12).

Geothermal R&D

Geothermal research began in the early 1960s with an inventory of the hot springs. The first geothermal exploratory well was drilled in 1963 in the Agamemnun (Balcova) field, west of Izmir. Geological and geophysical studies later identified numerous high and low enthalpy geothermal fields that are exploited for electricity generation and/or in district-heating and other direct uses.

The main high enthalpy fields in Turkey are Denizli–Kizildere, Aydin–Germencik, Canakkale–Tuzla, Izmir–Seferihisar, Nemrut–Zilan–Suphan–Tendurek and Nevsehir–Acigol.

The main low enthalpy areas are Izmir–Balcova and Afyon–Omer–Gecek. Studies have also been carried out in several other possible areas and drilling has already begun in Kutahya–Simav, Ankara–Kizilcahamam, Aydin–Salavatli and Izmir–Dikili–Bergama areas.

Denizli–Kizildere field in the Menderes graben was the first area to be exploited commercially. Two reservoirs were identified: the first contains a fluid at 198°C at an average depth of 400 m and the second a fluid at 212°C in the range 450–1100 m. A 20 MW power-plant was installed in 1984, but scaling has caused serious production problems.

Aydin–Germencik field, also in the Menderes graben, has been investigated by 9 deep wells in the depth range 285–2398 m. Production rate of these wells ranges from 130 to 450 t h^{-1} at temperatures between 200 and 230°C. Tests are now being carried out in this field.

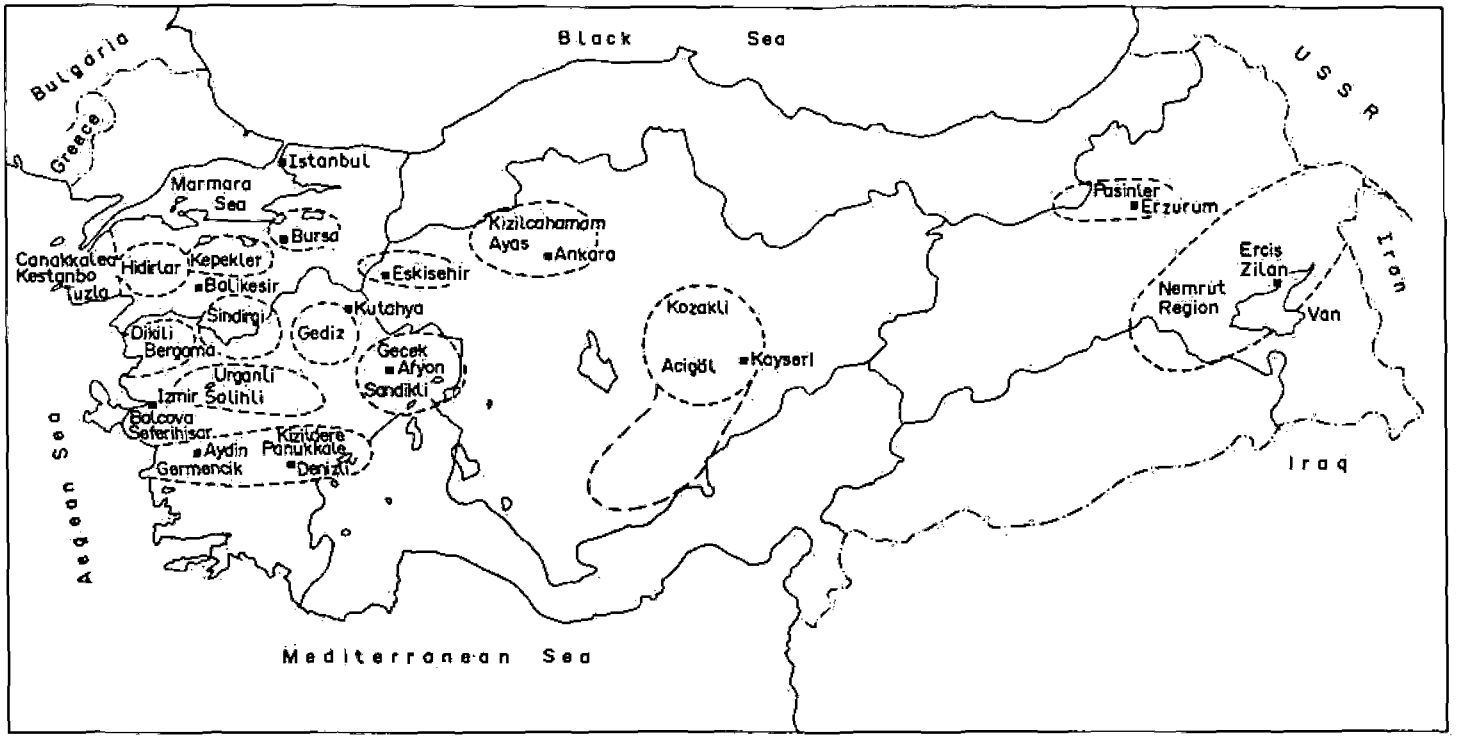

Fig. 12. Location of geothermal areas in Turkey (from Karul, 1988).

Canakkale–Tuzla field is located in north-western Anatolia. The first well, drilled in 1982 to 814 m, produced a steam/hot water mixture from 333–553 m depth in volcanic rocks. Fluid temperature was 173°C, discharge 130 t h^{-1} and steam content 13%. Deeper wells are planned to discover higher temperature layers and other production zones.

Izmir–Seferihisar field lies 40 km south-west of Izmir; temperatures in the reservoir in the 70–720 m depth interval reach 145°C.

Detailed studies are planned in two other high enthalpy areas.

The low enthalpy area of Izmir–Balcova was first drilled in 1963, producing a hot water/steam mixture at 124°C from 40 m depth. Rapid scaling, however, reduced the flow rate. A downhole heat exchanger was used to solve this problem and the heated secondary fluids are now used to heat a tourist hotel/spa and its recreational facilities as well as parts of Izmir–Dokuz–Eylul University. Binary power-plants delivering 3 MW are programmed for this field in the future.

Afyon–Omer–Gecek field was also affected by rapid scaling phenomena. Downhole and wellhead heat exchangers were tested and installed. The 98°C secondary fluid is now used to heat a spa/hotel and a 2000 m^2 greenhouse complex.

Turkey is estimated to have a geothermal electric potential of 4500 MW and a thermal potential of 31,000 MWt. Electricity generation is a primary objective, although scaling has created serious technical problems so far.

Installed geothermal plants

Electric	
Kizildere	20.6 MW
Non-electric	
Denizli–Kizildere	Liquid CO_2 and dry ice production (120 t day^{-1})
Denizli–Kizildere	Greenhouse heating (5000 m^2)
Tekkehamam	Greenhouse heating (3000 m^2)
Izmir–Balcova	Space-heating
Balcova	Greenhouse heating (60,000 m^2)
Afyon–Omer–Gecek	Space-heating, greenhouse heating (5000 m^2)

Main sources of information

Karul, K. (1988) Geothermal activity in Turkey. *Proc. UNITAR/UNDP Workshop on Small Geothermal Resources, Pisa, 1987. Geothermics* **17**, 557–564.

Popovski, K. (Ed.) (1988) Geothermal energy resources and their use in European agriculture. *FAO/CNRE Study No.* 2, p. 117.

Simsek, S. (1986) Geothermal activity in Turkey. *U.N. Workshop on the Development and Exploitation of Geothermal Energy in Developing Countries, Reykjavik*, DTCD/NRED/CTP/2, p. 8.

Pakistan

Background information

Surface area: 796,095 km^2
Population: 83,782,000 (1981)
G.N.P. per capita: 380 U.S.$ (1984)
Total electric capacity installed: 5010 MW (1984)
Total electricity generated: 21,873,000,000 kWh yr^{-1} (1984)

Geothermal manifestations can be found throughout the country. High-temperature springs are prevalent in the northern sector and springs of medium temperature in the south-eastern sector (Fig. 13).

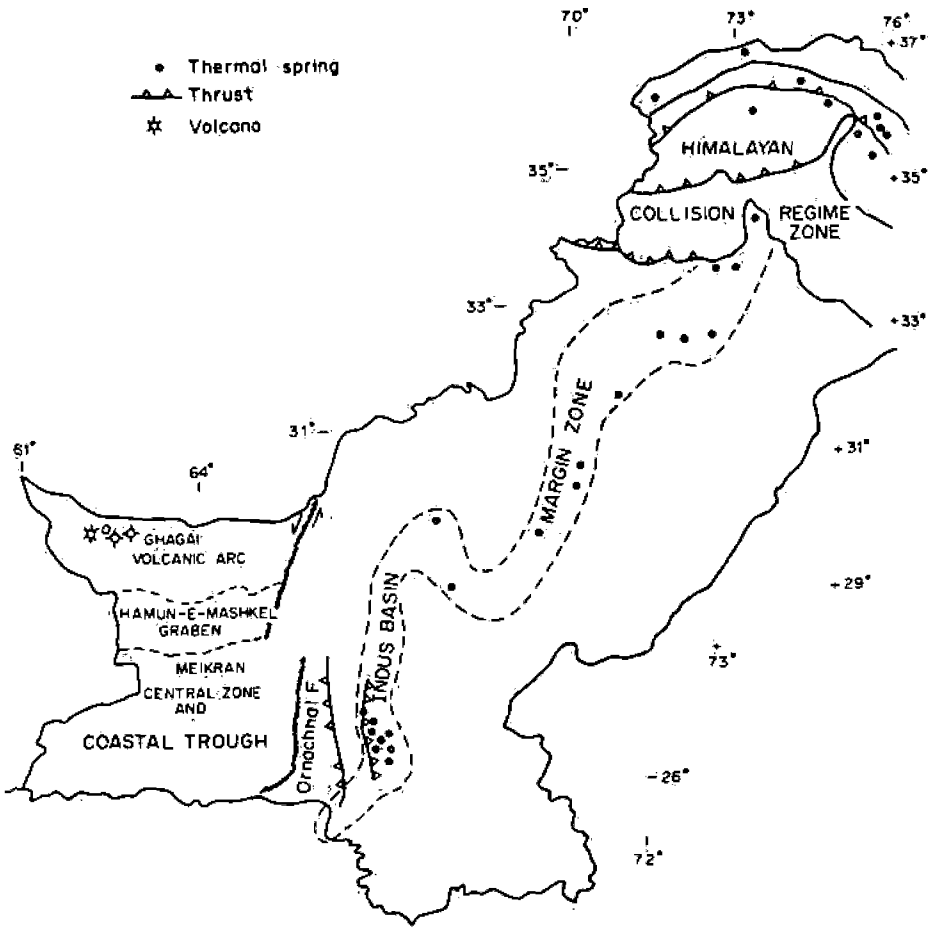

Fig. 13. Distribution of hot springs and volcanoes in Pakistan (from Shuja, 1988).

Geothermal R&D

Research is at a preliminary stage, consisting of an inventory of the thermal manifestations and study of some. However, the results have indicated the presence of high temperature waters in the northern part of Pakistan: emergence temperatures between 24 and 71°C have been recorded in the Gilgit area and 50–91°C in the Hunza area. Moderate temperatures have also been found in the Yasin and Skardu valleys. Several springs with emergence temperatures around 40°C have been found in Dadu District (south-eastern sector).

Although no reliable data are available on the commercial potential of these resources, the heat content of the geothermal resources could probably be utilized for the benefit of the local population, especially in the northern sector.

Main source of information

Shuja, T. A. (1988) Small geothermal resources in Pakistan. *Proc. UNITAR/UNDP Workshop on Small Geothermal Resources, Pisa, 1987. Geothermics* 17, 461–464.

India

Background information

Surface area: 3,287,782 km^2
Population: 685,184,692 (1981)
G.N.P. per capita: 260 U.S.$ (1984)
Total electric capacity installed: 47,690 MW (1984)
Total electricity generated: 165,440,000,000 kWh yr^{-1} (1984).

India is divided into an orogenic extra-peninsular zone (Himalayan zone) and a peninsular zone, with different geothermal characteristics and separated by the great Indo–Ganges plain (Fig. 14). Hot water with temperatures of 90–140°C can be found in the former and lower temperatures in the latter.

Geothermal R&D

A systematic inventory of the geothermal manifestations began in 1968 to identify the priority areas for exploration. Based on the results of this inventory, exploratory research commenced in three of the most promising areas: Puga Valley, Parbati Valley and along the Western Coast. This work was accelerated after the oil crisis of 1973.

At present most of the geothermal projects in India are at the exploration stage. Utilization of geothermal energy is limited to a few applications such as space-heating, extraction of chemicals, spas and tourism.

Exploration has been completed in three areas: Parbati Valley (Himachal Pradesh), west Coast (Maharashtra) and Sohna (Haryana). Exploratory drilling has begun in three areas: Puga Valley (Jammu and Kashmir), Beas valley (Himachal Pradesh) and Tattapani–Jhor geothermal belt (Madhya Pradesh). Surveys and exploratory drilling are under way at Tapoban in the Alaknanda valley (Uttar Pradesh) and Salbardi in the Narmada–Tapti basin (Madhya Pradesh). Preliminary investigations have begun in four areas: Bhagirathi Valley (Uttar Pradesh), Labsot–Toda Bhim belt (Rajasthan), Tata Jarom area (Bihar) and Attri–Tarbola area (Orissa).

Results so far indicate the possibility of small electric power generation at Puga, where a 0.5–1 MW plant is programmed and binary-cycle power generation at one or two locations. In other locations only non-electric utilization of geothermal resources is feasible.

Geothermal plants installed

Non-electric

Puga	Space-heating. Extraction and refinement of salts
Chumatang	Greenhouse heating
Kasol	Space-heating

Main sources of information

Dubey, C. S. (1988) Development and role of geothermal resources in India. *Proc. UNITAR/UNDP Workshop on Small Geothermal Resources, Pisa, 1987. Geothermics* **17**, 451–460.

Moon, B. R. and Dharam, P. (1988) Geothermal energy in India. Present status and future prospects. *Proc. UNITAR/UNDP Workshop on Small Geothermal Resources, Pisa, 1987. Geothermics* **17**, 439–449.

Vedantham, S. (1986) Geothermal programme of India with special reference to UNDP project. *U.N. Workshop on Development and Exploitation of Geothermal Energy in Developing Countries, Reykjavik*, DTCD/NRED/CTP/18, p. 13.

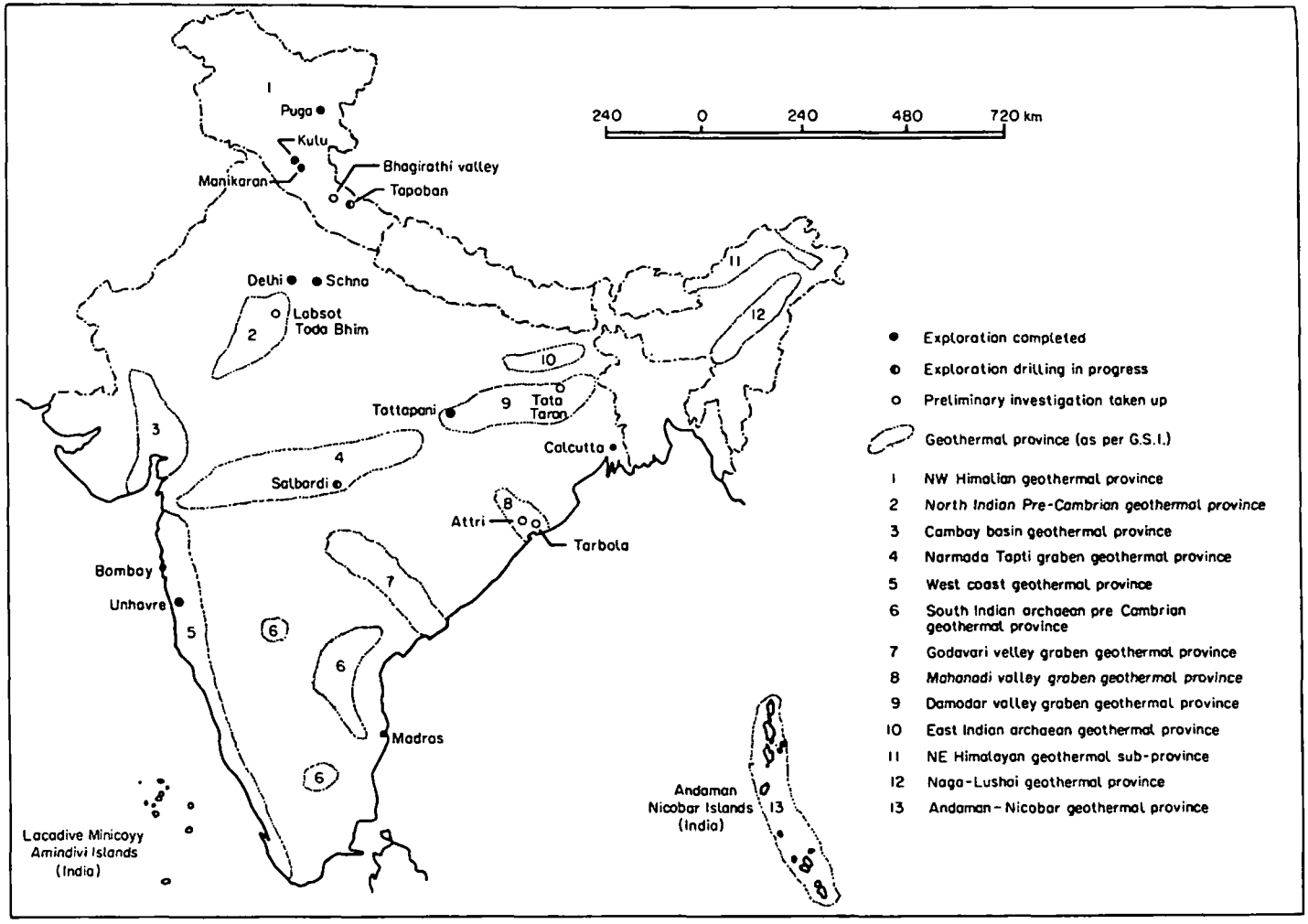

Fig. 14. Distribution of geothermal areas in India (from Moon and Dharam, 1988).

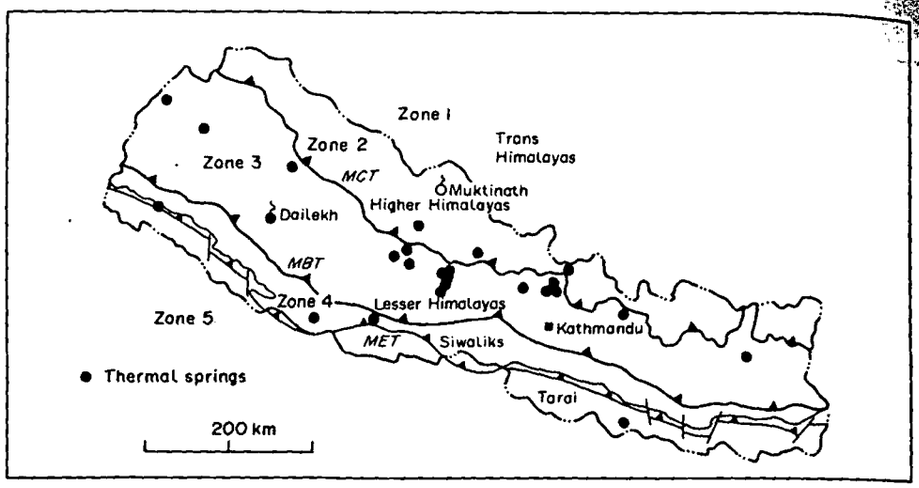

Fig. 15. Distribution of main hot springs in Nepal (from Bhattarai, 1986).

Nepal

Background information

Surface area: 140,797 km^2
Population: 15,023,000 (1981)
G.N.P. per capita: 160 U.S.$ (1984)
Total electric capacity installed: 178 MW (1984)
Total electricity generated: 350,000,000 kWh yr^{-1} (1984)

There are several thermal springs in Nepal, with temperatures in some cases above 70°C. These springs generally lie along the main tectonic lineaments (Fig. 15).

Geothermal R&D

It would appear that geothermal research is for the moment confined to an inventory of the main thermal springs and the study of some. The hot springs are more or less grouped into three WNW–ESE trending belts. The northernmost group lies beyond the Higher Himal, the central group includes Kathmandu and the southernmost group includes Siwaliks region. The central belt has the most and the hottest thermal springs. Geothermal energy could be conveniently utilized in this country, considering its geographic and climatic conditions.

Main source of information

Bhattarai, D. R. (1986) Geothermal manifestations in Nepal. *Geothermics* **15**, 715–717.

Burma

Background information

Surface area: 678,033 km^2
Population: 35,313,905 (1983)
G.N.P. per capita: 180 U.S.$ (1983)
Total electric capacity installed: 741 MW (1984)
Total electricity generated: 1,726,000,000 kWh yr^{1} (1984)

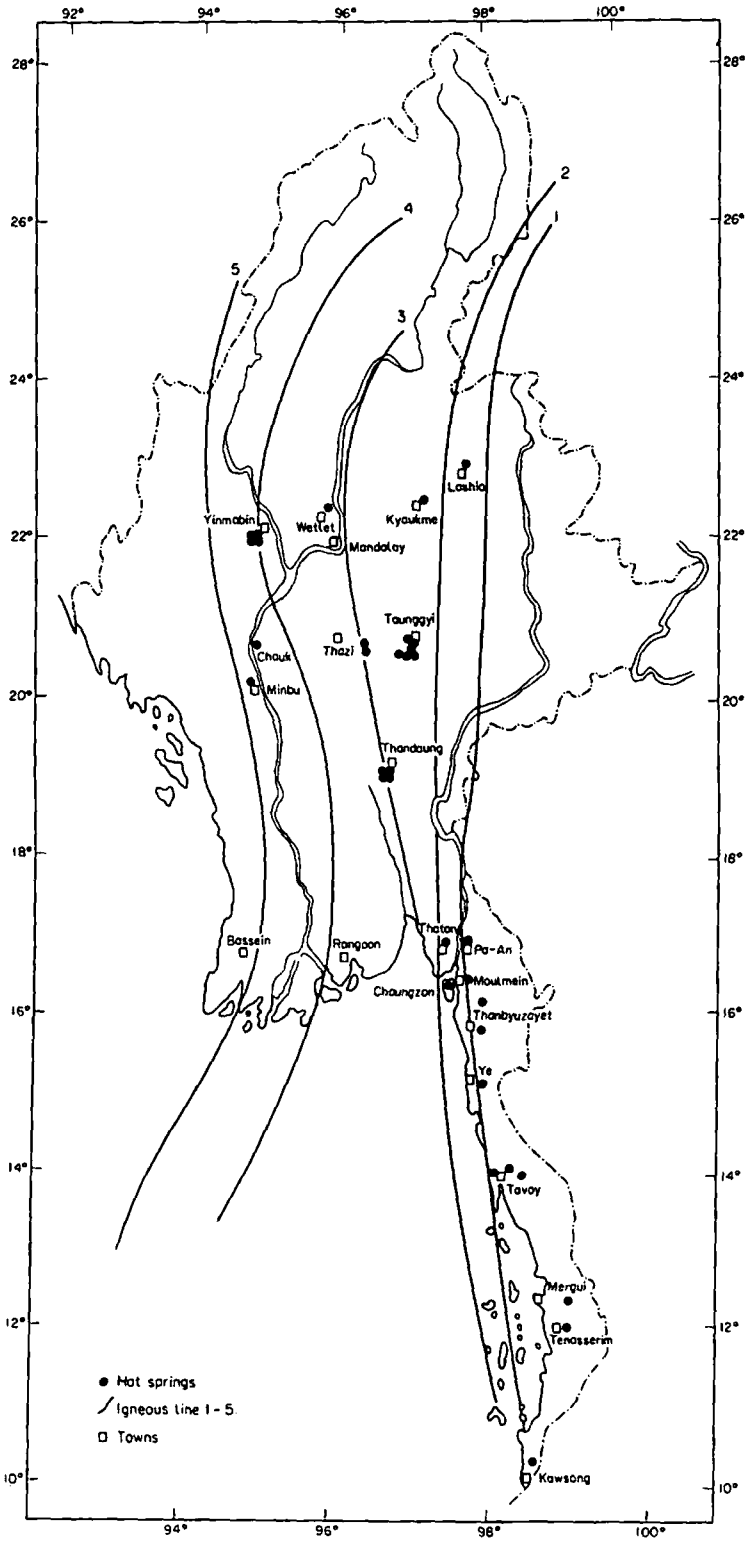

Fig. 16. Geothermal resources of Burma (from Tin Tun Aung, 1988).

Burma consists of several geostructural units of different ages and types trending roughly north to south in correspondence to the main tectonic lineaments. The manifestations of volcanic activity range in age from Paleozoic to Tertiary, with rare examples of the Quaternary (Mount Popa). Several thermal springs are present, especially in the central and southern parts of Burma (Fig. 16).

Geothermal R&D

The first inventory of Burma's thermal springs dates back to 1933, updated and integrated in 1965–1966. At the moment 97 hot springs have been recorded, with temperatures between 25 and 65°C. A hydrogeochemical study was made of some springs in 1986 and geological and geophysical surveys initiated in the most interesting areas. Geothermal research in Burma is therefore still in a very preliminary phase.

Main source of information

Tin Tun Aung (1988) Geothermal resources of Burma. *Proc. UNITAR/UNDP Workshop on Small Geothermal Resources, Pisa, 1987. Geothermics* **17**, 429–437.

Thailand

Background information

Surface area: 513,115 km^2
Population: 44,824,540 (1980)
G.N.P. per capita: 860 U.S.$ (1984)
Total electric capacity installed: 6287 MW (1984)
Total electricity generated: 22,029,000,000 kWh yr^{-1} (1984)

There are more than 90 thermal springs in Thailand, with emergence temperatures between 40 and 100°C (Fig. 17). About two thirds of these springs are tied to areas of recent tectonic activity and the presence of granitic bodies. They are located in northern Thailand. This part of the country also contains the areas of major geothermal interest.

Geothermal R&D

The first inventory of hot springs was made in 1946, but systematic geothermal studies did not begin until 1979. Two priority areas were then identified: San Kamphaeng and Fang, in Chiang Mai province, north Thailand.

Six wells were drilled in the 1981–1983 period at San Kamphaeng to an average depth of 500 m (GTE 1–GTE 6). A number of shallow holes (10–20 m) were also drilled to monitor subsurface temperature variations and for seismic studies. The geothermal gradient in GTE 6 is about 200°C km^{-1} and flow rate ranges from 6–7 l s^{-1}. Another deep exploratory well (1500 m) is now being drilled in the vicinity of GTE 6. The San Kamphaeng field will hopefully be able to feed a 5–10 MW power-plant.

In the Fang geothermal field 18 boreholes were drilled for a feasibility study to depths of 18–120 m. Most of these boreholes produce pressurized fluids at temperatures between 98 and 105°C. Total flow rate from three wells (FGTE 12, 14 and 15) is over 20 l s^{-1}. By the end of 1988 a 300 kW binary plant will be installed in this field.

Studies are also being made in Thailand of the possibility of utilizing the heat content of the geothermal fluids directly in rice parboiling, drying of tobacco and tea leaves and other essentially agricultural applications. A small pilot plant has been installed near GTE 6 well at San Kamphaeng to conduct experiments of this type. It is used to dry tobacco leaves, one of the

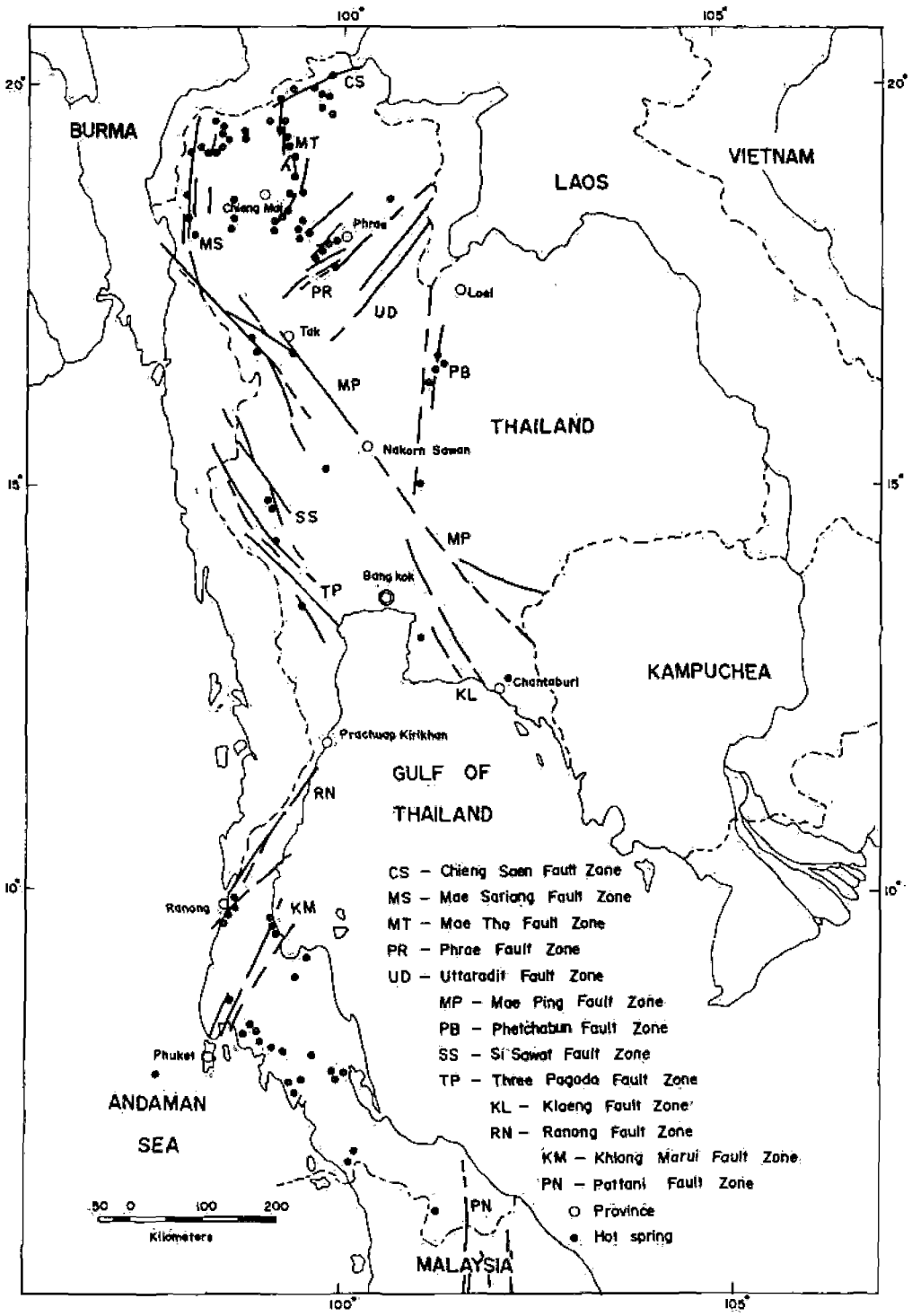

Fig. 17. Distribution of hot springs in Thailand (from Chuaviroj, 1988).

main industries in north Thailand. This small plant has been operating successfully since the 1985–1986 season. In order to utilize the plant over the whole year, and not just during the tobacco season, the plant will be modified to dry other products such as red peppers, bananas and longan.

Geothermal plants installed

Non-electric

San Kamphaeng	Drying of agricultural products (pilot plant)

Main sources of information

Chuaviroj, S. (1988) Geothermal development in Thailand. *Proc. UNITAR/UNDP Workshop on Small Geothermal Resources, Pisa, 1987. Geothermics* 17, 421–428.

Thieprasert, A., Surinkum, A. and Raksaskulwong, M. (1986) Geothermal exploration and development in Thailand. *U.N. Workshop on the Development and Exploitation of Geothermal Energy in Developing Countries, Reykjavik,* DTCD/NRED/CTP/6, p. 18.

Vietnam

Background information

Surface area: 329,566 km^2
Population: 52,739,756 (1979)
G.N.P. per capita: 170 U.S.$ (1983)
Total electric capacity installed: 1220 MW (1984)
Total electricity generated: 5,800,000,000 kWh yr^{-1} (1984)

About 200 surface thermal manifestations have been inventoried in Vietnam, most of which are in the northwestern part of the country (temperatures between 40 and 70°C) and some in the south.

Geothermal R&D

Geothermal research began only a few years ago, with an inventory of the geothermal manifestations and study of the chemical composition, temperature and other main parameters of the fluids.

The most interesting areas appear to be Mylam, Hoi Van and Dan Thanh, where surface temperatures exceed 80°C. Experiments are now under way on the utilization of these hot waters in drying farm products, tea, bananas, coconut, etc.

Thermal gradients have been measured in oil and gas wells. Temperatures in the Songhong basin are estimated to exceed 200°C between 2000 and 3000 m.

The Vietnamese Government has approved a national geothermal development progamme and heat flow study.

Main sources of information

Hong Le Vinh and Trac Viet Nguyen (1988) Personal communication.

Waring, G. A. (1965) Thermal springs of the United States and other countries of the world—a summary. *U.S. Geol. Surv. Prof. Pap.* 492, 384.

China

Background information

Surface area: 9,536,499 km^2
Population: 1,045,320,000 (1985)
G.N.P. per capita: 310 U.S.$ (1984)
Total electric capacity installed: 83,000 MW (1984)
Total electricity generated: 376,990,000,000 kWh yr^{-1} (1984)

There are more than 3000 active hydrothermal systems in China (Fig. 18). The high temperature systems are located in Taiwan, southern Tibet and west Yunnan; the low temperature systems are spread all over the vast territory of the Chinese hinterland.

Geothermal R&D

Systematic research began in the early 1960s and led to the identification of several geothermal fields, the most important of which are Yangbajain, Yunnan–Tengchong, Yangyixiang, Naqu and Tianjin.

So far 53 wells have been drilled in the Yangbajain field (Tibet) and an experimental 13 MW power-plant installed. This plant provides more than 50% of the electricity produced in Lhasa.

Yangyixiang and Naqu fields are both located within the tectonic and seismically active belt of the Nyenchhenthangla Mountains. Yangyixiang field lies 55 km south–west of Yangbajain geothermal field; maximum temperature measured in a well was about 200°C. Surface exploration has been completed and more than 10 exploratory wells drilled. The fluid produced is a water/steam mixture. Reservoir temperatures and pressures are higher than in the Yangbajain field.

Naqu field is located in northern Tibet. Surface exploration has been completed and eight exploratory wells drilled. Borehole temperatures are around 100°C.

Installed geothermal plants

Electric

Yangbajain	Unit 1	1 MW
	Units 2–5	4 × 3 MW
Zhaoyuan	Unit 1	0.2 MW
Dengwu	Unit 1	0.086 MW
	Unit 2	0.20 MW
	Unit 3	0.30 MW
Huailai		0.20 MW
Wentang	Units 1, 2	2 × 0.050 MW
Huitang		0.03 MW
Chingshui		3 MW
Xiongyue	Units 1, 2	2 × 0.100 MW
Total		17.316 MW

Non-electric

Beijing	District heating, greenhouses, farming
Tianjin	Industrial processes, district heating, greenhouses, farming

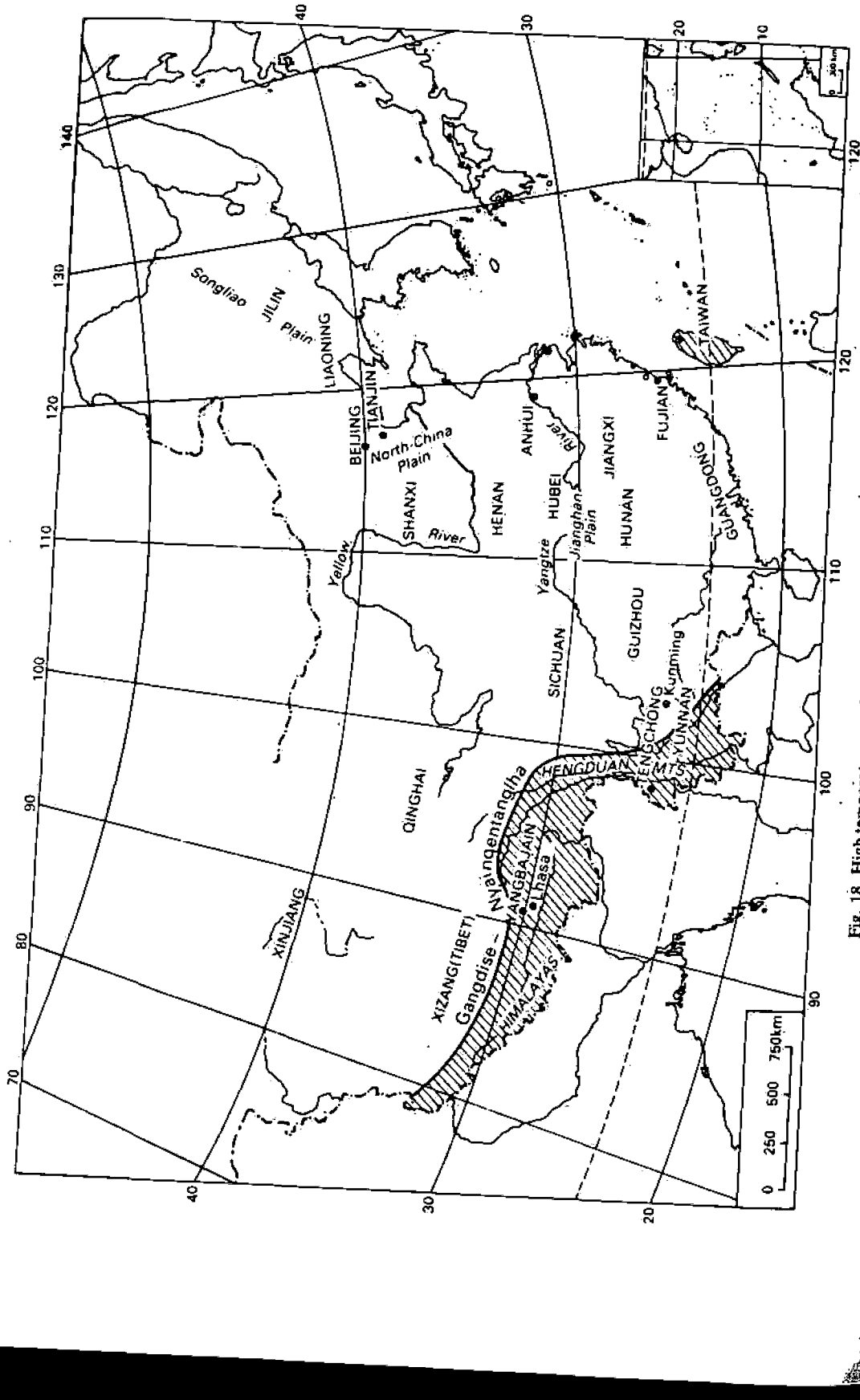

Fig. 18. High temperature geothermal areas in China (from Tong Wei *et al.*, 1986).

Hebei province	
Renqui, etc.	District heating
Niutuozhen, Huailai, etc.	Greenhouses, farming
Shanxi province	
Jiangxian	Greenhouses, farming
Liaoning province	
Tanggangzi, etc.	District heating
Xiongyue, etc.	Greenhouses, farming
Shandong province	
Weihai	Industrial processes
Weideng, etc.	Greenhouses, farming
Jiangxi province	
Suichuan, Yichun	Greenhouses, farming
Fujian province	
Fuzhou	Industrial processes
Fuzhou, Zhangzhou	District heating
Fuzhou	Greenhouses, farming
Henan province	
Lushan	Industrial processes
Shanxian, etc.,	Greenhouses, farming
Hubei province	
Yingshan	Industrial processes
Jingshan, etc.	Greenhouses, farming
Hunan province	
Huitang, Rucheng	Greenhouses, farming
Guangdong province	
Dongshanhu, Conghua, etc.	Farming
Yunnan province	
Kunming	District heating
Xizang province	
Yangbajain	District heating, greenhouses

Main sources of information

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Di Pippo, R. (1988) International developments in geothermal power production. *Bull. G.R.C.* **17**, 8–19.
Dou Ji and Wang Yue (1988) Personal communication.
Tong Wei, Liao Zhijie, Liu Shibin and Zhang Mingtao (1986) Present status of research and utilization of geothermal energy in China. *Geothermics* **15**, 623–626.
Wu Fangzhi, Tong Wei, Liu Shibin and Zhang Zhifei (1986) First decade of geothermal development in Yangbaijin field, China. *Geothermics* **15**, 633–638.
Yang Qilong, Xin Kuide and Zhang Zhenguo (1985) Preliminary assessment of the geothermal resources of China. *GRC Int. Symp. Geothermal Energy, Int. Vol.*, 43–52.

Philippines

Background information

Surface area: 300,000 km^2
Population: 48,098,460 (1980)
G.N.P. per capita: 660 U.S.$ (1984)
Total electric capacity installed: 6155 MW (1984)
Total electricity generated: 20,800,000,000 kWh yr^{-1} (1984)

The Philippine archipelago is a tectonically active portion of the rim of the Pacific basin. There are at least 27 identified geothermal prospects in the Philippines. These areas are evidenced on the surface by the presence of Tertiary to Quaternary volcanoes, thermally altered grounds, steaming vents, fumaroles, mud pools and warm springs (Fig. 19).

Geothermal R&D

Geothermal research began in the Philippines in 1964. Assessments of the geothermal potential of developed fields such as Tongonan, Palinpinon, Tiwi, Mak–Ban and lately Bacon–Manito (Bac–Man) indicate that the reserves are in excess of present and planned generating capacities.

Tiwi geothermal field has a proven capacity of 545 MW at the wellheads of 87 productive wells. At present it contributes 330 MW to the Luzon power grid.

Mak–Ban geothermal area in Laguna has a 415 MW proven capacity and currently contributes 330 MW to the Luzon power grid. So far 69 wells have been completed, of which 14 are for reinjection.

The Tongonan field in Visayas appears to have the largest reserves in the country. The potential of part of this field has been estimated at 450 MW for a plant life of 25 yr. The total field reserves are considered to be 885 MW. A total of 52 deep wells have been completed since exploratory drilling and field development began in 1976. Thirty-eight are production wells, nine are reinjection wells and the rest are either non-productive or have still to be tested. While 360 MW have been confirmed at the wellheads of the 38 production wells, only 12 of them were required to fully operate the first 115.5 MW power-plant installed in the field.

Palinpinon, the second geothermal field in Visayas, on the island province of Negros, is also at an advanced stage of development. Palinpinon 1, a 112.5 MW power-plant, was put into commercial operation in 1983 and plans are under way for the development and installation of a second 112.5 MW power facility in the 1990s, in anticipation of the planned interconnection of Negros and Panay island power grids. Another four well units of 1.5 MW each have also been installed in this field, half in 1980 and the other half in 1984. A total of 53 deep wells have already been drilled, including two exploratory wells in Dauin. Thirty-two of these wells are productive, 12 for reinjection and the rest are either non-productive or have yet to undergo testing. A total of 180 MW have been confirmed from the tested production wells, 21 of which are hooked up to Palinpinon I. Assessments of the field place its reserves at about 700 MW for a plant life of 25 yr.

Bacon–Manito geothermal field, located in the provinces of Albay and Sorsogon, Bicol, southern Luzon, is at an advanced stage of development. Fifteen deep wells were completed by the middle of 1985 within the area called Palayang Bayan. Eleven of these wells have a tested output of 76.3 MW, all of them for hook-up to the first power facility. The rest are wells intended for reinjection. Recent assessments within the drilled area of 12 km^2 indicate that reserves of about 150 MW for a 25 yr plant life have already been identified. There are already plans to commission a 110 MW power facility in the 1990s. Three more exploratory wells have been drilled for direct utilization in the lowland area of Manito, an extension of the Bac–Man Project,

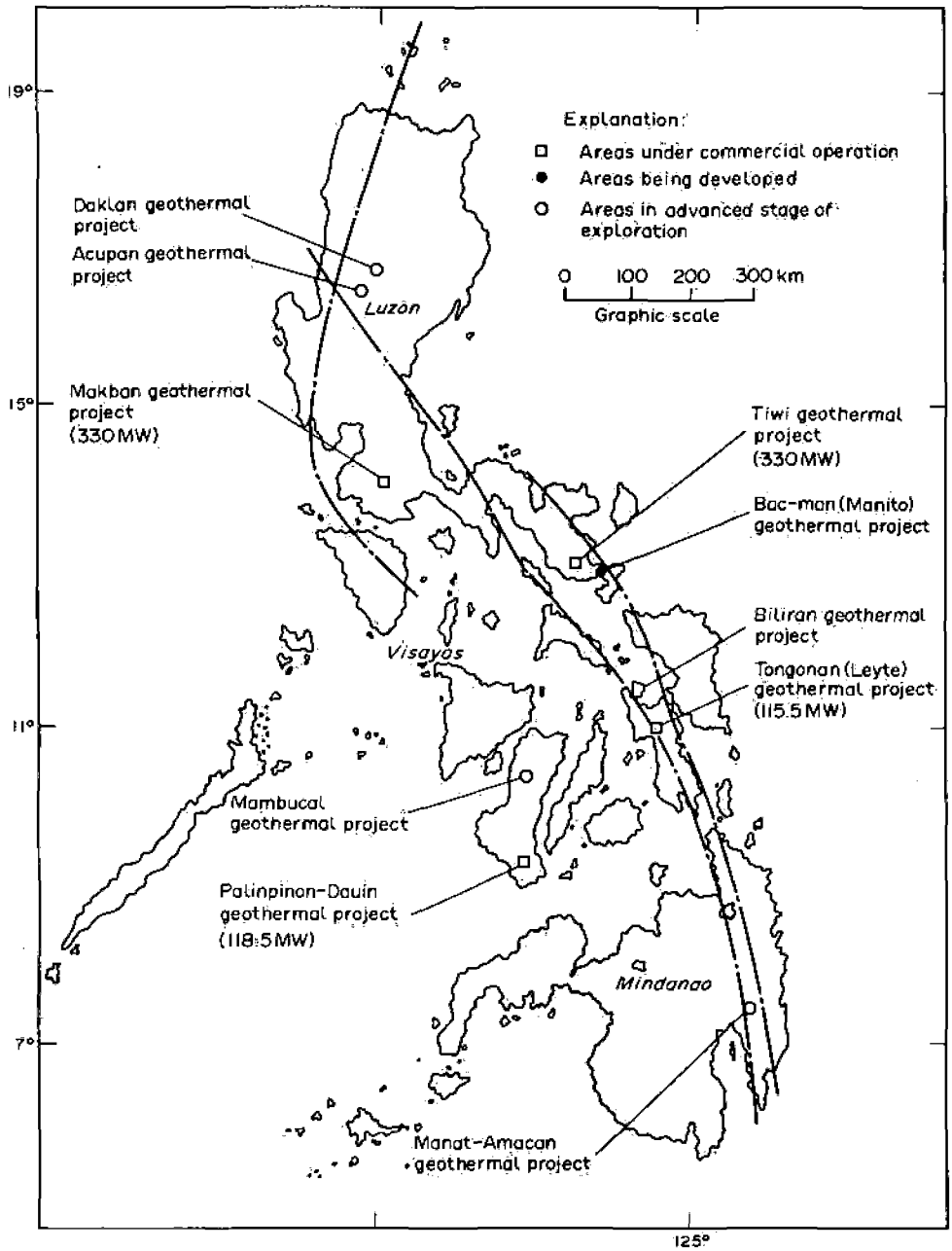


Fig. 19. Geothermal areas in the Philippines (from Vasquez, 1988).

north of the site chosen for the 110 MW plant. These resources are expected to be utilized in grain and abaca pulp drying.

Future development is scheduled for several other areas of Luzon island, Visayas and Mindanao, where geothermal resources have been identified.

The installed geothermoelectric capacity is expected to increase in the near future to 1041.5 MW, after commission of the new units in Palinpinon and Bacon–Manito.

Installed geothermal plants

Electric		
Tiwi	Units 1–6	6 × 55 MW
Mak–Ban	Units 1–6	6 × 55 MW
Tongonan	Wellhead unit	3.0 MW
	Units 1–3	3 × 37.5 MW
Palinpinon	WH units 1–4	4 × 1.5 MW
	Units 1–3	3 × 37.5 MW
Total		894 MW
Non-electric		
Tiwi	Fish canning (experimental plant)	

Main sources of information

Datuin, R. T. and Troncales, A. C. (1986) Philippine geothermal resources: general geological setting and development. *Geothermics* **15**, 613–622.
Gazo, F. M. and Apuada, N. A. (1988) Personal communication.
Tolentino, B. S. and Buning, B. C. (1985) The Philippines' geothermal potential and its development: an update. *GRC Int. Symp. Geothermal Energy, Int. Vol.*, pp. 157–174.
Vasquez, N. C. (1988) The economics of geothermal power development in the Philippines. *Proc. U.N. Workshop on Geothermal Energy, Reykjavik, 1986.* pp. 112–145

Indonesia

Background information

Surface area: 1,904,569 km^2
Population: 146,934,948 (1980)
G.N.P. per capita: 540 U.S.$ (1984)
Total electric capacity installed: 6700 MW (1984)
Total electricity generated: 21,330,000,000 kWh yr^{-1} (1984)

A large part of the Indonesian archipelago is occupied by volcanic edifices, with some young volcanoes that form active volcanic belts (Fig. 20). Tectonic movements in the past caused the ascent of magma to shallow depths. The presence of shallow magma, abundant precipitations and volcanic rocks that could act as a cap and reservoir, have created ideal conditions for the development of geothermal systems.

Geothermal R&D

Geothermal research in Indonesia started in 1926 in the Kamojang area, west Java, where the first five shallow exploratory wells were drilled. One of these is still discharging steam. No further investigations were done until the 1960s. Inventories made during the last 15 yr have indicated the presence of about 90 thermal areas located on several islands, such as Sumatera, Java, Bali, Lambok, Sumbawa, Flores, Sulawesi, Cerom and Halmahera. Based on these surveys, Indonesia has a potential of 3000–10,000 MW, i.e. 5000 MW in Java, 1100 MW in Sumatera, 1400 MW in Sulawesi and 2000 MW on other islands.

The electric power sector in Indonesia will be expanded by a further installed capacity of about 5256 MW at the end of the Fourth five-year Development Programme (1984/85–1988/89). Accordingly, the utilization of geothermal energy for power generation will increase by 200 MW

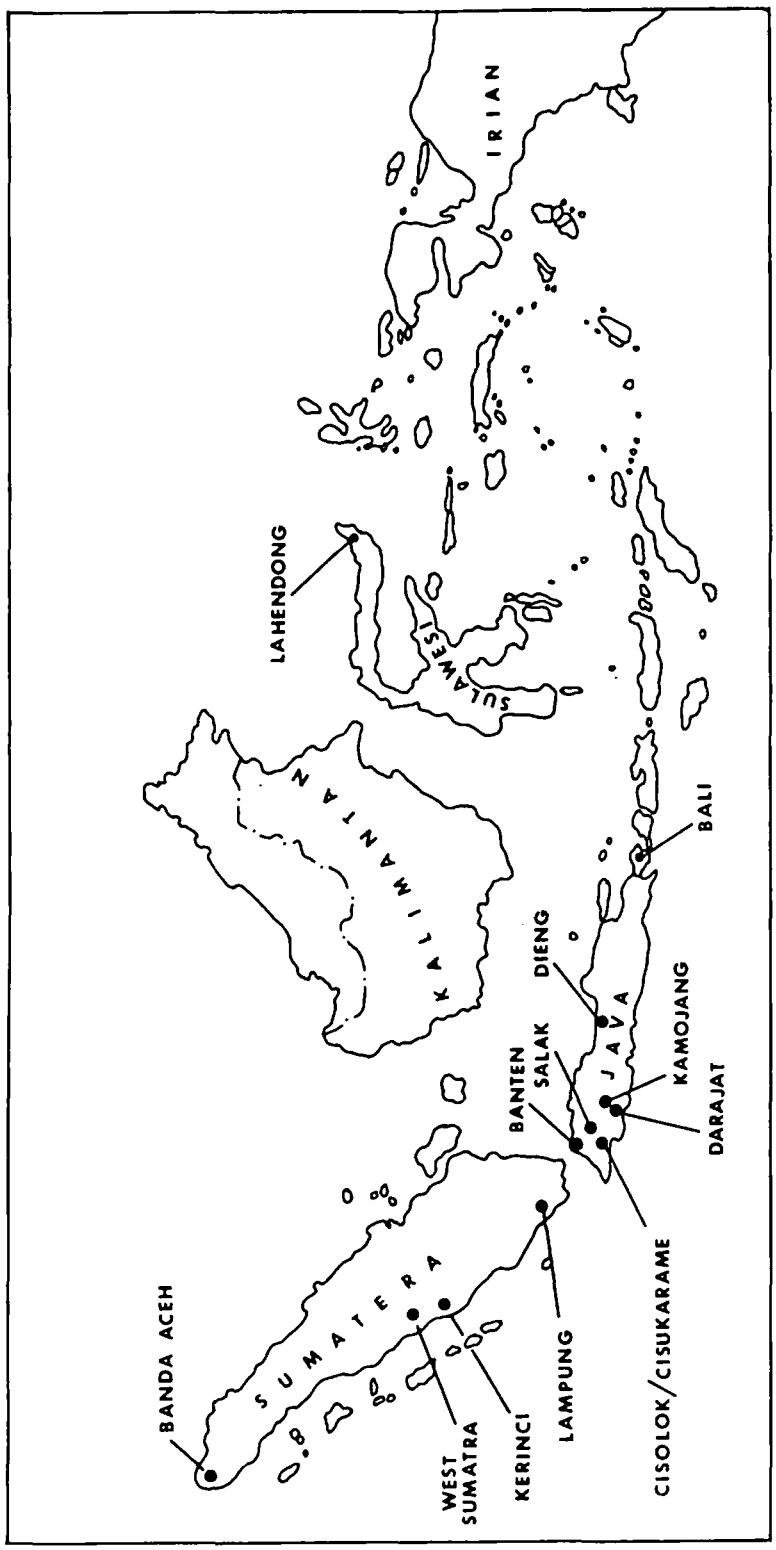


Fig. 20. Geothermal prospects in Indonesia (from Marzuan, 1986).

and 660 MW during the 4th (1984–89) and 5th (1989–1994) Energy Programmes, reaching a total capacity of about 1000 MW.

At the moment, a total of 140 MW are installed in geothermal plants at Kamojang, west Java. The first unit, of 30 MW capacity, has been operating successfully since 1983, and the second and third units, 55 MW each, since early 1988.

The geothermal prospects discussed below are expected to produce additional geothermoelectric power during the next six years.

At Dieng–Central Java, 14 deep wells have been drilled. A highly conservative estimate indicates a potential of 500 MW. Funds have been obtained for a feasibility study and engineering design of a plant with two 55 MW units. The field is scheduled to be in commercial operation by 1989. One experimental plant of 2 MW has been operating since 1981.

The Gunung Salak geothermal field of west Java is expected to generate 220 MW of geothermoelectric power by 1994. The feasibility study and engineering design of two 55 MW units have already been financed.

At Darajat, west Java, a 110 MW plant is expected to be installed by 1990.

At Banten, west Java, one deep well has been drilled, as well as another at Cisolok, to confirm the potential of these two fields. A 110 MW plant is scheduled in each of these fields for 1994.

At Wayang–Windu geothermal field, west Java, exploration began in 1982. Most data indicate that the Wayang–Windu prospect is similar to the Kamojang geothermal field. A steam zone with temperatures above 230°C is expected at depths below 500 m and a two-phase reservoir may occur at depths below 1000 m. Three slim holes will be drilled in 1989 to confirm field potential.

In Lahendong geothermal area, north Sulawesi, four deep wells have been drilled and a highly conservative estimate indicates a potential of 75 MW. Two 15 MW units are planned for 1993.

At Bedugal, Bali, the potential is estimated at 200 MW. Various surveys have been conducted over the last eight years and two deep wells are scheduled for 1989.

Installed geothermal plants

Electric		
Dieng		2 MW
Kamojang	Unit 1	30 MW
	Units 2, 3	2 × 55 MW
Total		142 MW

Main sources of information

Agus, I. (1988) Personal communication.
Alzwar, M. (1986) Geothermal energy potential related to active volcanism in Indonesia. *Geothermics* **15**, 601–607.
Manalu, P. (1988) Geothermal development in Indonesia. *Proc. UNITAR/UNDP Workshop on Small Geothermal Resources, Pisa, 1987. Geothermics* **17**, 415–420.
Marzuan (1986) Methodology of geothermal exploration and development in Indonesia. *U.N. Workshop on the Development and Exploitation of Geothermal Energy in Developing Countries, Reykjavik*, DTCD/NRED/CTP/11. p. 16.

OTHER COUNTRIES (ASIA)

Jordan

One well of about 1500 m depth has been drilled in the thermal zone near Zarqa Main, with the objective of utilizing the heat of the deep waters to produce electric energy.

Saudi Arabia

Studies of geothermal resources in the Kingdom of Saudi Arabia started in 1980. These consisted of a hydrogeochemical reconnaisance of the hot springs in the south and a geologic reconnaissance of the large volcanic areas known as harrats. Harrat Khaybar, harrat Kishb and harrat Rahat are the only three areas that appear to be of geothermal interest. The hydrogeochemical study concentrated on systematic sampling of hot springs in the Jizan and Al Lith areas in order to assess deep fluid temperatures and reconstruct the hydrothermal system.

North Yemen (Yemen Arab Republic)

Research conducted in 1982–1983 identified more than 30 thermal springs, with temperatures between 30 and 60°C, in the regions of the Western, Eastern and Southern Escarpment. The areas around Manakha and between Dhamar and Rada, north and south of Hammam Ali (District of Dawran'Anis), seem to hold the greatest promise for exploitation of geothermal resources. A preliminary study, including the drilling of a few wells, has been carried out in the Dhamar–Rada region.

Iran

A reconnaissance study was conducted in the north-western part of the country in 1975. Four zones were identified as being of major interest: Damavand, Sabalan, Sahand and Maku–Khoy. Until 1978 more detailed studies were carried out in these four areas, with encouraging results in Sabalan area in particular.

Malaysia

Preliminary reconnaissance work has been carried out on the geothermal resources of Sabah.

Bhutan and **Korea** are also of geothermal interest.

AMERICAS

Mexico

Background information

Surface area: 1,972,547 km^2
Population: 75,567,000 (1984)
G.N.P. per capita: 2060 U.S.$ (1984)
Total electric capacity installed: 23,386 MW (1984)
Total electricity generated: 87,083,000,000 kWh yr^{-1} (1984)

Mexico is located in a tectonically active zone with the result that its geological and structural conditions are extremely favourable to the occurrence of geothermal resources. The main geothermal regions are the Neovolcanic Belt, the Baja Peninsula and the Gulf of California, as well as other minor areas. Geothermal manifestations can be found throughout Mexico, especially in the central part of the country (Figs 21 and 22).

Geothermal R&D

Mexico is the third largest producer of electric energy from geothermal resources. This country has ten high enthalpy (170–350°C) and about 310 low-to-mid enthalpy (80–170°C) fields; most of the high enthalpy fields, except for Cerro Prieto, lie within a belt of recent volcanism extending from the Pacific Ocean to the Gulf of Mexico.

The fields under exploitation are Cerro Prieto and Los Azufres, with exploitation due to begin shortly at Los Humeros and La Primavera. Drilling has already begun or is due to begin in several other fields.

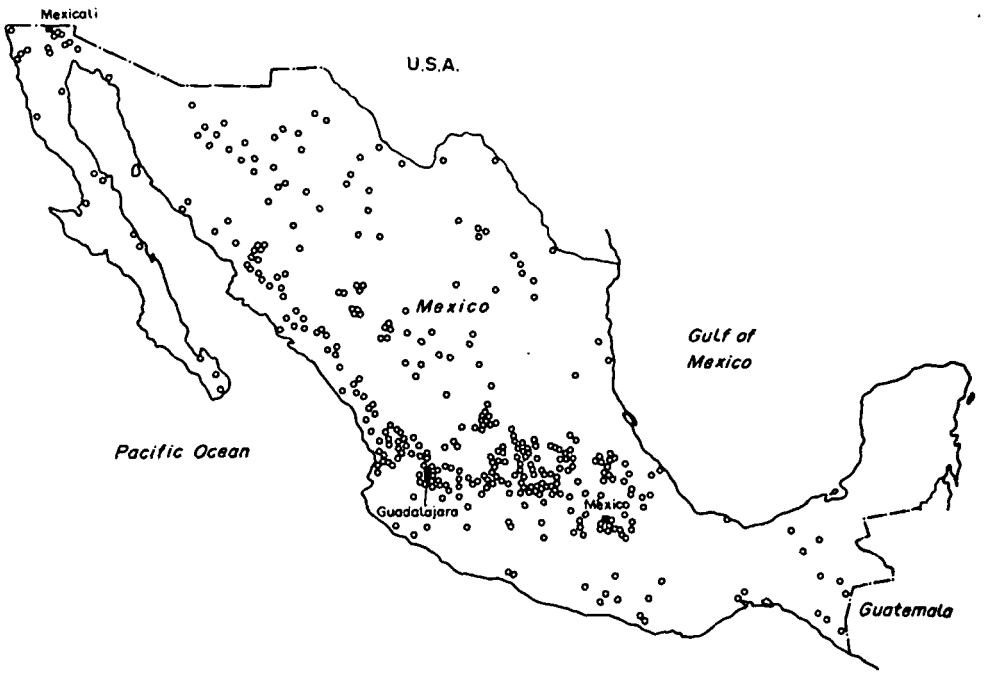


Fig. 21. Thermal manifestations in Mexico (from Hernandez-Galan, 1988).

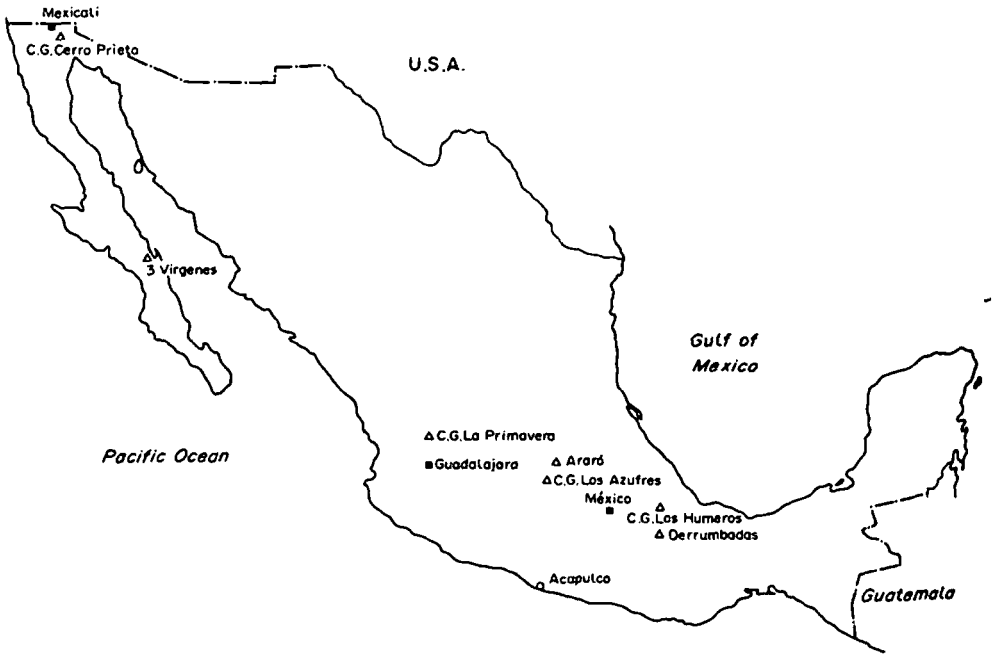


Fig. 22. Main geothermal fields in Mexico (from Hernandez-Galan, 1988).

The proven geothermal resources of Mexico, i.e. the estimated electric potential from fields already under exploitation or that have a number of wells drilled and a defined reservoir model (Cerro Prieto, Los Azufres, Los Humeros and La Primavera) amount to 1400 MW. The probable reserves are 4600 MW, based on an assessment of reservoir volume and thermal energy in fields such as Tres Virgenes, Ceboruca, Ararò, Ixtlan and Los Negritos. The possible reserves, estimated from surface activity in 3500 thermal manifestations, amount to 6000 MW.

Exploration began at Cerro Prieto in 1959 and the field began generating electricity in 1973. At present the installed capacity is 620 MW, with a further 220 MW programmed for 1992.

At Los Azufres 80 MW have already been installed and a further five 5 MW wellhead units are under construction.

Four 5 MW wellhead units are under construction for the Los Humeros field. A further 110 MW are scheduled for the early 1990s.

Two 5 MW wellhead units now under construction are destined for La Primavera field.

Geothermal applications other than power generation are limited in Mexico. Installation of a heat pump of 30 kW is being considered at Los Azufres and feasibility studies have been made on the use of geothermal brines in refrigeration schemes. An analysis has also been made of the feasibility of utilizing 156°C brines separated in Cerro Prieto to heat the water for catfish and shrimp culture ponds using specially designed heaters to avoid scaling on their heat transfer surfaces. No further action has so far been taken as regards this scheme.

Installed geothermal plants

Electric

Cerro Prieto I	Units 1–4	4 × 37.5 MW
	Unit 5	30.0 MW
Cerro Prieto II	Units 1–2	2 × 110 MW
Cerro Prieto III	Units 1–2	2 × 110 MW
Los Azufres	WH units 1–6	6 × 5.0 MW
	Tejamaniles 1	50 MW
Total		700 MW

Main sources of information

Di Pippo, R. (1986) Geothermal power, worldwide status 1986. *Bull. GRC* **15**, 9–18.
Hernandez-Galan, J. L. (1988) Small geothermal schemes. The Mexican experience. *Proc. UNITAR/UNDP Workshop on Small Geothermal Resources, Pisa, 1987. Geothermics* **17**, 303–309.
Hernandez-Galan, J. L. (1988) Personal communication.
Hernandez-Galan, J. L. and Gutierrez Ramirez, R. (1986) Geothermal energy in Mexico. Its utilization and research. *U.N. Workshop on the Development and Exploitation of Geothermal Energy in Developing Countries, Reykjavik*, DTCD/NRED/CTP/19, p. 15.

Guatemala

Background information

Surface area: 108,889 km^2
Population: 7,045,916 (1979)
G.N.P. per capita: 1120 U.S.$ (1984)
Total electric capacity installed: 775 MW (1984)
Total electricity generated: 1,625,000,000 kWh yr^{-1} (1984)

Guatemala has 35 volcanoes and an intense volcanic activity. The volcanic highlands, where most of the geothermal resources are located, lie in the southern and south-western parts of the

country. In the 23 areas that have been studied, the estimated reservoir temperatures range from 140 to 300°C. The two most promising areas are Zunil (8 km south of Quezaltenango) and Amatitlan (25 km south of Guatemala City).

Geothermal R&D

The reconnaisance studies defined the boundaries of 13 priority areas with hydrothermal manifestations. The areas considered worthy of further investigation were Amatitlan, Zunil, San Marcos, Tecuamburro and, in second priority, Los Achiotes and Moyuta.

The first prefeasibility studies, between 1975 and 1978, were carried out in Zunil and Moyuta. These investigations led to a feasibility study for a 15 MW geothermal power-plant at Zunil. In the Amatitlan geothermal area the studies have reached the preliminary feasibility stage.

Moyuta is located in the eastern part of the country. The reconnaissance studies, started in 1972, led to the siting of two wells. Exploration was abandoned in 1976.

In Zunil I geothermal area the first reconnaissance studies were carried out between 1973 and 1977. Since 1977 prefeasibility studies were aimed at locating the geothermal reservoir. The most promising zone was identified and an exploratory drilling program was drawn up. Six exploratory wells were drilled, four of which produced a water/steam mixture or steam in commercial quantities. Production tests and reservoir simulation confirmed the feasibility of installing a geothermal power-plant in this field.

In Zunil II field, located near the previous area, studies have only just begun. Apart from generating electricity, this field is scheduled to feed an experimental plant for the dehydration of vegetables, using the heat of the fluid from one of the slim holes.

In the Amatitlan area research began in 1977. So far seven slim boreholes have been drilled.

Reconnaissance studies have also been conducted in the areas of Tecuamburro and San Marcos, giving satisfactory results.

Main source of information

Caicedo Anchissi, A. (1988) Direct application of geothermal energy for process heat in Guatemala. *Proc. UNITAR/UNDP Workshop on Small Geothermal Resources, Pisa. 1987, Geothermics* 17, 311–318.

El Salvador

Background information

Surface area: 21,041 km^2
Population: 4,609,478 (1979)
G.N.P. per capita: 710 U.S.$ (1984)
Total electric capacity installed: 500 MW (1984)
Total electricity generated: 1,684,000,000 kWh yr^{-1}(1984)

The abundant geothermal resources of El Salvador are distributed all over the country (Fig. 23). There are three main geological units, trending approximately east–west: a volcanic system of Tertiary age in the north, a central graben and a southern volcanic system of Quaternary age that is still active in places. More than 70 areas of surface thermal activity associated with these structural features have been identified.

Geothermal R&D

Systematic exploration began in 1966 and led to the identification of the Ahuachapan field, whose first geothermoelectric plant (30 MW) began operating in 1975. One year later the capacity had doubled and by 1980 a total of 95 MW had been installed, supplying 25–35% of the

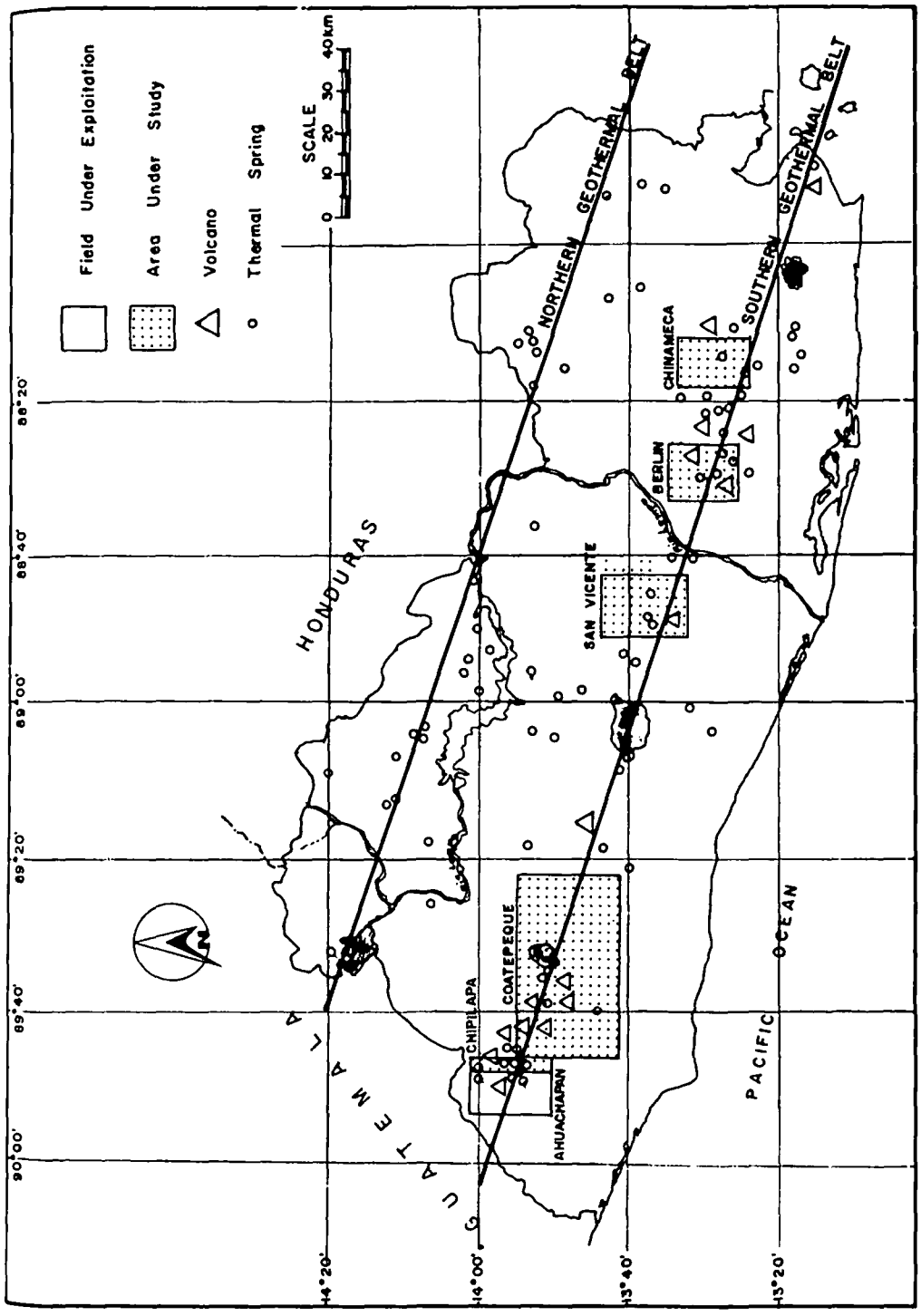


Fig. 23. Main geothermal prospects in El Salvador (from Campos, 1988).

country's total electric production. Over-exploitation has led to steep declines in the pressure and temperature of the fluid produced. Reinjection managed to stabilize fluid pressure but two badly sited injection wells had an adverse effect on temperature. Reinjection was thus abandoned in 1983. The Ahuachapan power-plant now operates at 60% of its capacity. A reassessment and reinjection programme and an adequate model of the field are now under study and should help to optimize field management.

Following the development of the geothermal resources at Ahuachapan, exploration was extended to other areas. The most promising for electric energy production were Berlin, Chipilapa and San Vicente and, subordinately, Chinameca. Exploratory studies are now in progress in the new area of Coatepeque.

An intensive programme initiated at Berlin in 1987 will lead to the installation of two 5 MW wellhead back-pressure turbogenerators, which will be commissioned in late 1988. These units will be supplied by two of the five deep wells drilled as part of the feasibility studies of 1976–1980. Two other wells could be put into production by stimulation, and their fluid added to some excess steam that is already available. In this liquid-dominated geothermal field, with reservoir temperatures of about 300°C , studies have been conducted since 1987 to define the drilling area and a large-scale exploitation programme.

At Chipilapa an area of approximately 12 km^2 has been identified for an accelerated exploratory programme. The feasibility studies should be completed in the short-term, after which some eight wells (exploration, production and reinjection) will be drilled to install two 5 MW wellhead units by 1989 and to continue to full development of this field.

Geothermal exploration began at Coatepeque in 1986, covering an area of approximately 1000 km^2. This project includes the drilling of four wells to depths of about 400 m.

The San Vicente geothermal field was identified during the exploratory studies in the period 1976–1980. The well San Vicente 1 crossed a 230°C reservoir to a depth of 1300 m. Two wells drilled at Chinameca to depths of 760 and 2500 m found temperatures below 200°C due to abnormal temperature inversions, thus relegating the project to second priority. No work is now being done at San Vicente and Chinameca, but they will be reconsidered in the future.

Installed geothermal plants

Electric

Ahuachapan	Units 1, 2	2 × 30 MW
	Unit 3	35 MW
Total		95 MW

Main source of information

Campos, T. (1988) Geothermal resources of El Salvador. Preliminary assessment. *Proc. UNITAR/UNDP Workshop on Small Geothermal Resources, Pisa, 1987. Geothermics* **17**, 319–332.

Honduras

Background information

Surface area: 112,088 km^2
Population: 4,372,000 (1985)
G.N.P. per capita: $700 U.S. (1984)
Total electric capacity installed: 285 MW (1984)
Total electricity generated: 1,060,000,000 kWh yr^{-1} (1984)

Fig. 24. Geothermal prospects in Honduras (from Flores, 1986).

Honduras lies on the trailing edge of the Caribbean plate, east of the Cocos plate. Subduction of the Cocos Plate beneath the Caribbean Plate has created the volcano–tectonic conditions necessary for the development of widespread positive thermal anomalies (Fig. 24).

Geothermal R&D

In 1980 an inventory of the thermal springs in Honduras was completed, and subsequently six geothermal sites were selected: Platanares, San Ignacio, Azacualpa, Pavana, La Cliba Region and El Olivar, for detailed hydrogeological investigations.

As Platanares was clearly identified as the best site in Honduras due to subsurface temperatures of an estimated 225°C, a programme of detailed studies was implemented: geological, geophysical and geochemical surveys and drilling of boreholes to an average of 570 m.

The Platanares system consists of two reservoirs: a shallow one with temperatures around 160–165°C and a deeper reservoir with temperatures of 225–240°C. Extrapolation of the geothermal gradient measured in the second borehole (PLT6-2) suggested that a temperature of 225–240°C occurs at a depth of about 1.5 km within the deeper system.

Main sources of information

Arevalo, Y. and Navarrete, N. (1988) Personal communication.
Flores, W. S. (1986) Geothermal project of Honduras. Current status. *U.N. Workshop on Development and Exploitation of Geothermal Energy in Developing Countries, Reykjavik*, DTCD/NRED/CTP/15, p. 10.

Nicaragua

Background information

Surface area: 139,000 km^2
Population: 3,217,700 (1985)
G.N.P. per capita: 870 U.S.$ (1984)
Total electric capacity installed: 394 MW (1984)
Total electricity generated: 973,000,000 kWh yr^{-1} (1984)

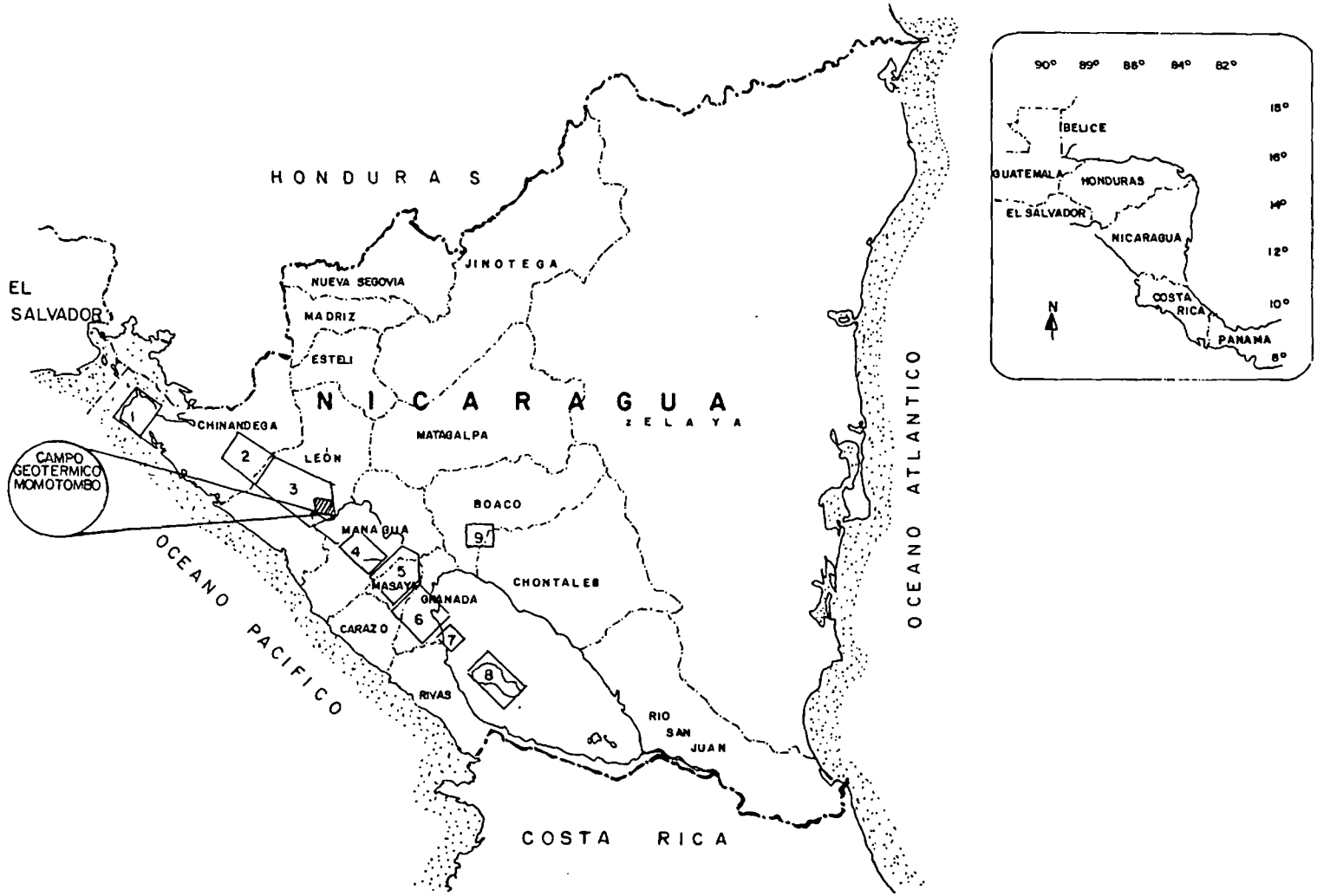


Fig. 25. Areas of geothermal interest in Nicaragua (from Martinez Tiffer *et al.*, 1988). (1) Cosiguina volcano, (2) San Cristobel–Casita volcano, (3) San Jacinto, El Hoyo, Momotombo–Galan, (4) Managua–Chiltepe, (5) Masaya–Titipapa, (6) Lapoyo–Mombacho volcano, (7) Zapatera Island, (8) Ometepe Island, (9) Las Lajas.

The western sector of this country is characterized by a chain of active volcanoes (Cordillera Los Marriabos). Along this belt of active volcanoes, explosion craters, scoria cones, etc. lie the most interesting geothermal areas (Fig. 25).

Geothermal R&D

Geothermal reconnaissance studies of this country began in 1966. Between 1969 and early 1971 more detailed surveys were conducted in the western part of Nicaragua, indicating that the most promising areas were Momotombo and San Jacinto. The existence of these two fields, covering an area of 10 and 7 km^2 respectively and with reservoir temperatures estimated in the order of 230°C, was confirmed by studies in the period 1972–1973. Between 1974 and 1976 pre-feasibility and feasibility studies were completed in the Momotombo field for the installation of the first geothermoelectric power-plant. As part of these studies, 28 boreholes were drilled to depths between 320 and 2250 m, between 1975 and 1978. In 1980 a feasibility study was launched at Momotombo for a second geothermoelectric power-plant, similar in size and design to the first. Construction of this second plant began in 1985. In March 1981 construction began on the first (35 MW) plant, which was completed in 1983 and is now in operation.

In 1980 research was further extended in order to define the priority areas for later studies. The very high priority areas are, from north to south, Cosiguina, San Cristobal–Casita, San Jacinto–Galan, Apoyo–Mombacho. The high priority areas are, from north to south, Managua and Masaya–Tipitapa.

Installed geothermal plants

Electric

Momotombo	Unit 1	35 MW

Main sources of information

Martinez Tiffer, E. (1986) Operation of the Momotombo geothermal wells. *U.N. Workshop on the Development and Exploitation of Geothermal Energy in Developing Countries, Reykjavik*, DTCD/NRED/CTP/9, p. 6.

Martinez Tiffer, E., Arcia Lacayo, R. and Sabatino, G. (1988) Geothermal development in Nicaragua. *Proc. UNITAR/UNDP Workshop on Small Geothermal Resources, Pisa, 1987. Geothermics* 17, 333–354.

Costa Rica

Background information

Surface area: 51,100 km^2
Population: 2,416,809 (1984)
G.N.P. per capita: 1210 U.S.$ (1984)
Total electric capacity installed: 819 MW (1984)
Total electricity generated: 3,067,000,000 kWh yr^{-1} (1984)

The Republic of Costa Rica (Fig. 26) is characterized by many volcanoes, product of the interaction of the Cocos and the Caribbean tectonic plates. There are some potential geothermal reservoirs related to the two main volcanic ranges, the Guanacaste volcanic range and the Central volcanic range.

Geothermal R&D

In 1974 a reconnaissance study was made of the areas considered most favourable by virtue of their volcanic activity. Two years later a pre-feasibility study began in the Miravalles area in the Guanacaste volcanic range (north-western part of the country). The most important geothermal anomaly was identified at La Union–Las Hornillas–La Fortuna, on the southern skirts of the

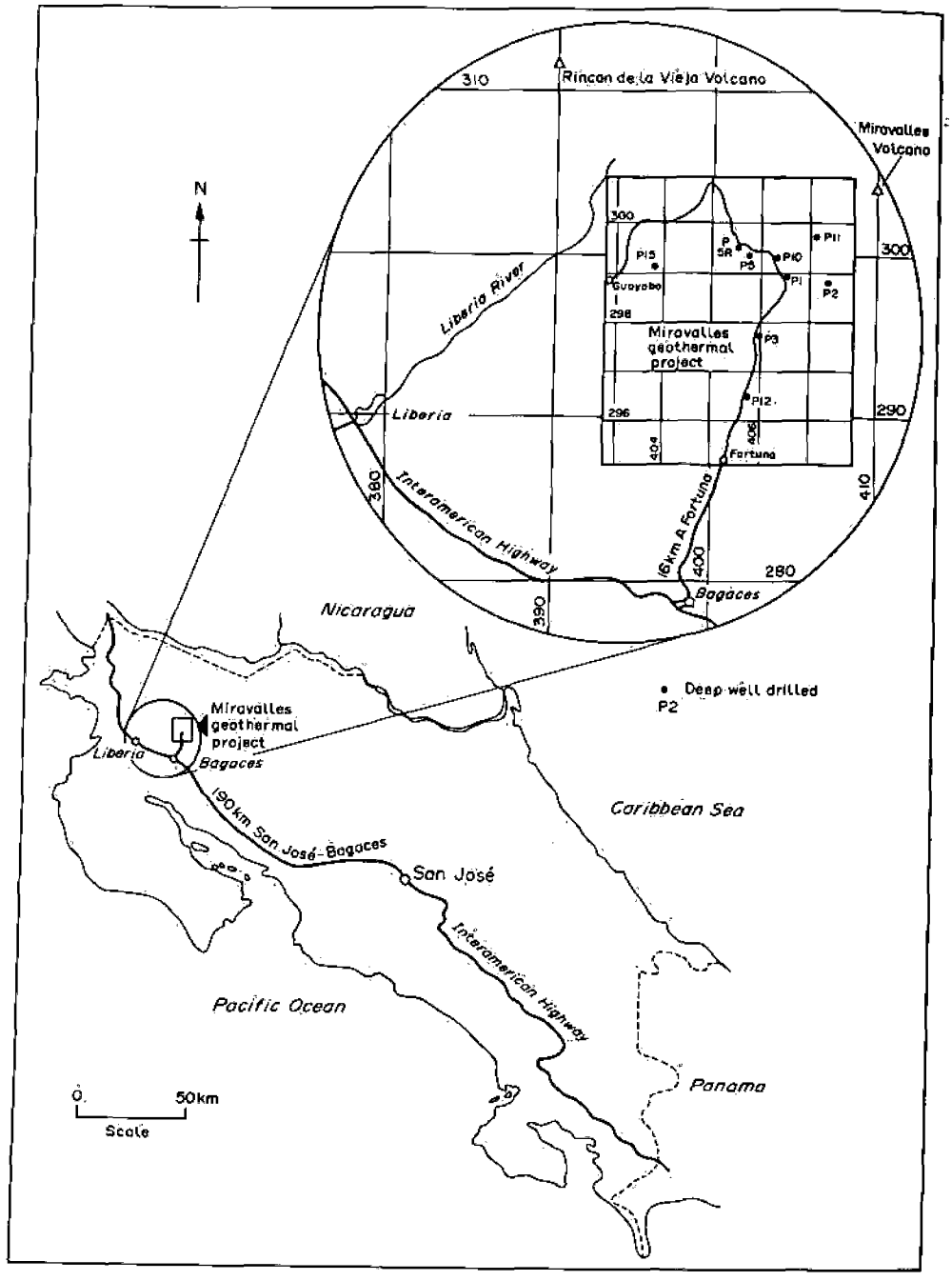


Fig. 26. Location of Miravalles geothermal field, Costa Rica (from Corrales, 1986).

Quaternary Miravalles volcano. Within the framework of the Miravalles Project, three wells were drilled in 1978–1979 and another six between 1984 and 1986. These nine wells, between 270 and 2000 m depth, have confirmed the existence of a reservoir with fluid temperatures ranging from 200 to 260°C. The fluid from these wells could feed a 37 MW geothermoelectric power-plant. The last phase of the project will include the drilling of another 16 wells for production and reinjection and the installation of a 55 MW power-plant, which should be commissioned by mid-1991.

Finally, in 1987 a detailed reconnaissance study began in the active volcanic belt, followed by a pre-feasibility study in the most favourable zone.

Main source of information

Corrales, M. F. (1986) Costa Rica, Country update report. *U.N. Workshop on the Development and Exploitation of Geothermal Energy in Developing Countries, Reykjavik*, DTCD/NRED/CFP/7, p. 6.

Panama

Background information

Surface area: 75,650 km^2
Population: 2,180,900 (1985)
G.N.P. per capita: 2100 U.S.$ (1984)
Total electric capacity installed: 879 MW (1984)
Total electricity generated: 2,360,000,000 kWh yr^{-1} (1984)

This country has widespread manifestations of Tertiary and Quaternary volcanic activity. The presence of magmatic chambers still at high temperatures has created thermal anomalies that are evidenced by numerous thermal springs (temperatures generally between 25 and 50°C).

Geothermal R&D

The geothermal reconnaissance studies of the Republic of Panama were directed at making a systematic evaluation of its geothermal potential. So far these studies have been conducted in areas that, according to preliminary surveys, contain reservoirs with high enthalpy fluids capable of producing electric energy. Exploratory work is in progress in El Valle de Anton, which appears to be the most promising area, in Citra–Calobre, Baru–Colorado, Isla de Coiba and Tonosi areas.

In El Valle de Anton area geological, volcanological, hydrogeochemical and geophysical studies have been completed. On the whole the results confirmed the existence of a commercially exploitable geothermal reservoir. The geochemical thermometers indicate temperatures of the order of 150–200°C for the deep fluids. The geothermal fluids in this zone, about 100 km from Panama City, could be exploited in various direct uses, such as drying of agricultural products, food processing, refrigeration, etc.

In the other areas mentioned above, studies are not so far advanced so that no conclusions can yet be drawn, although they do seem to be promising.

Main source of information

Ramirez, A. H. (1988) Present status of geothermal reconnaissance studies in the Republic of Panama. *Proc. UNITAR/UNDP Workshop on Small Geothermal Resources, Pisa, 1987. Geothermics* 17, 355–367.

Colombia

Background information

Surface area: 1,141,748 km^2
Population: 26,526,000 (1985)
G.N.P. per capita: 1370 U.S.$ (1984)
Total electric capacity installed: 6150 MW (1984)
Total electricity generated: 27,800,000,000 kWh yr^{-1} (1984)

Colombia lies within a tectonically active belt running along the western side of the continent. It contains many geothermal areas, with thermal manifestations in the three Cordilleras trending roughly north to south (Fig. 27).

Geothermal R&D

The reconnaissance studies have concentrated on the two zones considered of greatest interest: in the middle of the Colombian Central Cordillera (Ruiz Massif) and in the southern Volcanic Cordillera (Cauca and Narino). Research in the latter zone has also indicated the importance of the sector bordering on Ecuador (Tufino–Chiles area), where Colombia–Ecuador joint research is now being carried out.

Other zones identified by the reconnaissance studies are: Azufral de Tequeres (where research is due to begin soon), Cunasol, Dona Juana, Galeras, Puracé, Sotarà and Huila, located in the Southern Cordillera, and Paipa, in the Eastern Cordillera. Altogether these zones cover a surface area of some 10,000 km^2.

Pre-feasibility studies have been conducted in some preferential areas of the central part of the country (Ruiz Massif), indicating that future activity should be concentrated in the areas of Nereidas, Laguna del Otun and Volcan Machin.

Pre-feasibility studies are also in progress in some areas of the southern sector (Chiles–Cerro Negro).

The estimated temperatures of the potential reservoirs in all these areas are generally above 200°C.

Main sources of information

Barberi, F., Cataldi, R. and Merla, A. (1986) Resources and development perspectives of geothermal energy in Central and Southern America. *Proc. Cong. on Heat Flow and Geothermal Energy, Guaruja*, in press.
Lozano, E. (1988) Hot springs and geothermal energy in Colombia. *Proc. UNITAR/UNDP Workshop on Small Geothermal Resources, Pisa, 1987. Geothermics* **17**, 377–380.

Ecuador

Background information

Surface area: 283,561 km^2
Population: 8,008,474 (1982)
G.N.P. per capita: 1220 U.S.$ (1984)
Total electric capacity installed: 1837 MW (1984)
Total electricity generated: 4,400,000,000 kWh yr^{-1} (1984)

The Ecuadorian Andes are characterized by recent and present-day tectonics and volcanic activity. Along a N–S trending belt in the western part of the country are numerous surface manifestations and the studied geothermal areas (Fig. 28).

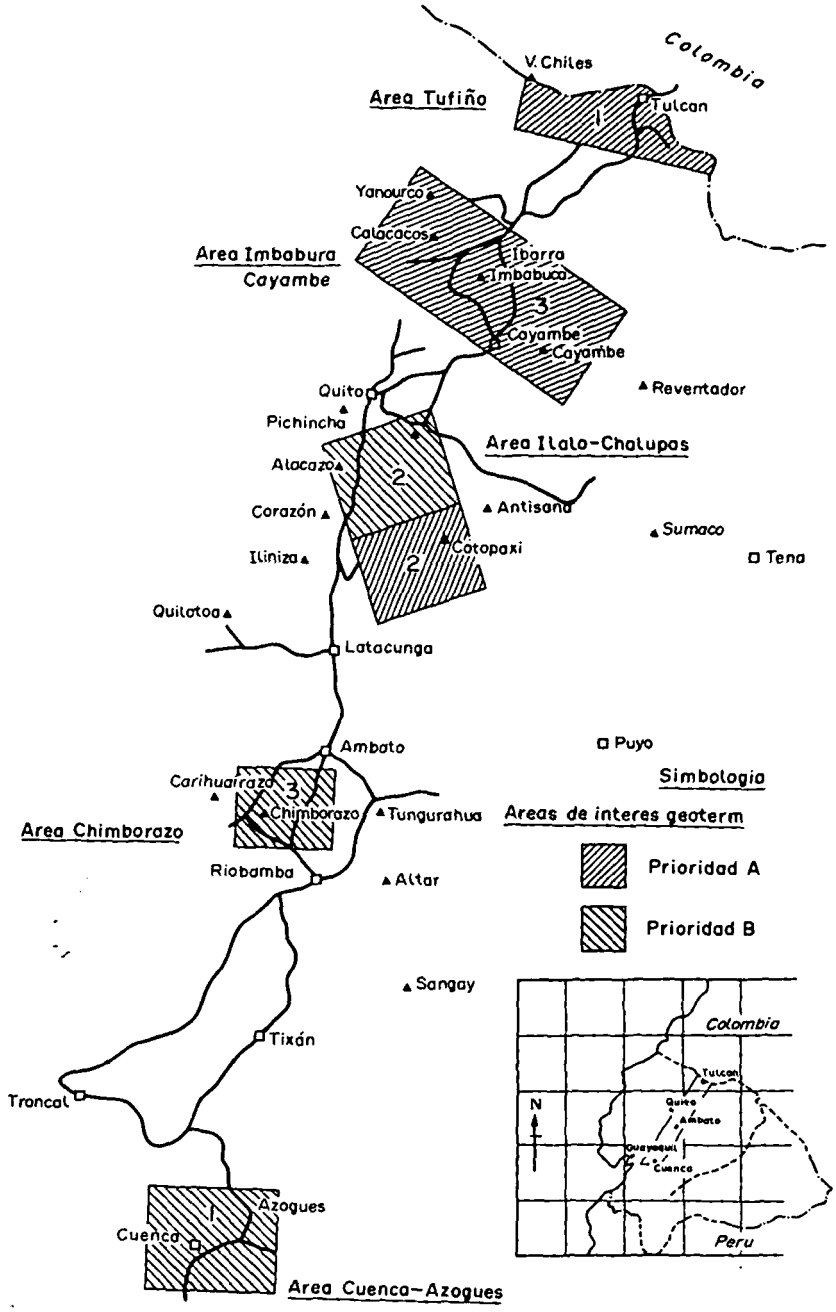


Fig. 28. Distribution of geothermal areas of interest in Ecuador (from Sandoval, 1986).

Geothermal R&D

Between late 1978 and 1980 a reconnaissance study was carried out in Ecuador to define the priority geothermal areas. From north to south these are: Tufino, Imbabura–Cayambe and Ilalo–Chalupas (southern sector). Of secondary priority are, from north to south, Ilalo–Chalupas (northern sector), Chimborazo and Cuenca–Azogues.

Tufino zone, located astride the Colombia–Ecuador border, has been studied as part of a joint Columbian–Ecuadorian geothermal research programme covering a zone of some 2000 km^2. The pre-feasibility study of this area has recently been completed.

Main source of information

Sandoval, G. (1986) Present activity and future prospects of geothermal energy in Ecuador. *U.N. Workshop on Development and Exploitation of Geothermal Energy in Developing Countries, Reykjavik,* DTCD/NRED/CTP, p. 8.

Venezuela

Background information

Surface area: 912,050 km^2
Population: 17,317,700 (1985)
G.N.P. per capita: 3220 U.S.$ (1984)
Total electric capacity installed: 12,499 MW (1984)
Total electricity generated: 44,330,000,000 kWh yr^{-1} (1984)

The geothermal manifestations (thermal springs with temperatures in some cases at near boiling point) are located mainly in Sucre State.

Geothermal R&D

During the last few years an inventory has been compiled of the geothermal resources of central and eastern Venezuela. On the basis of the results of this inventory, the El Pilar–Mundo Nuevo area, in central Sucre State, was selected as being of highest priority. This is the area with the highest density of surface manifestations, with several boiling springs. Three main geothermal systems have been identified in this area: El Salvaje–Buena Esperanza, El Palmar–Aguas Calientes–Los Chirriaderos and Mundo Nuevo–Los Mereyes. The geochemical thermometers indicate deep reservoir temperatures between 260 and 300°C for the first system, between 250 and 280°C for the second and between 170 and 200°C for the third.

Should future research be successful, then the hottest geothermal fluids could be used to generate electricity and the excess lower temperature fluids utilized in fish meal and timber drying, in fast drying of farm products and in evaporation and sugar refining.

Main source of information

Hevia Almandoz, A. and Jauregui Rojas, J. (1988) Geothermal prospects in the central region of Sucre State, Venezuela. *Proc. UNITAR/UNDP Workshop on Small Geothermal Resources, Pisa, 1987. Geothermics* **17**, 369–374.

Peru

Background information

Surface area: 1,285,215 km^2
Population: 17,005,210 (1981)
G.N.P. per capita: 980 U.S.$ (1984)

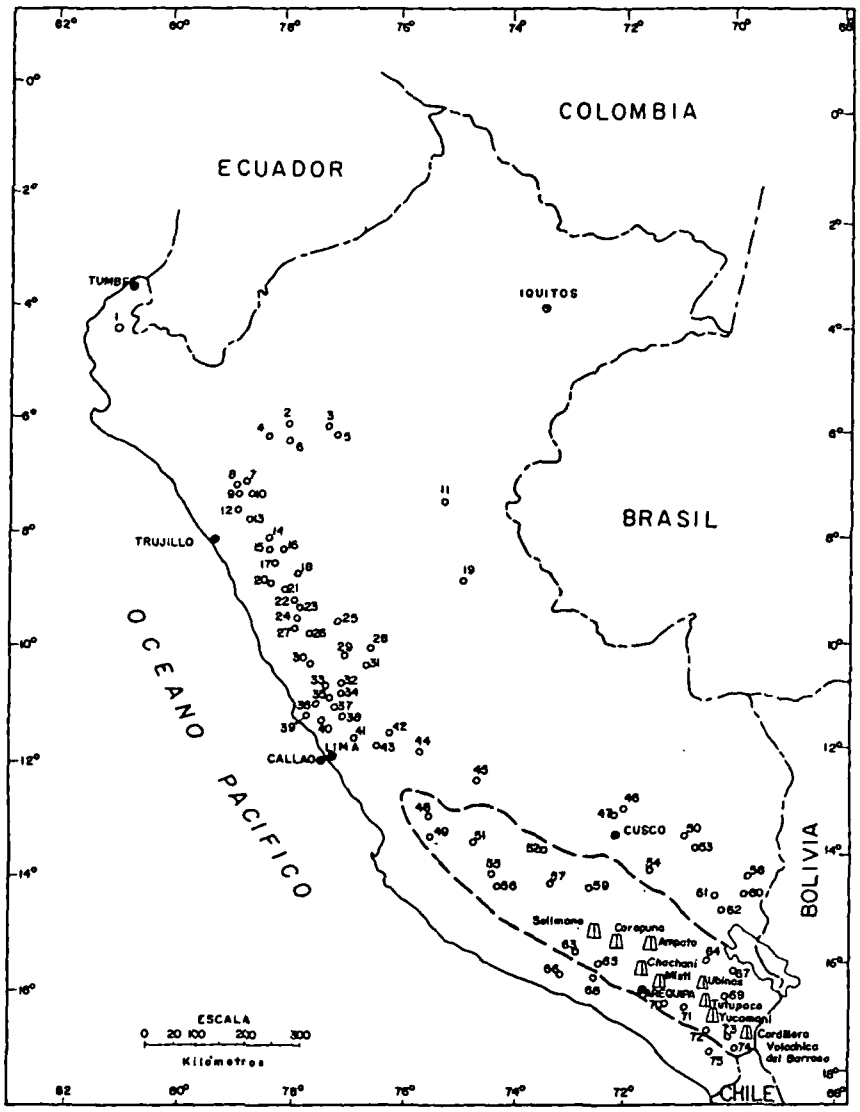


Fig. 29. Thermal manifestations in Peru (from Diaz Huaina, 1988).

Total electric capacity installed: 3167 MW (1984)
Total electricity generated: 11,769,000,000 kWh yr^{-1} (1984)

Thermal springs with temperatures between 20 and 92°C occur in correspondence to the western and eastern Cordilleras. The most interesting areas from the geothermal viewpoint are in the western and, in particular, the southern parts of the country, sites of an intense post-orogenic volcanic activity (Upper Tertiary and Quaternary) that led to the formation of the chain of volcanic cones of the western Cordillera (Figs 29 and 30).

Geothermal R&D

In 1978 a national inventory was made of the geothermal manifestations, which gave the first indication of the most promising zones.

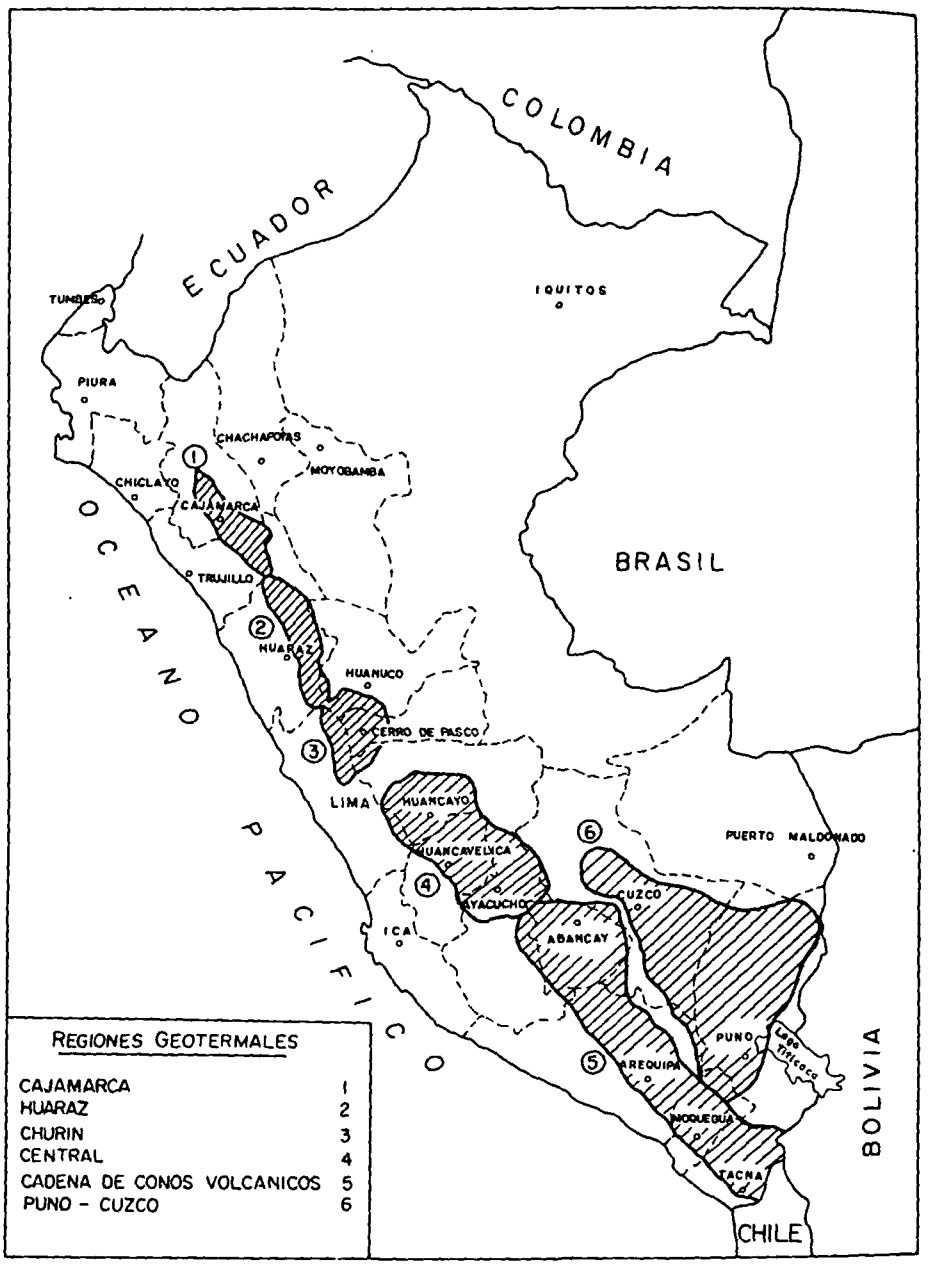


Fig. 30. Geothermal prospects in Peru (from Diaz Huaina, 1988).

Between 1979 and 1980 geothermal surveys were conducted in the south-western region, in the Departments of Arequipa, Tacna and Moquegua. In 1980 work began on three projects in the areas considered most promising: Centre–North, South Challapalca and South Arequipa. Pre-feasibility studies are scheduled for the last two areas in 1988. In the Centre–North project work began on a more accurate assessment of the resources in 1983, leading to the selection of the following priority zones divided into three groups: Group A, including the Callejon de

Huaylas area; Group B, including Otuzco and La Grama–Aguas Calientes; and Group C, Cajamarca–Banos del Inca.

The exploratory data available so far indicate the existence of geothermal potential in the area covered by the Centre–North and the South Arequipa projects. Consequently, the National Plan for the Expansion of Electric Frontier includes the installation of small (a few hundred kW) geothermoelectric power-plants in these areas, for the express benefit of their rural communities. The first stage of development of this project will be for the communities of Aquilina Banos, Ranhuas, Llacusbamba, Yanac, Ninabamba and Pocatqui (Province of Coronga, Department of Huaraz) which have no electricity supply.

Main source of information

Diaz Huaina, G. N. (1988) Potential for developing small geothermal power stations in Peru. *Proc. UNITAR/UNDP Workshop on Small Geothermal Resources, Pisa, 1987. Geothermics* **17**, 381–390.

Bolivia

Background information

Surface area: 1,098,581 km^2
Population: 6,252,700 (1984)
G.N.P. per capita: 410 U.S.$ (1984)
Total electric capacity installed: 566 MW (1984)
Total electricity generated: 1,695,000,000 kWh yr^{-1} (1984)

The Andean region of Bolivia (south-western sector) has numerous thermal springs with temperatures between 20 and 86°C and geological conditions that are favourable for geothermal energy exploitation (Fig. 31). The western Andes, with their Tertiary and Quaternary volcanic activity, are particularly interesting from this viewpoint.

Geothermal R&D

Preliminary studies and assessments made between 1975 and 1976 indicated that the most important geothermal resources were located in the Andean Region, i.e. in the western Andes (Cordillera Occidental), the Highlands (Altiplano) and the eastern Andes (Cordillera Oriental). Designated as priority areas were the Rio Empexa Valley and Laguna Colorada areas. In 1979 a pre-feasibility study confirmed that in both areas there are commercially exploitable geothermal systems. The results of exploration until 1982 indicated that the highest priority should be given to the Sol de Mañana and Cerro Apacheta zones in the Laguna Colorada area. Three or four deep wells were scheduled for drilling in the period 1987–1988. One exploratory well (1600 m) has already been drilled in the Cerro Apacheta zone, with temperatures measured at about 200°C, although permeability is not too high. Drilling of the second programmed borehole will begin in the Sole de Mañana zone in early autumn 1988. If successful, there are plans to install a small power-plant to supply electricity to the mining industry in the Laguna Colorada area.

In the Rio Empexa Valley, which is also considered very interesting, further studies are needed before proceeding with exploratory drilling.

Geochemical studies are also under way in Sajama, as part of a Latin-American interregional geothermal study programme.

So far the hot fluids have been used in Bolivia for bathing, but in view of local climatic conditions and the presence of the geothermal resources in mining areas, these fluids could

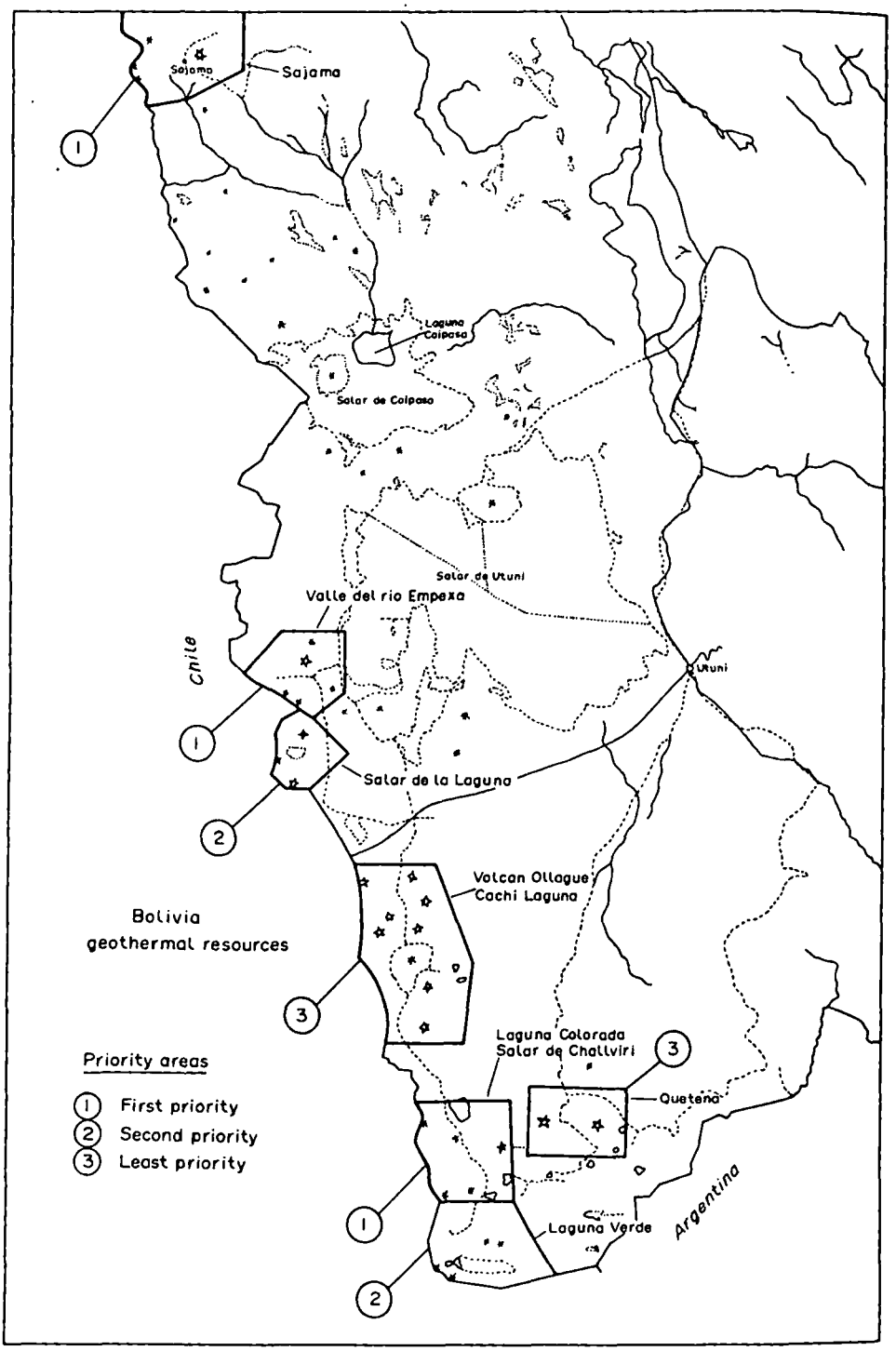


Fig. 31. Geothermal resources in Bolivia (from Rico Calderon, 1986).

probably be conveniently utilized in direct heat applications (space-heating, domestic water supplies, etc.), as well as for generating electricity.

Main sources of information

Paz Claure, O. L. (1988) Geothermal resources in Bolivia. *Proc. UNITAR/UNDP Workshop on Small Geothermal Resources, Pisa, 1987. Geothermics* **17**, 391–399.

Rico Calderon, G. (1986) Geothermal development in Bolivia. *U.N. Workshop on the Development and Exploitation of Geothermal Energy in Developing Countries, Reykjavik*, DTCD/NRED/CTP/5, p. 6.

Chile

Background information

Surface area: 756,626 km^2
Population: 11,878,419 (1984)
G.N.P. per capita: 1710 U.S.$ (1984)
Total electric capacity installed: 3355 MW (1984)
Total electricity generated: 13,490,000,000 kWh yr^{-1} (1984)

Numerous thermal springs, some at boiling point, are located along the Andean Cordillera parallel to the eastern border of the country; these springs are associated with Quaternary volcanism (Fig. 32). Volcanic activity and relative geothermal systems are mainly controlled, as in the other Andean countries, by the subduction processes of the oceanic plates beneath the South American plate.

Geothermal R&D

The inventory of the thermal manifestations and the preliminary investigations covered an area of more than 100,000 km^2 in the provinces of Antofagasta and Tarapaca in northern Chile.

Some 20 zones have been identified as of potential interest: Jurase, Untupuyo, Churiguaya, Surire, Polloquere, Chucmillani, Berenguela, Quitariri, Puchuldiza, Chusmiza, Enquelca, Pampa Lirima, Colpagua, Manina, Pica, Acostàn, El Tatio, Alitar, Aguas Calientes, Tilopozo and Tusajto.

In some of the more promising zones, e.g. El Tatio, Puchuldiza, Surire and Pampa Lirima, detailed reconnaissance and pre-feasibility studies have also been carried out.

Deep exploration and other activities relative to feasibility studies have been conducted only in the central part of the areas of El Tatio and Puchuldiza.

At least 13 wells have been drilled so far at El Tatio, to depths ranging between 600 and 1800 m. The maximum temperature measured in the reservoir (at around 1500 m) is 260°C. The flow rate of the fluid found so far would reportedly allow operation of a 15 MW power unit, but the potential of the field is probably much greater.

Six wells have been drilled to date at Puchuldiza, to depths ranging between 450 and 1150 m. The maximum temperature recorded in the reservoir (at around 1000 m) is 200°C. The estimated geothermoelectric potential of this field, which is thought to cover an area of more than 100 km^2, is between 120 and 180 MW.

In view of the geographic and socio-economic conditions of Chile, and the distribution and quality of its geothermal resources, the main utilization in northern Chile will probably be the generation of electricity. This would also lead to interesting industrial activities such as the recovery of chemicals from evaporite deposits and from the brines of salars, sulfur refining, etc. In central–south Chile, in addition to power generation by small units for rural communities and industry, the most suitable application of geothermal energy is in agriculture, aquaculture and animal husbandry.

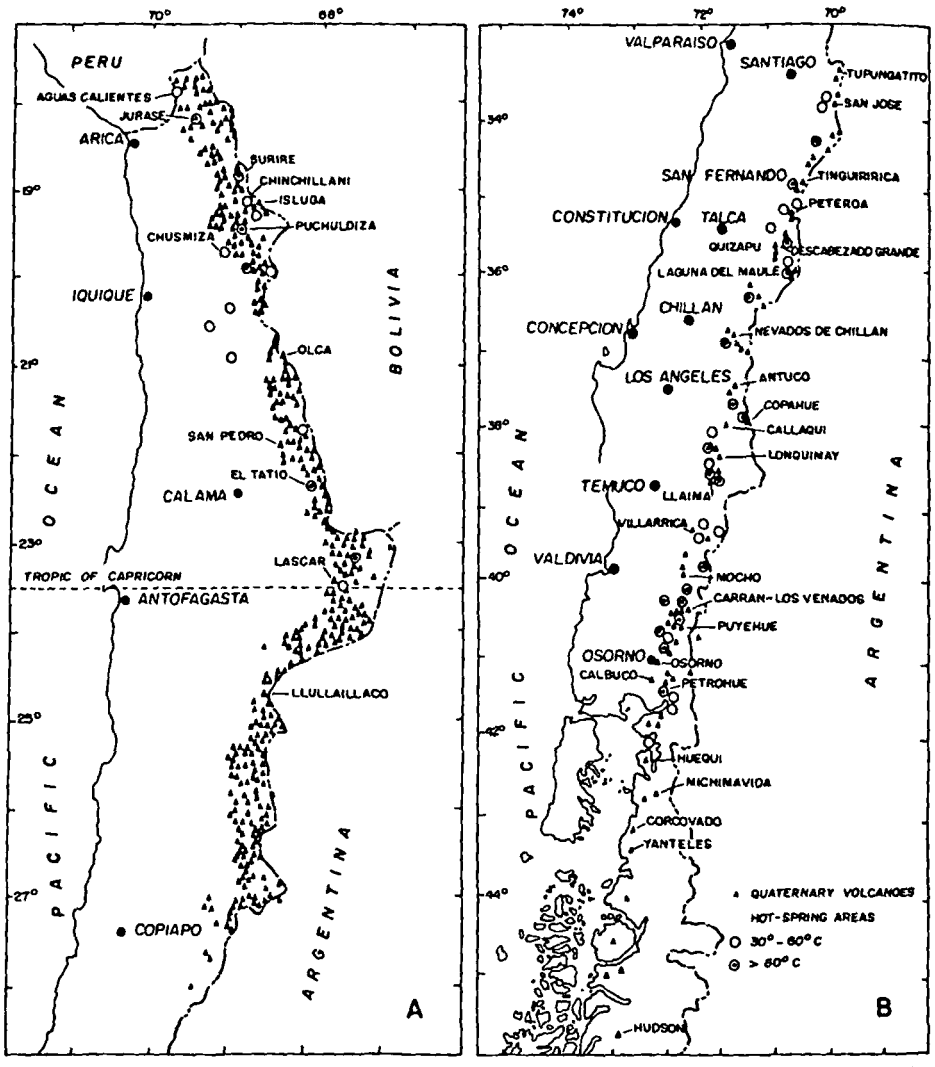


Fig. 32. Location maps of the Quaternary calc-alkaline volcanoes and hot spring areas A.—Northern Chile (including Pliocene volcanoes) and B.—Central-South Chile. Only active volcanoes in historic times are named. ▲ Quaternary volcanoes; ○ Hot spring areas 30–60°C; ⊙ >60°C.

Main sources of information

Barberi, F., Cataldi, R. and Merla, A. (1986) Resources and development perspectives of geothermal energy in Central and South America. *Proc. Cong. on Heat Flow and Geothermal Energy, Guarujà*, in press.

Lahsen, A. (1988) Chilean geothermal resources and their possible utilization. *Proc. UNITAR/UNDP Workshop on Small Geothermal Resources, Pisa, 1987. Geothermics* 17, 401–411.

Argentina

Background information

Surface area: 2,780,092 km^2
Population: 27,947,446 (1980)
G.N.P. per capita: 2230 U.S.$ (1984)

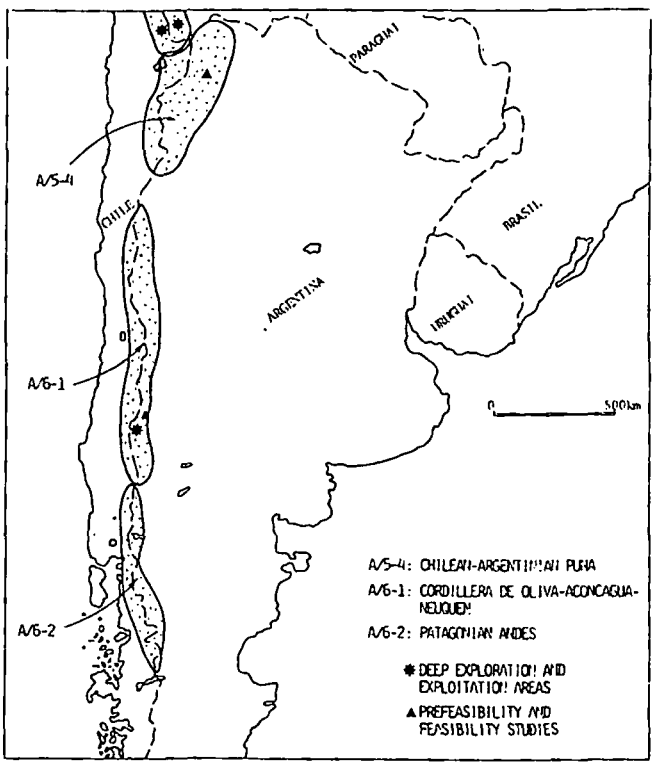


Fig. 33. Areas of geothermal interest in the Argentinian and Chilean Andes (from Barberi *et al.*, 1986).

Total electric capacity installed: 15,280 MW (1984)
Total electricity generated: 44,914,000,000 kWh yr^{-1} (1984)

Geothermal manifestations can be found in many parts of this country, especially the Andean and sub-Andean belt (Fig. 33). The most interesting areas from the geothermal viewpoint are Puna, the northern Cordillera, the central Cordillera, the southern Cordillera, the northern sub-Andean region, the Sierras Pampeanas and the southern Mendoza Region.

Geothermal R&D

The regional reconnaissance surveys and preliminary studies in the 1960s and 1970s led to the identification of the following most promising regions: Jujuy, Salta–Catamarca, Tinogasta, Iglesia, Tupungato, Sosneado, Chosmalal, Neuquen, Chubut, Santa Barbara, Metan, Belén, Famatina, Rio Hondo and Payun Matru.

Detailed reconnaissance studies in some of these regions have identified the following areas: Tuzgle (Jujuy), Copahue and Domuyo (Chosmalal) and El Ramal (Santa Barbara).

The pre-feasibility studies have been concentrated mainly on Copahue and Domuya areas and subordinately on Tuzgle.

A feasibility study has recently begun in the Copahue area and two wells have already been drilled, both productive, to depths of approximately 800 and 1200 m. Temperature in the reservoir is about 240°C. A small 600 kW binary pilot-plant installed in this area has recently begun producing electricity. A third well (COP 3) will be drilled in the next few months to a

scheduled depth of 1400 m. Field development in the near future will probably include the installation of a power-plant of at least 50 MW. The estimated potential, in terms of electric energy, of the Copahue field is reported to be some 44 billion kWh.

Installed geothermal plants

Electric

Copahue 0.6 MW

Main sources of information

Barberi, F., Cataldi, R. and Merla, A. (1986) Resources and development perspectives of geothermal energy in Central and South America. *Proc. Cong. on Heat Flow and Geothermal Energy, Guarujà*, in press.
Esteves, A. (1988) Personal communication.

Dominican Republic

Background information

Surface area: 48,442 km^2
Population: 5,648,000 (1981)
G.N.P. per capita: 990 U.S.$ (1984)
Total electric capacity installed: 960 MW (1984)
Total electricity generated: 4,009,000,000 kWh yr^{-1} (1984)

The central part of the Dominican Republic has been the site of volcanic activity from almost 2 million yr ago to recent times. There are numerous geothermal manifestations in this country, especially in correspondence to the main fractures.

Geothermal R&D

Geological, geochemical and geophysical investigations have revealed that the area most conducive to the development of a geothermal field is that east of Constanza, which is also the zone with the youngest volcanic activity. An exploratory well was drilled in this zone but the results are still under study. However, at the moment the situation seems promising.

Main source of information

Espaillat Lamarche, J. E. (1988) Personal communication.

Saint Lucia

Background information

Surface area: 616 km^2
Population: 113,409 (1980)
Total electric capacity installed: 16 MW (1984)
Total electricity generated: 68,000,000 kWh yr^{-1} (1984)

The island of St Lucia belongs to the Windward Islands in the Lesser Antilles. It is made up almost exclusively of products of volcanic origin, emplaced by several centres scattered over various localities. The presence of a shallow magmatic chamber has created a heat flow that is 6–7 times the mean terrestrial value and favourable conditions for the development of geothermal systems.

Geothermal R&D

In 1982 a detailed survey was made of an area of 70 km^2 in the Qualibou Caldera. The results indicated the existence of promising hydrogeological and thermal conditions and led to the construction of a preliminary model of the geothermal system. This model consists of a reservoir with fluids at temperatures of 220–250°C at a depth of 1000–1500 m and of a possible deeper reservoir with fluids of more than 350°C. Based on the results of these and subsequent studies, two wells were recently drilled to depths of about 2000 m. One well (Sulphur Spring) produces 50 t h^{-1} of dry steam at 280°C.

Main sources of information

Aquater (1988) Personal communication.

Gandino, A., Piovesana, F., Rossi, R. and Zan, L. (1984) Preliminary evaluation of Soufrière geothermal field—St Lucia (Lesser Antilles). *Proc. U.N. Seminar on the Utilization of Geothermal Energy for Electric Power Production and Space Heating, Florence*, EP/SEM.9/R.26, p. 10.

OTHER COUNTRIES (AMERICAS)

Haiti

Preliminary geothermal research has been conducted in various zones: Jeremie, Sources Chaude, Sources Pauntes and Los Pozos. Temperatures of 120–130°C have been calculated for the reservoir fluids in Los Pozos zone.

Dominica

A pre-feasibility study was carried out in three areas in 1981: Soufrière, in the southern part of the island, Wotten Wawen, near the town of Roseau in the central sector of the island and Boiling Lake and Desolation Valley zone, 5 km east of Wotten Wawen. Wotten Wawen is considered of priority interest, with temperatures of 230°C calculated for the deep fluids.

Grenada

Mt Saint Catherine area has been indicated as of possible geothermal interest.

Geothermal development could also be possible in **Cuba, St Kitts, Montserrat** and **St Vincent**.

COUNTRIES WITH MAJOR UNDEVELOPED GEOTHERMAL RESERVES
(Using presently commercial technology)

1. PROBABLY OVER 5,000 MW

- Ethiopia
- Indonesia
- Japan
- Kenya
- Philippines
- Mexico
- New Zealand
- USSR
- United States

2. PROBABLY OVER 1,000 MW

- Argentina
- Chile
- El Salvador
- Italy

3. PROBABLY OVER 500 MW

- Bolivia
- China
- Columbia
- Costa Rica
- Guatemala
- Iceland
- Nicaragua
- Papua New Guinea
- Tanzania
- Zaire

4. PROBABLY OVER 100 MW

- Canada
- Djibouti
- Ecuador
- Greece
- Peru
- Rwanda
- Turkey

5. STRONG POTENTIAL, UNCLASSIFIED BY SIZE

- Dominica
- Fiji
- France
- Honduras
- India
- Iran
- Montserrat/St. Kitts
- Portugal
- St. Lucia
- St. Vincent
- Solomon Islands
- Spain
- Thailand
- Taiwan
- Uganda
- Vanuata
- Yemen

6. LESSER POTENTIAL, UNCLASSIFIED BY SIZE

Algeria
Brazil
Burma
Burundi
Cameroon
Cape Verde
Chad
Comorro Islands
■ Czechoslovakia
Dominican Republic
Germany
Grenada
Haiti
■ Hungary
Malagasy Republic
Malawi
Morocco
Mozambique
Pakistan
■ Panama
Poland
Romania
Saudi Arabia
Somalia
Sudan
Tonga
Tunisia
Venezuela
Western Samoa
■ Yugoslavia
Zambia
Zimbabwe

MAJOR GEOTHERMAL DEVELOPMENT ASPIRATIONS
1991-2006

Philippines	- to 1,500 MW
Indonesia	- to 500 MW
Kenya	- to 500 MW
Mexico	- hundreds of MW
Japan	- hundreds of MW
El Salvador	- perhaps 200 MW
Costa Rica	- perhaps 200 MW

USA China New Zealand Iceland Guatemala Nicaragua Turkey	Significant Increments

St. Lucia Dominica Bolivia Canada Greece Portugal France Hungary Djibouti Honduras Ethiopia Thailand	Interest Expressed

COUNTRIES ALLOWING PRIVATE INVESTMENT IN GEOTHERMAL DEVELOPMENT

Operational

USA	- steam field, power plant, transmission
Japan	- " "
Canada	- steam field, power plant anticipated
Philippines	- " "
Indonesia	- " "
New Zealand	- steam field, power plant

Planned or Beginning

Mexico	- steam supply contract
Portugal	- power plant anticipated; possibly steam field
Guatemala	- proposed steam field and power plant
Costa Rica	- " "
Kenya	- " "
Dominica	- " "
St. Lucia	- " "
Turkey	- " "
Greece	- " "
Honduras	- " "
Hungary	- proposed power plant

CASE HISTORIES (OR FUTURE)

Kenya

Growth, debt, resource and experience
Acres report - 400 to 500 MW
Privatization
World Bank role
Bilateral project

Philippines

Critical situation: debt, resource, insularity, demand
PNOC, NPC and Unocal
Privatization
To 1,500 MW
WB & ADB

Mexico

CFE historically
Money squeeze
Private steam field operator
National patrimony
International loans

Indonesia

Oil exports
Demand, resource, insularity
Privatization
Pertamina, PLN, Unocal and Caltex
Bilateral and Multilateral

Azores

interchange → Nine islands total 900 km² with 258,000 people.
- An autonomous region of the Portuguese Republic.
- Plant on São Miguel, largest island (check further)
- Potential on Terceira has been explored w/ 240–250°C fluids.
- Other islands have potential as well.

more geology
- In Atlantic Ocean on a hot spot associated with a transform fault.

Argentina

- Area 2,771,300 km² with 30.5 million people (1985)
- 1982 installed elect capacity 13,460 MWe
  40% hydro, 36% steam, 14% gas turbine
  hydro potential 40,000 MWe
- Reservoir potential > 500 MW at Copahue, T ≈ 230°C. in west-central part of country. Unquantified at Jujuy in extreme northwest, near border with Bolivia.
- Copahue may be presented to IDB for financing
- 3 Other areas have been explored in cooperation with Japanese.

China

- Area 9.6 million km² with 1 Billion people.
- Installed capacity 72,360 MWe (1982), 31% hydro, 52% coal, 17% diesel.
- ~~Fuel~~ main geothermal areas: High temperature in Xizang (Tibet) province, where 10. MWe are produced at Yangbajing
- Identified potential is 220 MWe. Three other high-temp areas identified. Extensive low- to moderate-temperature potential, some good enough for binary plants.

Several other power plants in range 100–300 kWe.

Anil Malhotra -

1. Recent world Bank Development reports.

Also Gustavo Calderon - where are opportunities in Latin America for private company to come in?

Ecuador

- 283,561 km² with 9.4 million people (1985)
- Total installed elect capacity 1,200 MWe ; Hydro 19%, hydro potential 23000 MW ; Diesel 81%.
- Italians have been active
- Tufino area, along Ecuador–Colombia borders, has had pre-feasibility studies. volcanic rocks 3.5 ; comma
- Andes mountains are active volcanos.
- Chalupas area, 70 km South Quito in a Caldera
- Imbabura area 20 km north of Quito w/ volcanic dome.
- Some direct use potential.

El Salvador

- 21,476 km² with 4.8 million people
- Installed capacity 500 MWe, 57% hydro, hydro potential 1400 MW, 14% steam, 29% geothermal.
- 95 MWe at Ahuachapan. Other areas include Chipilopa (adjacent to Ahuachapan), Berlin, San Vicente, Chinameca and San Miguel.
- High potential in these areas for power plants.

John Weare 12 Dec 90

1. Lang-Standing program for Macintosh is available to potential users. He wants to hold workshop on this.

2. His model
   - gas/liquid equil in CH_4-CO_2-H_2O systems.
   - Solubility scaling answers
   - partial fugacity in mixed-gas systems.

3. Says we need to compare/validate various codes
   EPRI - developed GMIN an offshoot of his code.
   USGS - PHREEQE
   - SOLMINEQ

4. His code is in FASTRAN -- an array -- Is this avail on IBM-compat? MC 5E30?

5. Gas-Phase Models
   - Gas partial pressures determine Scale amounts
   - CO_2 abatement strategies
     Japanese want to liquify CO_2 and inject into deep ocean. It will form clathrate. How does it move? What will happen?

6. See his article in PAEROFI

7. Has found out that at high T-high P, gases any ideally. However, below critical point, esp at lower & lower, lower temps, they go non-ideal.

Greg Mines

- Ted says we must re-adjust objectives to make sure they can still be lived with.
- Ted wanted to see more airborne charts.

- Red Hill Geothermal - Subsidiary of Magma Power, operates Fenton, Klamath, Elk Ranch -

- McCabe plant at E mesa. Geo plants have now SCE operated.

w/ Marshall 12 Dec 90

1. Guy at Johns Hopkins —

2. MR's priority for John Moore:
   (a) get his progs together
   (b) get plugged in w/ Sol
   (c) more work on CH_4-CO_2-H$_2$O sys tm. has implications for CH_4-CO_2 geothermometer of Truesdell + Franco ~~Ohmoto~~.

w/ Marshall + Law —

1. Michael Lawson to MR
   - got funding for PBS docs + done edited versions for schools + commercial TV spots.

2. Law said check up thread —
   also Phillips - they sell polybutylated pipe for heat pumps. —

Notes @ DOC 13 Dec 90

1. AFDB/BD/WP/90/118
23 Oct 90

Title: Tanzania: Terms of Reference -- Feasibility Study for Caustic Soda/ Soda Ash Project Based on the Natural Soda Deposit at Lake Natron.

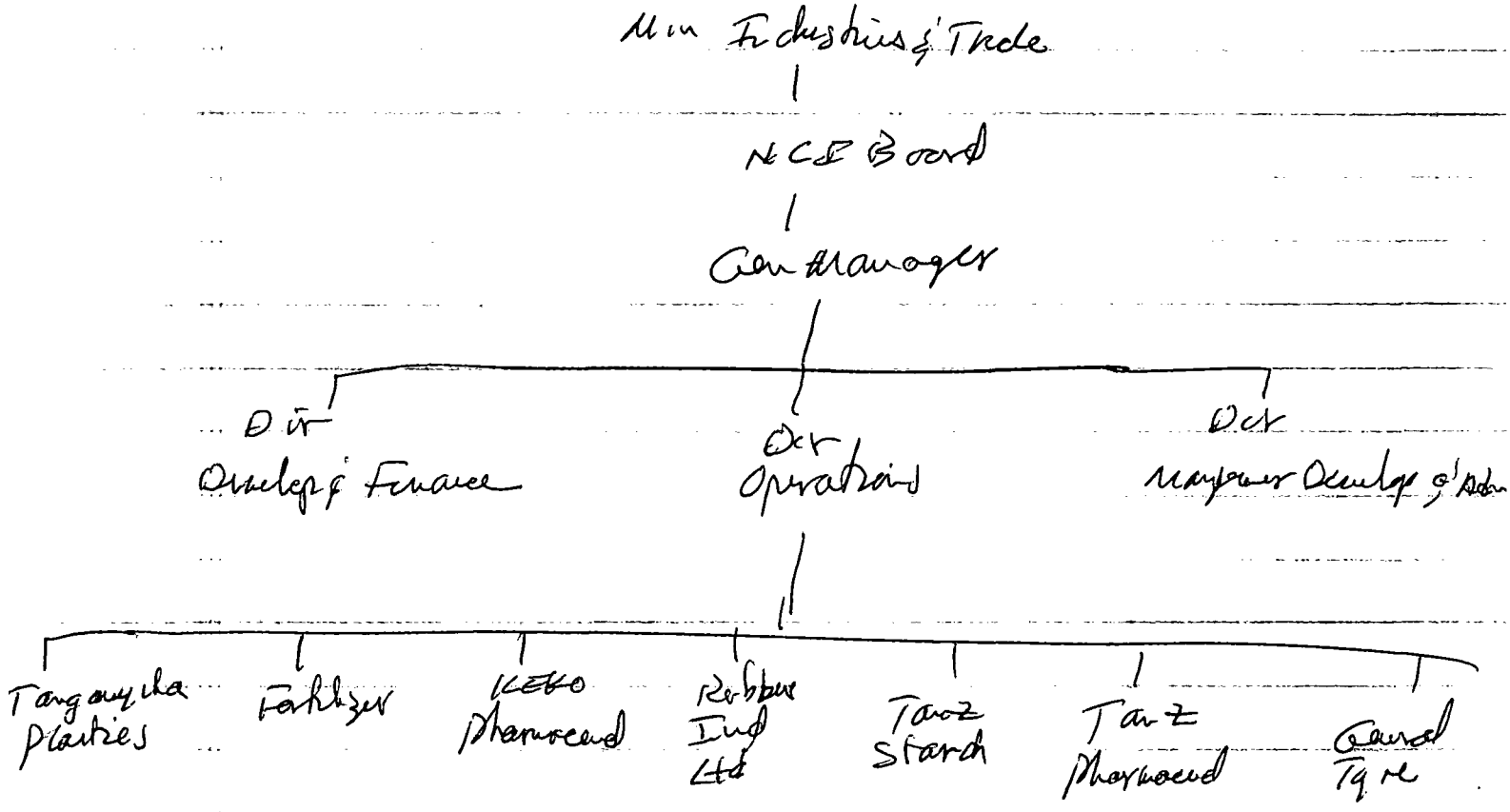
ADF number TAN/SII/90/01

Capitalized

(a) Description - determining technical, financial & economic viability & optimization of project so that findings will allow investment decision to be taken by Govt & other participants. Study cover market, marketing & distribution of caustic soda & soda ash in Tanzania & PTA/SADCC countries, project capacities, facilities, location & infrastructure, implementation arrangement & schedule, resources, production processes, capital & operating costs, equity financing & legal aspects, financial analysis, environmental reconnaissance.

TOR had nice, 2 page description of situation in Tanzania

(b) National Chemical Industries is implementing agency for project, & will supervise. NCI operates under ministry of Industries & Trade.



Study Cost FUA 808,000

Foreign Exch 762,600

Local Curr 45,400

ADELTAF Grant 762,600

Approval Nov 90

Est start date 2 mo from July 1991

- Single consulting firm or consortium of one prime w/ (1) engineering specialists & experienced in similar plants & designs, construction, operations (2) exploration of soda ash & caustic soda both Lead (water (3) ~~op~~ market & financial of experience in SA & S.

currency shilling 15.25 per USD

SOW

A. (c) review existing market data
(c) review existing supply & demand.

Act Cgm

A Report to Congress on the U.S. Renewable Energy Industry Sector; US DOC April 1987 -- grew out of PL 98-370 "The Renewable Energy Industry Development act of 1983."
-- says growth is recognized as needed

Also

⇒ International Directory of Electric utilities: ed Lee Catalano mc Graw-Hill, 1988

Also Loan Proposal for Financing of the Zanzebar - Pemba Power System Rehabilitation.

First good data --
Stanfeld, Goldsmith study ~~&~~ by Watkins

- got no soluty data

So this is just data

Zuni

1. Temps are consistent w/ present temps
So we can use fluid chem

2. Los ~~Azopes~~ was first model
-- tested at Zuni.

3. Fluid in 4-6 wt % CO_2 --
CO_2 Clathrate -- hydrated CO_2 ice
Pressure to trap >2% > hydrostatic
o occur mainly upper portions
(a) boiling -- trap CO_2 in dead end pockets
must carry the CO_2 -- lots evidence
for boiling
(b) pressure pulse due to Seismic
activity -- pressure exceeds than liquid
phase -- may not have to

a) Heat melts gradually
-- melts form in ~~[illegible]~~ minerals
already present.

low CO_2 gas on top

CO_2 > 3.8   Eq of 3.8, get
CO_2 clathrate.

CO_2 ≤ 3.8

reservoir // So reservoir is zoned