PAKISTAN

Asia-Pacific Energy Series Country Report

by

M. Nasir Gazdar, Ph.D.

Resources Programs
East-West Center
Honolulu, Hawaii

March 1992

Prepared for the
U.S. Department of Energy
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DOE/IE/10859--T1

DE92 008656

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EXECUTIVE SUMMARY

NATIONAL OVERVIEW

- Pakistan is South Asia's second largest country with a north-south length of 1,214 km, an east-west length of 933 km and an area of 796,095 km^2. It is situated in an arid and semi-arid climatic region, dominated by the southwestern summer monsoon, the northeast winter monsoon and by occasional low depressions from the Mediterranean.

- Pakistan is comprised of four provinces, Punjab, Sindh, the North West Frontier Province, and Baluchistan, with Islamabad as the capital. It has a constitutionally based, federal form of government. The federal government exerts substantial control over foreign affairs, economic affairs, defense, finance and currency, and most of the natural as well as human resources. It holds a monopoly in energy, heavy industries, commerce, communications, air and sea transportation, and the export and import of certain commodities.

- By population, Pakistan is South Asia's second largest country and the ninth most populated in the world: the population was 115 million in 1991. The United Nations Human Development Report has ranked Pakistan 120th among 160 nations in its human development index.

- Since independence in 1947, Pakistan has had a turbulent political history, including wars with India and East Pakistan, Bangladesh since 1972, and repeated internal military takeovers. In 1991, the Islamic Democratic Alliance was elected to government, with Nawaz Sharif as Prime Minister.

NATIONAL ECONOMY

- Since 1955, Pakistan's post-independence development pattern of strong centralized planning has been achieved through the regulation and control of private enterprise, state ownership, trade protectionism, and strict limits on foreign capital equity. Since November 1991, the Sharif administration has been overseeing Pakistan's shift to a market-oriented economy.

- Development investments are managed through five year plans (FYP). Pakistan is currently implementing its Seventh FYP (1988-93). Since 1988, Pakistan has

adhered to the International Monetary Fund's structural adjustment program which includes a sharp reduction in budget deficit; tight control on money supply; gradual import liberalization; and massive privatization of public assets in the nationalized sector.

- Analysis by sector for 1990-91 shows industrial sector growth at 6.4 percent; the agricultural sector increased by 2.7 percent; services at 4.8 percent; and wholesale and retail sector at 3.9 percent. Inflation ran at 13 percent. Military expenditure and debt servicing account for 88 percent of the 1991-92 budget.

- Pakistan's development efforts have been slow: gross domestic investment for 1970s and 1980s was extremely low. A combination of reduced multilateral and consortium assistance, lesser revenues, and problems of law and order will dent the recovery from the aftermath of the Gulf crisis.

ENERGY IN THE ECONOMY

- The government has recognized that increases in national economic growth have been associated with very high increases in energy consumption. The Seventh FYP includes a policy to make conservation and the efficient use of energy a common practice in all sectors and reduce power system losses.

- Pakistan's energy economy has been characterized by a policy of self-sufficiency and by the co-existence of public sectors units and semi-autonomous and private sector enterprises. Major energy projects traditionally have had a long gestation period and suffer from delays. Consequently, this has led to a high rate of growth in energy demand relative to economic output, low indigenous production, and deficiencies in capital stocks in the energy sector.

- In 1988-89 the total energy consumption was estimated at over 30 million tonnes of oil equivalent (mtoe). Commercial energy resources contributed 22.72 mtoe and the balance came from traditional sources: fuelwood, biomass and animal wastes. In 1990-91, oil accounted for 40 percent of energy use, while natural gas accounted for 35 percent, coal five percent, hydroelectric power 18 percent, nuclear power 0.5 percent, and liquified petroleum gas (LPG) one percent.

- The dependence on imported energy is about 25 percent, which is a great deal less than the import dependency of close to 60 percent in the 1970s.

- Since the 1950s, Pakistan has had a much faster rate of growth in energy demand compared to the growth in energy supplies. The Planning Commission tentatively projects an average annual growth rate in supply of seven percent for 1987-88 to 2002-03.

- The industrial sector uses about 30 percent of the total energy consumption. The dominant fuel in this sector is natural gas (30 percent), with coal at 26 percent, oil 19 percent and electricity four percent. Industry must also contend with the unreliability of the power system. During load-shedding, the domestic and agricultural sectors have priority over industry. It is estimated that a 10 percent power shortage in the industrial sector can cause an annual production loss of Rs18 billion ($US700 million) out of a total production of Rs121 billion ($US5 billion).

- Energy consumption in the transport sector has grown from 3.18 mtoe in 1983-84 to 4.58 mtoe in 1988-89. Largest demand is for petroleum products at almost 70 percent in 1990-91. Strong demand for diesel and, to a lesser extent, kerosene results from the attempts to impose a price structure through differential taxes and subsidies on various petroleum products. The Seventh FYP forecasts an increase in demand of 10 percent per year for petroleum products in the transport sector.

- Energy consumption in the domestic sector has grown from 2.6 mtoe in 1983-84 to 4.4 mtoe in 1988-89. According to the Planning Commission's 1987-88 estimates, commercial energy is used by about 10 percent of rural households and 40 percent of urban households.

- Noncommercial sources of energy dominate the rural energy supply pattern. The share of noncommercial sources is declining because of deforestation. Natural gas, petroleum products and electricity, where available, represent 16.6 percent of the total energy supply. Although one-third of villages has so far been electrified, only 15 percent of the rural population has access to electricity, compared to 81 percent of the urban population.

- The fact that the household sector is still dependent on biomass has had serious environmental consequences, including soil erosion and deforestation. The consumption of fossil fuels discharged an estimated 13.1 million tonnes (mmt) in carbon equivalent of carbon dioxide emissions in 1986. The Pakistan Environmental Protection Ordinance (1983) provides the framework for environmental protection in Pakistan. The government plans to release an environmental action plan for the energy sector.

OIL

- Pakistan has limited resources of oil and moderate resources of natural gas. For the Seventh FYP, the target for domestic production of oil is 76,000 barrels per day (b/d) by 1993-94. Present daily production as of September 1991 was 73,950 b/d. Fourteen domestic and foreign oil companies were engaged in exploration and development during 1991.

- By 2003, Pakistan will be using four times more oil and petroleum products than at present. The new petroleum policy is expected to assist in delaying the depletion of oil reserves but imports will play a more critical role. Reliable access to petroleum supplies abroad would have to be sought through joint ventures with oil-rich countries in West Asia and the Gulf. Investment of US$20 billion is needed in exploration and development and refining to meet petroleum needs in the 1990s. Pakistan's import bill for oil and petroleum has doubled in four years and now accounts for more than 30 percent of total imports.

NATURAL GAS

- The use of natural gas has been growing much more rapidly than any other energy source in the economy. In the longer run, gas may find new markets such as petrochemicals which yield higher netbacks than sale to power generation in Pakistan. Gas prices are only loosely connected to market value and supply costs.

- Natural gas is a major source of energy in Pakistan, supplying about 35 percent of total energy needs per year. Gas production grew from 880 million cubic feet per day (MMcf/d) in 1982 to about 1500 MMcf/d in 1991.

COAL

- Coal accounts for six percent of total energy consumption, and tends to be of low quality. Pakistan is a net importer of coal, largely from Australia, Canada and China for use in the steel industry. The government is finalizing a new policy on coal to encourage private and foreign investment in the development of deposits.

- There is a general uncertainty about the size and quality of coal reserves. Its exploration and development has been limited in the past by government subsidizing of fuel oil and natural gas. Currently, coal production of about 2.7 million tonnes per year is used mainly by brick kilns.

RENEWABLE ENERGY

- Renewable energy resources, derived almost entirely from biomass and fuelwood, constituted about 32 percent, or 11.5 million tonnes of oil equivalent, of total energy in Pakistan.

- Pakistan's hydroelectric potential is estimated at 30,000 megawatts (MW), but less than 3,000 MW have been developed so far.

NUCLEAR

- Pakistan has a number of nuclear power stations and more are being planned, with countries such as China.

TRENDS AND OUTLOOK

- Per capita consumption of energy in Pakistan has gone up 10 times since 1947 and the dilemma facing it in the 1990s is a continuing much faster rate of growth in aggregate energy demand compared to the growth in energy supplies.

- Pakistan's ambitious target of seven percent annual growth in the 1990s calls for massive investment to increase energy supplies. The total end-use energy consumption is forecast to reach 68.5 mtoe in 2002-03 compared to 28.2 mtoe in 1987-88. Commercial energy consumption will more than triple to 54.1 mtoe in 2002-03 compared to 17 mtoe in 1987-88. The Sharif government's ambitions for GDP and high population growth will mean much higher energy demand than the projections made by the Planning Commission in 1988.

- Privatization is being contemplated in the energy sector with the denationalization and disinvestment of public sector monopolies in gas and petroleum products and coal subsectors. Policy reforms and deregulation in the power sector are lacking.

- Several major policy reforms in energy have been recently incorporated. In addition, the recent investment-oriented petroleum policy is designed to enhance exploration of oil and gas, and is the first comprehensive policy aimed at making the country self-sufficient in oil and natural gas. Imports will, however, continue to play a critical role.

- To meet its energy needs, Pakistan will face pressure during the 1990s in external trade and payments, reflected in volatile exchange rates and its high external debt.

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PREFACE

As part of our continuing assessment of Asia-Pacific energy markets, the Energy Program has embarked on a series of country studies that discuss in detail the structure of the energy sector in each major country in the region. To date, our reports to the U.S. Department of Energy, Assistant Secretary for International Affairs and Energy Emergencies, have covered Australia, China, Indonesia, Japan, Malaysia, the Philippines, Singapore, South Korea, Taiwan, Thailand, Pakistan and India. The country studies also provide the reader with an overview of the economic and political situation in the various countries. We have particularly highlighted petroleum and gas issues in the country studies and have attempted to show the foreign trade implications of oil and gas trade. Finally, to the greatest extent possible, we have provided the latest available statistics—often from unpublished and disparate sources that are unavailable to most readers. Staff members have traveled extensively in—and at times have lived in—the countries under review and have held discussions with senior policymakers in government and industry. Thus, these reports provide not only information but also the latest thinking on energy issues in the various countries.

It is our hope that over the next few years these country studies can be updated and will provide a continuous, long-term source of energy sector analysis for the Asia-Pacific region.

Fereidun Fesharaki
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Honolulu
March 1992

ACKNOWLEDGEMENTS

Thanks are expressed to all the public and private sector functionaries in Pakistan for providing relevant information for the Pakistan Asia-Pacific Energy Series Country Report.

I sincerely appreciate the fellowship provided by Dr. Fereidun Fesharaki, Director, Resources Programs, for this study and comments and suggestions made by Dr. Lisa Totto. I would also like to express my gratitude to Dr. Kerry Jackson who edited the report and Ms. Liza Balantac for her invaluable secretarial support.

The views expressed in this study are not necessarily those of the East-West Center Resources Programs. Responsibility for errors, omissions and inconsistencies remains with the author.

LIST OF MEASUREMENTS

bbl	barrel
b/d	barrel per day
bcf	billion cubic feet
Btu	British thermal unit
km	kilometer
km^2	square kilometer
kW	kilowatt
m^3	cubic meters
mmb	million barrels
MMcf/d	million cubic feet per day
mmt	million tonnes
mtoe	million tonnes of oil equivalent
MW	megawatt
Rs	rupees 25Rs = $US1
scf	standard cubic feet
Tcf	trillion cubic feet
tonne	'metric ton' (1,000 kg)
tpy	tonnes per year

One

NATIONAL OVERVIEW

The Republic of Pakistan became independent on August 14, 1947 from British colonial rule (1857-1947) of the Indian sub-continent. Pakistan is bordered by Afghanistan to the northwest, Iran to the west, and to the east and southeast by India and Kashmir. There is a short frontier with the People's Republic of China in the northeast and a narrow panhandle in the northwest of the high Pamirs separates it from Central Asia. Pakistan is a member of the South Asian Association for Regional Cooperation (SAARC), along with Bangladesh, Bhutan, India, the Maldives, Nepal, and Sri Lanka.

GEOGRAPHY

Pakistan is South Asia's second largest country with a north-south length of 1,214 km, an east-west length of 933 km, and an area of 796,095 km^2. Pakistan stretches from the Himalayan-Pamirs-Karakorum mountain ranges through the plains of the Indus River southwards to the Arabian Sea. Pakistan lies between latitudes 23°45' and 37°50'N and longitudes 60°55' and 75°30'E.

Physical features

Pakistan comprises several regions with very different physiographical characteristics. Its northernmost territories consist of rugged mountains among which the western Himalayas run into the high Karakorum and Pamir ranges. From these the Indus River flows into the Indus Plain. West of the Indus lies Chitral, a region of high dry plateaus, valleys, and deep canyons. In the southwest, a series of north-south mountain ranges, Safed Koh, Sulaiman, and Kirthar, curve the highlands, with the Indus Plain to the east.

The Indus Plain is a vast north-south longitudinal flood plain of the Indus and its tributary rivers, Kabul, Jhelum, Chenab, Ravi, and Sutlej, that extends from the foothills of the Himalayas southwards to the Arabian Sea.

The northernmost extensions of the Indus Plain comprise the Peshawar Valley and the Bannu Plain. This northern subregion is very moist and supports agriculture through irrigation and rain-fed streams. The subregion of the central Indus Plain is characterized by many 'doabs' (interfluvial river plain), moderate to high precipitation, good soil, and irrigation-based settlements. The subregion of the Lower Indus Plain is characterized by low precipitation, desert and deltaic soil, and clusters of irrigation-based villages.

Baluchistan, the westernmost part, is essentially a region of plateaus and mountain ranges, extending into Iran and Afghanistan. It is an arid region with rugged topography, severe desiccation, scattered valleys, and piedmont plains and rangelands.

Pakistan possesses a coastal lowland zone of varying depth. Its eastern shores are of the Indus deltaic regime, with mangrove forests. The southwestern coastline is dissected by low hills with a few depressions on the Arabian Sea. Escarpments and scattered oases dominate the southwestern coastline on the Makran coast and limit its width to an average of less than 10 km.

Climate

Pakistan is situated in an arid and semi-arid climatic region. The climate is dominated by the southwestern monsoon in summer, the northeast monsoon in winter, and by occasional low depressions from the Mediterranean Sea. Due to its diverse physiographic features, there is a great deal of variability in the rainfall and temperature regime. The climatic regime of the northern and northwestern mountains of Pakistan is modified by altitude and is characterized by semi-aridity with a winter maximum of rainfall in the northwest. Annual rainfall ranges from 10 cm in Baluchistan and Thar Desert to two cm in north-central Pakistan.

The Indus Plain has an annual cycle of three seasons. Winter (December to February) has relatively low temperatures, averaging 8 to 10°C, with sunny days. The Upper Indus Plain receives winter rains from northwesterly disturbances in the jet

stream. Farther southwards towards the coast, it is drier and warmer, with average temperatures around 18° C. Summer (March to June) is very warm and dry with an average temperature range of 20-48° C. The monsoon season (July to September) is the rainy season with cooler temperatures and a southwesterly air flow.

Table 1.1: **Provinces and administrative regions**

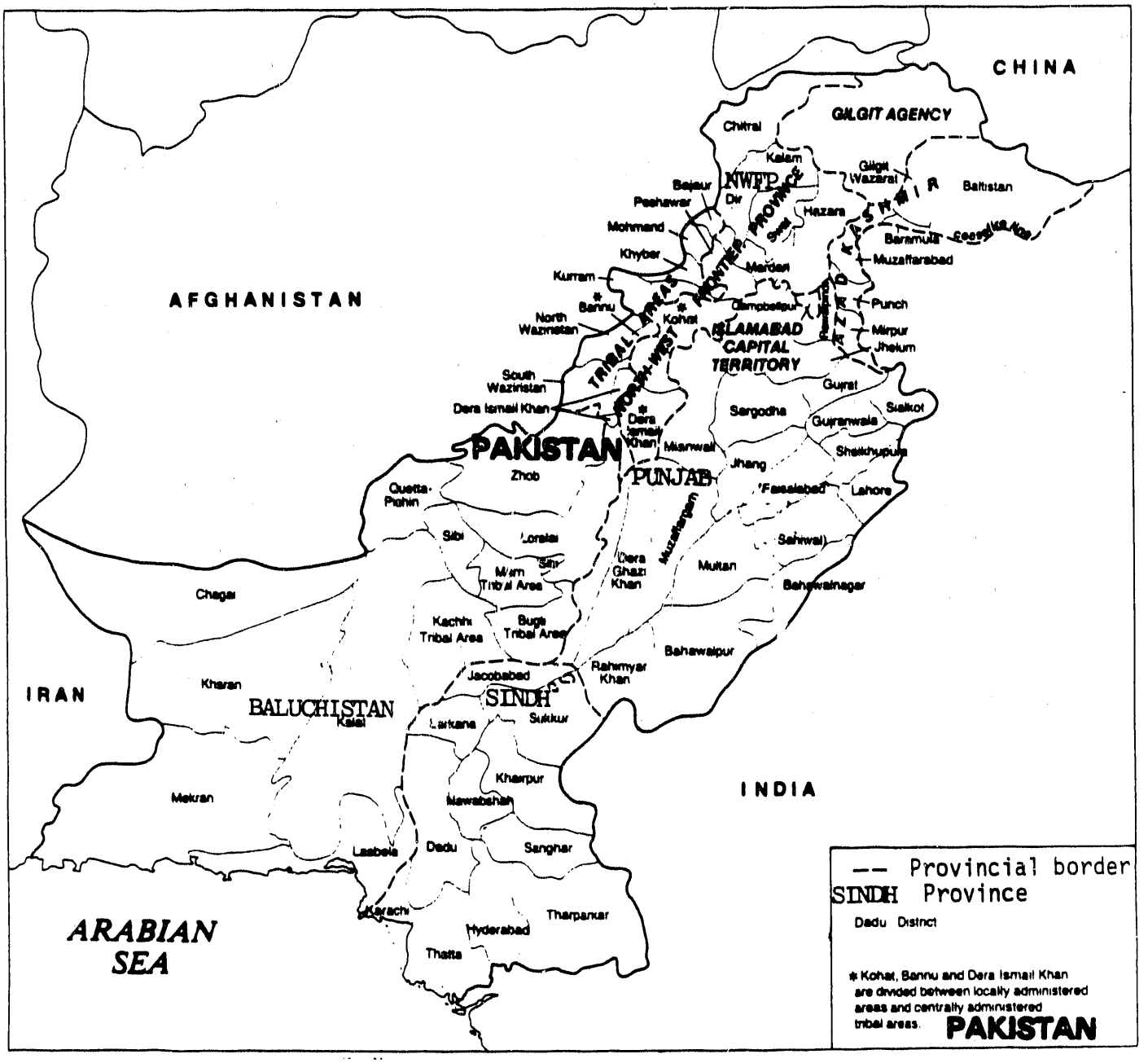
Province/region	Population % of total	Area km²	Area % of total
Baluchistan	5.1	347,190	43.6
NWFP	13.1	74,521	9.4
FATA	2.0	27,220	3.9
Punjab	56.1	205,344	25.8
Sindh	23.6	140,914	17.7
Islamabad (Federal Capital Territory)	0.1	906	0.1
Total	100.0	796,095	100.0

Source: Economic Survey 1990-91

ADMINISTRATIVE REGIONS

Pakistan is comprised of four provinces, Punjab, Sindh, the North West Frontier Province (NWFP), and Baluchistan, with Islamabad as the capital. The Federal Capital Area of Islamabad and the Federally Administered Tribal Areas (FATA) are under the administrative control of the federal government (Table 1.1). Pakistan also administers Azad Jammu and Kashmir, which are part of the disputed state of Jammu and Kashmir that Pakistan has held since the 1948-49 war with India. These areas are officially viewed to be independent and are not included in the country's national statistics.Pakistan has a constitutionally based, federal form of government. The various constitutions (1956, 1962, and 1973) divided the responsibility of the powers of government between federal and provincial units. The federal government exerts substantial control over foreign affairs, economic affairs, defense, finance and currency, and most of the natural resources

Figure 1.1: **Administrative regions**



as well human resources. It holds a monopoly in energy, heavy industries, commerce, communications, air and sea transportation, and the export and import of certain commodities.

The provinces have powers in the areas of agriculture, education, health, road transportation, irrigation, local government and rural development. The national language is Urdu and Punjabi, Sindhi, Baluchi, and Pushtu are widely spoken. The official religion is Islam, representing the religion of 97 percent of the population.

POPULATION

By population, Pakistan is South Asia's second largest country and the ninth most populated country in the world. The population of Pakistan was 115 million in 1991, with an increase of 31 million from the 1981 population of 84 million (Table 1.2). The annual population growth rate is 3.1 percent, the highest in Asia. Pakistan's population rose from 34 million in 1951 to 84 million in 1981, a growth of 148 percent between 1951 and 1981, and of 32 percent between 1981 and 1991. The population is expected to double over the next 22 years.

Table 1.2: **Population size and growth pattern 1901-1991**

Year	Population millions	Annual average growth rate %
1901	16.576	na
1911	19.382	1.58
1921	21.109	0.86
1931	23.542	1.10
1941	24.267	1.52
1951	33.817	1.80
1961	42.978	2.43
1972	65.321	3.67
1981	84.254	3.06
1991	113.780	3.15

na: not available
Source: Economic Survey 1990-91

As well as a rising birth rate in all the provinces, an influx of about four million refugees from Afghanistan and a general increase in the fertility rate of women have contributed to the high birth rate during 1981-1991. With a high and stable crude birth rate, about 45 percent of the Pakistan's population is under 15 years of age. In part, these demographic patterns reflect the strong cultural effect of religion in Pakistan.

In terms of Pakistan's population growth — as with its history, culture and economy — there is not just one Pakistan, but several different and distinct Pakistans. The government has recently endorsed family planning as part of official development programs, but it has proven difficult to disseminate the practice throughout the tradition bound and still largely illiterate people.

Distribution of population

About 69 percent of the population lives in the rural areas and the estimated population density in 1991 was 142 persons per square km. The majority of the population lives in the plains of the Indus River and its tributaries in Punjab and Sindh. Other areas of the country, devoid of river valleys, are sparsely populated.

The most populated province is Punjab, followed by Sindh, the Northwest Frontier Province (NWFP), and Baluchistan. The main ethnic groups in Pakistan are the Punjabis, the Sindhis, the Baluchis, and the Pathans. Punjabis represent about 56 percent of the population and have a dominant role in the economic, political, and military affairs of the country.

Although the majority of the population still lives in the rural area, there is a relatively rapid urbanization taking place. The growth in population of urban areas is one and a half times that of the rural areas, as the rural population migrates in increasing numbers to the urban areas (Table 1.3 and Table 1.4). Average annual growth rate in urban population from 1960 to 1990 has been 4.3 percent, while the rural population growth rate during the same period was 2.6 percent. Karachi, Lahore, Peshawar, Faisalabad, Islamabad, Hyderabad, and Quetta are the largest cities. The spatial distribution of the urban population is uneven; coastal Sindh is more urbanized

Table 1.3: **Population and demographic trends 1990-91**

	January 1, 1991
Population, million	113.78
Area, million sq km	79.61
Population density, persons/sq km	142
Population dynamics	
Growth rate	3.1
Crude birth rate	40.5
Crude death rate	10.8
Infant mortality rate	107.7
Population statistics	
Life expectancy at birth	
Male	59.73
Female	60.7
Distribution by sex	
Male	59.73
Female	54.05
Labor force, million	32.81
Growth rate of labor, %	23.95
Participation rate, %	8.86
Employed labor, million	31.78
Rural	23.33
Urban	8.45
Unemployment rate, %	3.13
Rural	2.60
Urban	4.58

Source: Economic Survey 1990-91

Table 1.4: **Labor force by sector**

Sector	1987-88	1992-93	1997-98	2002-03
Agriculture	48.8	47.1	45.1	43.2
Manufacturing and mining	14.3	15.7	17.3	18.8
Construction	6.1	6.4	6.5	6.7
Electricity and gas	1.1	1.1	1.0	1.0
Transport and communications	5.3	5.4	5.6	5.8
Trade	12.0	12.5	12.9	13.4
Banking and insurance	0.8	0.7	0.7	0.7
Other	11.6	11.2	10.9	10.5
Total	100.0	100.0	100.0	100.0

Source: Economic Survey 1990-91

than the interior Sindh, the Punjab is more urbanized than the northern areas, and Baluchistan and NWFP are largely rural.

Urban migration and population

Migration to urban areas is partly due to the disparity between employment opportunities and social services between the rural and urban areas. Some of the causes of rural to urban migration are high population growth, increasing land pressure and landlessness, high unemployment, and few educational opportunities.

Despite appalling urban conditions, the migration continues because of the lack of employment prospects and public services in the countryside. The largest cities, including Islamabad, the capital, have been growing rapidly: many tripling or quadrupling their population since the 1960s. By the year 2000, Pakistan is expected to have 11 urban areas with a population in excess of one million, compared to only one in 1960.

There is a net migration from the rural north and interior of the NWFP and interior south to urban Sindh, particularly Karachi, the largest metropolitan area. The population of Karachi has increased to 8.1 million in 1991 and is projected to reach 12.2 million in 2000. This has placed tremendous strains on the basic services of housing, sanitary facilities, water and power supplies, traffic, and communication.

Social unrest and ethnic violence in Karachi since 1986 can be attributed to the increasing urban problems of inadequate sanitary facilities, serious traffic congestion, *katchhi abadis* (squatters settlements), unemployment, overcrowding, and air and noise pollution. For example, about 40 percent of Karachi's population lives in *katchhi ababdis*.

Labor force

The total labor force in 1991 was 31.78 million, about 28 percent of the total population. This low percentage is due to the lack of participation by women in official economic activities. The average annual growth rate in the labor force during 1960-70 was 2.1 percent, in 1970-80 2.8 percent, and in 1980-90 2.9 percent.

Unemployment was officially estimated at 3.13 percent for 1991, although underemployment is very high. The sectoral distribution of the labor force is dominated by agriculture; rural and agricultural labor represented about 71 percent of the total labor force in 1991. Manufacturing and services sectors absorbed, respectively, 13 percent and 12 percent of the total labor force.

SOCIAL INDICATORS

Though Pakistan's economic growth rate has been consistently strong, this has been insufficient to improve social indicators. The United Nations *Human Development Report* has ranked Pakistan 120th among 160 nations in its Human Development Index, with an average life expectancy of 57.7 years, an adult literacy rate of 26 percent, and GNP per head of US$350 in 1990-91.

The quality of social, health, and educational services is low across nation, but at its worst in the rural areas. The literacy rate is as low as 12 percent in some rural areas.

HISTORICAL AND POLITICAL BACKGROUND

Pakistan was formed in August 1947 when Britain's former Indian empire was partitioned into two independent countries, India and Pakistan. The country was given little chance of survival.

Pakistan originally consisted of two separate areas, East Pakistan (Bangladesh since 1972) and West Pakistan, which were geographically separated by a thousand miles of Indian territory. The majority of the population lived in East Pakistan, but political and economic activities were concentrated in West Pakistan.

At the time of its creation, Pakistan became a constitutional monarchy with the British monarch as the Head of the State. In March 1956, the country was declared an Islamic republic and the Governor General became the President. In October 1958, Pakistan came under military rule when President Iskander Mirza abrogated the constitution, declared martial law, and appointed General Ayub Khan, the army chief, as the martial law administrator. Twenty days later General Ayub Khan took over the government. This takeover opened the way for repeated military takeovers; in a sense,

the Pakistani military never returned to barracks. To this day, martial law as a means of solving political crisis appears to be embedded in the thinking of many politicians.

In 1960 General Ayub Khan lifted martial law and permitted a controlled basic democracy, through which he was elected as the President. A new constitution was introduced in 1962 and political parties were permitted to resume their activities. However, in the following years widespread agitation against General Ayub Khan's repressive regime brought about his downfall, and he was forced out of office in March 1969 by the army chief who led a bloodless military coup, reimposed martial law and declared himself President.

In December 1970, the first national elections of Pakistan were held for an assembly which would draw up a new constitution. In East Pakistan, an overwhelming majority of seats was won by the Awami Party. In West Pakistan, the majority was won by the Pakistan's People Party (PPP) under the leadership of Zulfiquar Ali Bhutto. Attempts to persuade the two parties to form a coalition government were not successful; the deep differences between the representatives of the two sides resulted in a breakdown in negotiations. A civil disobedience movement began in East Pakistan, and, in March 1971, the army was sent to East Pakistan to bring the area under control. India intervened militarily to support the Bengali freedom fighters, and the Pakistan army was forced to surrender. East Pakistan was declared in December 1971 as the independent nation of Bangladesh.

After Pakistan's defeat, the President was forced to resign and Bhutto became the President of a truncated Pakistan that was confined to the west wing of the post-colonial nation. A new constitution was introduced in April 1973 with Bhutto as Prime Minister, the executive position, and Fazal Elahi Chaudhry as a figurehead president.

Bhutto nationalized banks, steel, cement, and vegetable oil industries. In his early years, Bhutto introduced measures to promote democracy but later he became dependent on certain groups (particularly influential landlords in Punjab and Sindh) and alienated others (such as the leaders of the opposition parties).

Bhutto held national elections in March 1977, in which the PPP won the majority of seats. However, the opposition groups' claim of election fraud resulted in a breakdown

of law and order. A bloodless military coup led by the chief of army staff, General Muhammad Zia-ul-Haq, deposed Bhutto and promised elections within 90 days. Ex-Prime Minister Bhutto was put on trial for alleged complicity in the murder of a political opponent and was executed in April 1979.

General Zia, who had initially assumed the role of chief martial law administrator, became Pakistan's president in September 1978. General Zia not only postponed elections several times, but imposed severe restrictions on political activities. In 1980 and 1981, political parties became increasingly concerned with the constraints on public freedom and eventually formed an alliance, the Movement for Restoration of Democracy (MRD), which was mostly led by the PPP under the leadership of Benazir Bhutto, a daughter of Z.A. Bhutto.

General Zia embarked on a program of Islamization which was aimed at creating an Islamic economic system and a democracy consistent with the requirements of Islam. In December 1984, Zia held a referendum through which he sought affirmation of the Islamization process and confirmation of his being in office for another five years. This referendum was boycotted by the opposition, but the official result indicated 98 percent of the vote in favor of the proposal. In February 1985, elections were held for the National Assembly and the Senate. The following month Zia issued a revised constitution according to which most of the power was shifted from the post of prime minister to the post of president. He then appointed Mohammad Khan Junejo as Prime Minister.

In 1986 General Zia dismissed the Junejo government for its failure to deal with corruption and implement the Islamic system. An interim government was sworn in, which functioned directly under Zia, with no prime minister in charge.

On August 17, 1988, President Zia was killed in an air crash. In accordance with the constitution, the Chairman of Senate, Ghulam Ishaq Khan took over as the acting president. A state of emergency was declared, but the Chairman proceeded with elections as scheduled, and the Supreme Court ruled that all political parties were eligible to participate in elections. Political parties were divided into three groups: the Pakistan's People Party (PPP), under the leadership of Benazir Bhutto; the Islamic

Jamhoori Ittehad (IJI), also referred to as the Islamic Democratic Alliance, a coalition of the Pakistan Muslim League and its right-wing allies, under the leadership of Junejo and Nawaz Sharif, a Zia protege; and residual groups which had not entered into alliance with the two major political factions.

The elections for the National Assembly were held as scheduled on November 16, 1988. The PPP, which acquired 93 of the 207 seats, was the only party to secure seats in each of the four provinces, but did not achieve a decisive victory in the elections for the provincial assemblies. As a result, the PPP entered into a coalition with a small party representing the Urdu speaking population of Karachi and Hyderabad. Ms. Bhutto became Pakistan's first female prime minister, and the first female prime minister in a Muslim country, in December 1988.

Benazir Bhutto faced many obstacles in her administration since the troika of power was shared among her party, the President, and the army. Many of her programs were thwarted within this troika and by the other political parties who controlled the Senate. After eighteen months, she was not able to control the power struggle within the troika. Despite its majority in the National Assembly, Ms Bhutto's government was dissolved in August 1990 by President Khan and mid-term elections were called for new national national and provincial assemblies. The IJI and its allies won both the national and provincial elections in October-November 1990; and there were allegations by the Pakistan Democratic Alliance, a coalition of the PPP and other parties, of rigging in elections at both the national and provisional levels against the IJI and the caretaker government. The IJI elected Nawaz Sharif as their parliamentary leader, and he was sworn in as the Prime Minister in November 1990.

Nawaz Sharif's main challenge is to deal with accumulating economic problems worsened by the crises in Afghanistan and the Gulf. The Sharif administration started with the promise of an economic revolution and has enjoyed unprecedented advantages: a two-thirds majority in the National Assembly, a comfortable majority in the Senate, and in the four provinces, and the support of the President and the armed forces.

However, within a year of his accession to power, the initial momentum appears to be lost. Sharif's administration has been stressed by lack of credibility and scandals. The

ambitious privatization program of selling off 160 public sector units (PSUs) has become bogged down by accusations of nepotism and corruption.

The most potentially explosive political questions in Pakistan involve relations between the center and the provinces and the role of armed forces in the affairs of the nation. Since 1957, the armed forces have been dominant in politics. Questions about autonomy and social issues involve relations between provinces, ethnic and linguistic groups; the recent proliferation of violence, terrorism, and worsening of human rights in rural areas are testimonials to the continuing tensions. The United Nations Development Program (UNDP) has ranked Pakistan 79th among 88 nations (just ahead of Vietnam) in its index of human freedom.

Other important impacts on Pakistan include the United States suspension of aid because of nuclear transgressions and the continuing troubled relationship with India. On the western front, Pakistan is burdened with an Afghan refugee population of 3.7 million, the world's largest concentration of refugees. The Soviet invasion and occupation of Afghanistan (1979-89) greatly aggravated internal and regional difficulties for Pakistan. The cost for Pakistan of caring for refugees has been US$500 million per year, not counting the added military expenditures for providing security.

ECONOMY

Since 1955, Pakistan's post-independence development pattern of strong centralized planning has been achieved through the regulation and control of private enterprise, state ownership, trade protectionism, and strict limits on foreign capital equity, and technology.

The state or public sector in Pakistan was very large until 1991. With preferred access to many economic resources, imports and inputs, and infrastructure, the state sector has monopoly in some sectors of economic activity. The public sector in Pakistan comprises public sector units (PSUs) and autonomous and semi-autonomous corporations. The public sector is currently being disinvested and denationalized.

Private enterprise coexisted with centralized planning. Almost all the agricultural land, most urban property, a large number of industrial operations, and most retail and wholesale businesses are privately owned. The private sector in Pakistan has produced

moderate growth and entrepreneurship and is a large sector of economy. Both the private and especially the public sector have been able to draw on an immense pool of domestic savings. Since November 1991, the Sharif administration has been overseeing Pakistan's shift from mixed economy to market-oriented economy. Pakistan has also received a generous supply of foreign aid for its economic expansion.

Planning

Development investments are managed through five year plans (FYP) and annual development plans or both. These plans are produced by the Planning Commission of the executive branch and approved by a parliament or similar body.

The design of a FYP comes after a political decision-making process. It includes allocation of domestic GNP between private and public sectors; allocation of the government's resources between development, defense, and other sectors; and the amount of overall national product to be taxed. Within the development budget, there are sectoral allocations: industrial, agricultural, energy production, transportation, and education.

Public sector development financial institutions (DFI) and the nationalized commercial banks (NCB) finance the public and private sector investments. There is a shortage of development capital in the domestic savings sector, and development budgets are heavily dependent on foreign loans and assistance. The budgets are also influenced in doctrine and practices by the views of multilateral development organizations such as the World Bank, Asian Development Bank, and by donor countries. Since Pakistan has been under intermittent martial rule for 30 years, national defense has taken a great portion of resources, particularly since the 1965 war with India.

Pakistan is currently implementing its Seventh Development Plan (1988-1993). The emphasis of economic planning has mostly been on rapid growth, with some shift to equitable distribution of income in certain periods. The economic growth rate has varied substantially during different periods, mostly due to differing political circumstances. The average annual growth rate was 3.1 percent in the 1950s. It then accelerated to above six percent per year and stayed at this level except for the period 1971-1977 when

Bhutto was President. Bhutto emphasized nationalization and equitable distribution of income through the implementation of annual plans.

Nationalization of the banking and energy sectors (including electricity generation, oil production and marketing and coal mines) was completed in Pakistan in the early 1970s. There were about 160 public sector units (PSUs), in aviation, shipping, rail and bus transportation, communications, new steel mills, energy sector (electricity, coal, oil and gas, hydropower and nuclear power), heavy industry, chemicals, fertilizers, armament, and other military equipment-making installations, and related activities.

Growth slowed in the 1970s to four percent per year as private sector investment declined. The public sector was inefficient: overegulation and protection hampered producers in becoming internationally competitive.

Recent developments

Since September 1988, Pakistan has adhered to the IMF's structural adjustment program, which is a short-term intervention in the financial sphere and has four features. These include a sharp reduction in budget deficit; tight control on money supply; gradual import liberalization; and massive privatization of public assets in the nationalized sector. These are part of efforts to move towards a market-oriented economy.

The Sharif administration has moved quickly to remove government-owned industries and infrastructure from the cocoon of nationalization and bureaucracy. Backing up the economic reforms, popularly dubbed the 3Ds — disinvestment, deregulation, and denationalization — are incentives to attract foreign investment, technology, and management skills (Table 1.5). During 1991, the government took a number of bold steps on the economic front. It decontrolled foreign exchange regulations and privatized two public sector banks, the Muslim Commercial Bank and Allied Bank. The central government and the provinces have signed the first ever National Finance Commission accord, an agreed formula of distribution of resources between the center and the provinces. Concern is expressed in Pakistan about the speed of privatization.

Table 1.5: **Public sector opened for privatization/investments May 1991**

Public sector	Nationalized sector
Oil and natural gas	Cement
Power generation	Engineering
Telecommunications and highways	Chemicals
Banks	Ceramics
Ports, shipping, and airlines	Fertilizers
Airlines	Wool and cotton
Ports	Cooking oil — ghee and roti

Source: Ministry of Industry 1991

Table 1.6: **GDP by sector, percent share**

Sector	1987-88	1992-93	1997-98	2002-03
Agriculture	23.3	21.4	19.4	17.6
Manufacturing	17.5	18.8	20.6	22.3
Mining	2.4	2.6	2.9	3.2
Construction	6.4	6.8	6.9	7.1
Electricity and natural gas	2.3	2.5	2.8	3.1
Services	48.2	57.9	47.4	46.8
Total 100.0	100.0	100.0	100.0	100.0

Source: Ministry of Planning 1989

The Gulf Crisis (1990-91) severely affected Pakistan because of its dependence on the import of crude oil and products from the Gulf and on workers' remittances from the Gulf. Pakistan's economy performed well for most of the 1980s, with GDP increasing at six percent per year (Table 1.6). But during the latter part of the decade, fiscal deficits led to unsustainable borrowing. After remaining at low levels of 4.8 and 4.6 percent during the first two years of the Seventh Development Plan, 1988-89 and 1989-90, the GDP growth rate increased to 5.6 percent in 1990-91. Thus during the first three years of the Seventh Plan the economy grew at a pace lower than the 6.5 percent and 6.2 percent achieved during the Sixth Plan period.

The high growth financed from borrowed sources has created imbalances in the economy. The rate of investment increased by 2.7 percent per year in real terms as against 4.4 percent in the Sixth Plan period and the 8.4 percent targeted in the Seventh Plan period. Fiscal and external imbalances continue to be the areas of concern as the overall budget deficit remains close to six percent of GDP and a current account deficit of four percent of GNP, leading to increased dependence on foreign and domestic borrowings. Pakistan's foreign debt stands at US$23 billion in 1991; almost 30 percent of export earnings is spent in servicing the external debt.

Analysis by sector shows industrial sector growth at 6.4 percent (4.6 percent in 1989-90); the agricultural sector showed an increase of 2.7 percent (6.9 percent in 1989-90). Services sector grew at 4.8 percent in 1990-91 as compared to 3.8 percent in 1989-90; the wholesale and retail sector slowed to 3.9 percent in 1990-91 (5.3 percent in 1989-90), mainly because of the poor performance of the agricultural sector.

Gross fixed investment increased by only two percent in 1990-91 in real terms compared to 10 percent in 1989-90. The share of gross domestic investment in the GDP declined from 18.9 percent in 1989-90 to 18.6 percent in 1990-91, as a result of the deterioration of law and order in the southern part of the country, and tight budgetary constraints on the government.

Inflationary pressures were generated in 1990-91 by exchange rate depreciation and import liberalization on the one hand, and the increased user charges on public utilities, such as electricity and gas on the other. The inflation was 13 percent in 1991 compared to nine percent in 1990.

Economic growth in the 1980s favored manufacturing and trade services at the cost of a declining share for the agricultural sector. In the period 1981-1989, the share of the manufacturing sector in total GDP increased from 15.1 percent to 16.3 percent while the share of agriculture declined from 30.8 percent to 26.8 percent. Table 1.7 shows national income and GDP by sector and Table 1.8 shows economic growth by sector.

Table 1.7: **National income**

National income	Fiscal 1990-91 (provisional) Rs billion
GDP	1016.7
GNP	1048.9
Total investment	186.5
National savings	144.8
Per capita GNP	Rs 9218

Source: Economic Survey 1990-91

Table 1.8: **Economic growth by sector**

Sector	1988-89 % growth rate	1989-90 % growth rate	1990-91 % growth rate
GDP	4.8	4.6	5.6
GNP	4.0	4.1	4.8
Agriculture	6.9	4.0	5.1
Manufacturing	4.0	5.7	5.7
Transport and communications	4.0	4.7	6.8
Services	6.5	6.5	6.5
Wholesale and retail trade	5.3	4.9	5.3

Source: Planning and Development Division 1991

Budgetary deficit and the 1990-91 budget

Military expenditures (Rs71 billion) and debt servicing (Rs80.7 billion) account for 88 percent of the 1991-92 budget against a total of Rs171.4 billion in total revenues.

The increasing recourse to borrowed funds has several adverse consequences. First, the deficit has been the principal factor propelling high rate of monetary growth, which, in turn, has fuelled inflationary pressures and expectations. Second, the greater recourse to government borrowing from the commercial banking system as well as directly from domestic savers has claimed a high proportion of household savings, leaving a lower proportion for use in directly productive sectors such as industry and agriculture.

Along with this, the mounting stock of public debt has led to burgeoning interest payments. This in turn has pre-empted an increasing portion of government expenditure for meeting such debt service obligation. In 1990-91, the government borrowed Rs56.55 billion to balance its budget. The interest bill was Rs40 billion on the total domestic debt of Rs422 billion; that is, four percent of GDP in 1991. The fiscal position in 1991 reached a critical stage because of increasing deficit and shortfall in revenues. The major allocations of the 1990-91 budget are shown in Table 1.9.

Table 1.9: **Public finance budget 1990-91, billion Rs**

Total expenditure	246.5
Current	183.5
Development	63.0
Total revenue	188.5
Tax	140.9
Development	38.5
Surplus of autonomous bodies	9.1
Overall deficit – financed by	58.0
External borrowings	21.1
Domestic non-bank borrowings	29.5
Banking system/deficit financing	7.4
Overall deficit as % of GDP	5.9

Source: Economic Survey 1990-91

Investment trends in Pakistan

Investment trends in Pakistan have been interconnected with the regulatory powers of the government at almost all stages. The central bank determined the amount of credit that development finance corporations and the nationalized bank could lend each year. The National Credit Consultative Committee (NCCC), composed of government officials, provincial representatives and businessmen, recommended who should get funding and how much they should receive.

Private sector companies were authorized in the late 1970s, but many of them failed because of alleged fraud and mismanagement. Cooperatives and investment companies proliferated in the late 1980s; however, the depositors have lost about Rs20 billion (US$1 billion) in the 1980s. The government is now moving towards a policy for a privately owned banking system and a set monetary expansion.

Pakistan's development efforts have not made real headway during the last two decades. Gross domestic investment for the 1970s through 1990s has been extremely low. Among the forty developing countries, it ranked 32nd, only above one country in Asia: Bangladesh; two countries in Africa: Ethiopia and Nigeria; and five countries in Latin America: Bolivia, Mexico, El Salvador, Guatemala, and Uruguay.

Within the last two decades, however, there have been substantial variations. During 1976-80 investment was high, reaching its peak in 1976. It began to decline in the following years, reaching the lowest level of 14.8 per cent of GDP exactly ten years later in 1986. It has remained more or less stagnant since then.

The break-up of investment into private and public sectors shows that in 1970 it was about equal: seven and 7.3 percent respectively. The increase in total as well as public sector investment coincided with the era of nationalization reaching its peak in 1977, when it was 12.4 percent against the private sector's share of 6.2 percent. During the 1980s total investment continued to decline, but the public sector maintained its lead despite government policies and efforts aimed at accelerating private investment. In 1989, while public sector investment constituted 8.4 percent of the GDP, private sector investment was 6.5 percent.

Outlook

The overall budgetary deficit as a percentage of GDP was brought down from 7.4 percent in 1988-89 to 6.7 percent in 1989-90 (revised). In 1990-91, it is expected to go down to 5.7 percent when the complete accounts for the year become available.

A combination of reduced multilateral and consortium assistance, lesser revenues, and breakdown of law and order in 1991-92 will dent the recovery from the aftermath of the Gulf crisis. A slow response overseas to the new economic and industrial policies has

not produced any major investment while high profile kidnapping of foreigners in Sindh has almost wiped new investment. International businessmen remain worried about political stability, bureaucratic obstacles, corruption, and discipline in financial institutions. It seems unlikely that the former United States aid program (US$587 million) will be resumed in 1991-92.

Even if the government succeeds in selling off all the profit making PSUs, privatization would not net more than Rs3 billion.

The effort of macroeconomic stabilization is likely to suffer a severe setback due to poor infrastructure, communications capabilities, and inadequate energy supplies. Despite (expected) record agricultural production and an export promotion drive, Pakistan's chronic trade deficit could worsen appreciably by mid 1992 because of fluctuations in world commodity prices.

Among the harvest of economic problems is an acceleration of inflation, widening of the current account deficit, and less than planned decline in the fiscal deficit according to the structural adjustment program. However, the structural adjustment program could be on track by 1992, with lower inflation and reduction in both the internal and external deficits.

Pakistan's economy in the future will depend upon the momentum of privatization and deregulation as well as macroeconomic and structural adjustments. Pakistan has approached the World Bank and IMF on another structural adjustment program for three years (1992-95) to be supported by a multilateral and bilateral aid package totalling US$9 billion.

Efforts are needed to reduce the fiscal deficit to sustainable levels, to shifting emphasis from international trade to domestic production as a source of tax revenue, and to carry out essential reforms to create an export-oriented economy. Progress in education and the serious problem of population growth need to be given priority.

AGRICULTURE

Agriculture in the Pakistan has been practiced since the Indus Valley Civilization (about 3,000 years ago). Out of a total 79.6 million hectares (mha) of land in Pakistan, only 25

percent is arable; about 20.73 mha was under cultivation in 1990-91, of which 19.80 mha was cropped land. Pakistan has the single largest irrigation system in the world; currently, 16 mha is under canal command area (CCA), almost half on perennial or year round flow into the farms (Table 1.10).

Table 1.10: **Agriculture 1990-91**

Total cropped area (million hectares)	19.8
Irrigation water availability (million acre feet)	119.6
Fertilizer offtake (mmt)	2.0
Improved seed distribution (mmt)	0.1
Credit disbursed (Rs billion)	18.2
Crop/food production (mmt)	
Wheat	15.2
Rive	3.3
Maize	1.2
Gram	0.6
Sugarcane	35.98
Cotton — bales	961,000
Meat products	1.6
Milk and dairy products	15.40
Fish products	0.45
Timber products, cubic meter	792,000

Source: Economic Survey 1990-91

Agriculture was intensified in 1859 with the building of canals for irrigating the plains with the waters of the Indus River and its tributaries. Since the 1960s canal building has increased to provide additional land for irrigation and perennial irrigation for an expanding population. Assured supplies of irrigation water have been created through a vast expanse of irrigation system fed by two large dams, Tarbela (1975) on the Indus and Mangla (1967) on Jhelum River, eight barrages, and 64,000 km of canals and thousands of watercourses. Coupled with expanded acreages, improved seed varieties and better farming techniques, Pakistan has made agricultural gains and today approaches self-sufficiency in food production.

Problems of intensive irrigation include salinity, waterlogging, and degradation of land and water quality, which have given rise to a host of public health and environmental problems. About 9.6 mha of productive agricultural land is affected by excess salts in the Indus Plain; about 40,000 hectares (ha) are lost annually to declining production at a cost of Rs36 billion (WAPDA 1987-88). Almost all of the irrigated land in the Lower Indus Plain (Sind) has been found to be salt-affected.

The target of Pakistan's agricultural policy is self-sufficiency in all major food crops. This was largely achieved in 1982-83. Since then, the government has tried to increase the surplus available for export. As a result, exports of agricultural products, particularly cotton, have increased substantially (Table 1.11).

Table 1.11: **Major crop production**

Crop	Unit	1989-90	1990-91	% change
Wheat	mmt	14.32	15.11	5.5
Rice	mmt	3.22	3.27	1.6
Sugarcane	mmt	35.49	35.59	0.3
Cotton	million bales	8.56	9.61	12.3

Source: Ministry of Agriculture 1990-91

Contribution to the economy

Agriculture has provided relatively little actual revenue in Pakistan. Total tax revenues averaged Rs1 billion at their peak in 1978-82. This represents only 2.8 percent of total government revenues. In more recent years, tax revenues from agriculture fell further as lower world prices for rice and cotton changed export tax revenues to net export subsidies in 1986 and 1987. Government budget subsidies to agriculture have exceeded tax revenues collected in every year since 1975. From 1975 to 1979, net subsidies to producers ranged from Rs1.1 billion to Rs2.3 billion per year. With the drop in export revenues in the mid 1980s, net subsidies to producers averaged Rs5.9 billion in 1986 and 1987.

The agricultural sector showed a growth of 2.7 percent in 1990-91 compared to 6.9 percent in 1989-90. The main reason for poor performance of the agricultural sector was a decline in the production of wheat and sugarcane and virtual stagnation of the production of rice and cotton. Problems include a shortage of fertilizers at the time of peak demand in 1990 and the adulteration of fertilizers and pesticides at the retail level.

Agriculture, including forestry and fishery, is the principal sector of the economy, employing 51 percent of the labor force and producing about 27 percent of GDP. Wheat, rice, sugar cane, and cotton are the main crops. The annual wheat harvest increased from 14.7 million tons in 1989-90 to 15.15 million tons in 1990-91 despite fertilizer shortages. The production of cotton lint reached 8.6 million bales in 1990 and a record high of 9.6 million bales in 1991. Raw and processed cotton represent the principal source of foreign exchange earnings.

Rice production reached about 3.4 million tons in 1983, but declined in the following three years due to pest infestation and a reduction in the planted area. Thereafter, production grew to reach a peak of 3.5 million tons in 1987, but declined again to 3.2 million tons in 1990-91. Domestic consumption of rice was about 2.2 million tons, leaving about one million tons for export.

Livestock raising, dairy farming, and animal husbandry contributed 30 percent in agricultural value added and 7 percent in GDP in 1990-91. During the 1980s the section had an annual growth rate of five percent. The government is now trying to expand this sector in order to export livestock and poultry to the Gulf states. Fishery, with 445,000 tonnes production, accounted for 0.7 percent of GDP in 1990-91. It represents a source of protein for the domestic population as well as a relatively important source of foreign exchange.

Forestry contributed about 0.3 percent of GDP in 1990-91. Forests cover only about four percent of the country's area. Major products comprise commercial wood such as timber and fuelwood; minor products include a large number of heterogeneous items such as ephsdra, fodder, resin, and medicinal herbs and plants and game fowl. Since 1979, the forests in the northwestern and western mountainous regions have been severely stressed by 3.5 million Afghan refugees along with their 16 million livestock.

Agricultural credit

Growth in agriculture in Pakistan is closely linked with the availability of agriculture credit for inputs, tractors and fuel supply on the farm.

The major agricultural lending institution in Pakistan is the public sector's Agricultural Development Bank of Pakistan (ADBP). Until their failure, the cooperatives had been the lending institution for farm credit after the ADBP. Commercial banks extend credit to the farmers and for agricultural-based activities.

The ADBP has a recovery problem of Rs15 billion (US$660 million) from loans to big and influential landlords, and since 1991-92 the ADBP has squeezed its credit supply to farmers.

Outlook

A growth rate of 4.5 percent in agriculture has been set for 1991-92. This target would be achieved by ensuring the availability of key inputs such as irrigation water, fertilizer, energy, improved seeds, and pesticides.

The Seventh Five Year Plan projects an overall growth rate of 4.7 percent in the agriculture sector (Table 1.12). The major emphasis during the Seventh Plan period will be on the production of crops having better demand prospects, including for export, and accelerated oilseeds production to achieve self-sufficiency. To meet domestic demand, production of sugarcane, fruits, vegetables, milk, and meat will also be given priority.

Table 1.12: **Agriculture sector's performance, percent per year**

	Long-term 1949-82	Sixth plan target	Sixth plan achieved	Seventh plan target
Major crops	3.4	3.6	2.3	4.0
Minor crops	3.1	7.0	3.6	5.5
Livestock	2.4	5.9	6.2	5.3
Fisheries	4.1	7.5	4.5	4.9
Forestry	2.2	5.0	10.8	2.6
Overall	5.1	4.9	3.8	4.7

Source: Economic Survey 1990-91

INDUSTRY

Pakistan's industrialization began after independence in 1947. Government industry policy, however, has fluctuated somewhat over the years. During the 1950s and 1960s, the government introduced vast incentives to encourage domestic investments in the industrial sector. As a result, the output of the manufacturing sector grew at a rate of nine percent per year. The basic aims of these measures were to reduce imports; diversify domestic sources of imports; increase production from a variety of domestic sources; and substitute from imported to domestic sources.

Past industrial policies have tended to favor large-scale manufacturing, which is capital intensive and urban based. During the early and mid-1970s, while Z.A. Bhutto was president, a number of sectors were nationalized and certain controls were introduced on investments. Private investment fell and the growth of the manufacturing sector declined to about three percent per year. The Zia government (1977-88) tried to reverse the trend by introducing a new industrial development policy in 1984. This policy has continued and even expanded to encourage private sector investments in the industrial sector.

The government's regulation of industry is directly linked to the lending policies of the banks, which are themselves developed within the broad framework of the government's economic policy and annual development and five year plans.

Private foreign investment increased from Rs2.3 billion (US$100 million) in 1987-88 to Rs16 billion (US$600 million) in 1989-90. In 1988-90, the PPP administration took a number of initiatives for rapid development in energy, fertilizers, cement, heavy engineering, and communications.

Recent developments

In January 1991, the Sharif administration introduced new measures involving investment, deregulation, establishing private banks, and liberalizing foreign exchange controls. By lifting restrictions on internal and external foreign exchange transactions, the present regime is gearing up a policy of openness to foreign and expatriate investments.

The government announced a new industrial policy (NIP) on December 13, 1990. The objectives of the NIP are to help promote a self-reliant economy and value added exports; to develop skills at all levels to enhance efficiency, productivity, and quality of products; and to promote labor-intensive industries.

Steps to industrialize and to deregulate the economy were almost as swift. Major concessions and incentives created a three year tax holiday on all industries set up anywhere in Pakistan between December 1, 1990 and June 30, 1995. As of December 1991, no substantial foreign investment has yet been made in Pakistan. The government has also announced a tax holiday for rural industry.

Manufacturing sector

The manufacturing sector accounts for 17.6 percent of the GDP and is the second largest source of employment. Manufactured products have been substantially substituted for imports and are now becoming a source of export goods.

The average growth rate during the 1980s was more than six percent per year. However, in the past three years growth in the manufacturing sector remained below the annual target (seven percent) since 1987 mainly due to slower growth in the large-scale manufacturing sector (Table 1.13 and Table 1.14). As the manufacturing sector contributes about 17 percent to GDP, a positive growth is essential for an export-oriented economy. In 1990-91, the manufacturing sector accounted for about 17.6 percent of GDP, a growth of 5.74 percent compared to FY1989-90 rate of 17.56 percent for GDP and 5.7 percent growth rate.

Table 1.13: **Manufacturing sector's major indicators**

Year	% share in GDP	Production index (1980-81 = 100)	% growth
1988-89	17.40	183.4	3.96
1989-90 (revised)	17.58	192.1	5.70.
1990-91 (provisional)	17.61	201.2	5.74
1991-92 (target)	18.00	210.0	6.00

Source: Economic Survey 1990-91

Table 1.14: **Manufacturing sector production**

Manufactured goods		Production July-March 1989-90	Production July-March 1990-91
Cotton yard	000 kg	675,234	775,654
Cotton cloth	000 sq m	223,074	221,674
Jute goods	000 tonnes	74	76
Cooking oil	000 tonnes	516	499
Cigarettes	million	26,256	24,707
Nitrogen fertilizer	000 nutrient tonnes	870	821
Phosphate	000 nutrient tonnes	78	75
Paper all types	000 tonnes	53	51
Paper and chip board	000 tonnes	78	79
Cement	000 tonnes	5,537	5,818
Soda ash	000 tonnes	119	120
Caustic soda	000 tonnes	55	59
Sugar	000 tonnes	1,714	1,712
Pig iron/hot metal	000 tonnes	725	752
Billets	000 tonnes	205	266

Source: Economic Survey 1990-91

Public sector industries (PSUs)

The Ministry of Production administers 75 industrial PSUs through eight holding corporations. A recent addition in the sector is the Pakistan Steel Mills (Bin Qasim), completed with the former Soviet Union's assistance, which became fully operational in 1988. Seven corporations, excluding Pakistan Steel, control 72 PSUs.

During 1990-91, the PSUs have shown improvements in all performance indicators (Table 1.15). The value of production in 1990-91 (constant prices of 1987=100) increased by 3.2 percent over 1989-90. The corporations showing increase in their production and sales include the State Petroleum Refining and Petrochemicals Corporation, the Pakistan Industrial Development Corporation, and the State Cement Corporation.

Table 1.15: **Public sector performance, billion Rs***

	1988-89	1989-90	1990-91
Production value**	39.35	29.83	30.81
Sales	35.20	34.70	39.51
Pre-tax profit	1.44	2.22	2.35
Taxes and duties paid	8.10	7.86	8.85

* Constant prices of 1987-88 = 100
** Excluding Pakistan Steel
Source: Economic Survey 1990-91

Large-scale industries

The sector is dominated by cotton textiles, fertilizers, cement, sugar, vegetable oil, and food processing. Large scale industries accounted for 12.6 percent of GDP in 1990-91, a growth of 4.72 percent over 1989-90's output. The government has planned a growth rate of 10.3 percent in large scale manufacturing for 1991-92.

Small-scale industries

Small-scale industries are mainly in the private sector and include both registered and non-registered industries. These include light engineering, small tools and appliances manufacturing, leather goods, ceramics, cutlery and small utensils, sports goods, pottery, wood working, carpet weaving, and handicrafts. They are labor intensive and are estimated to absorb about 81 percent of the industrial labor force. Small scale industries accounted for five percent of GDP in 1990-91, with a growth of 8.4 percent over 1989-90s output. The government has planned a growth rate of 8.4 percent in small-scale manufacturing for 1991-92.

Outlook

The industrial growth strategy for the Seventh Five Year Plan emphasizes the establishment of more efficient and sophisticated industries with a strong export orientation. This will be accomplished by the implementation of appropriate exchange

rate policies, tariff rationalization, and fiscal incentive designed to promote greater allocation and competitive efficiencies.

The Seventh Plan accords high priority to small-scale manufacturing, which will be provided greater access to infrastructure facilities such as power, gas, water, and telephones. This includes preferential treatment in credit allocation, encouragement of sub-contracting arrangements between large-scale and small-scale industries, and the establishment of one-window operations so that entrepreneurs can meet all their requirements in one place. Incentives are being offered for channeling foreign remittances to investment in small-scale industries.

The share of manufacturing sector in GDP is projected to rise from 17.5 percent in 1987-88 to almost 19 percent in 1992-93, the final year of the Seventh Plan. The manufacturing sector is expected to contribute about 22.5 percent of the increment in GDP during the Seventh Plan period. The structural changes emerging from the projected growth targets for major industrial subsectors are shown in Table 1.16.

Table 1.16: **Seventh Plan target percent share in value added large-scale manufacturing**

Industries	1987-88	1992-93	Annual growth rate %
Food, beverages, and tobacco	16.4	15.2	6.0
Textiles	12.1	11.7	5.2
Paper and board	1.1	1.4	13.5
Pharmaceuticals	4.5	4.2	6.1
Cement	2.2	2.1	8.0
Chemicals	8.4	7.8	5.7
Fertilizers	6.7	6.2	2.9
Petroleum products	6.8	5.9	4.5
Transport equipment	2.3	2.8	11.6
Other engineering products	9.6	10.1	15.0
Other	36.6	38.8	15.0

Source: Economic Survey 1990-91

The key problems facing Pakistan in industrialization include access to markets and capital; modernization of existing production facilities; quality control; lack of appropriate technology and in many cases, management skills; and the need for improvements in infrastructure and inter-industry linkage. Greater allocative and competitive efficiency through appropriate exchange rate policies, tariff rationalization, and fiscal incentives is needed.

A likely constraint on the growth of the manufacturing sector, particularly during the early 1990s, is expected to come from industries where the current rate of production has already approached capacity, for example, fertilizer, oil refining, sugar and basic chemicals. The major contribution is expected to come from food processing, garments, paper and board, pharmaceuticals, petrochemicals, automobile, tires and batteries, construction materials, and engineering industries.

Despite political and structural difficulties, the policies of import liberalization, privatization, and deregulation should have a positive impact on industrial growth in 1992. The injection of foreign capital is expected to bring with it advanced technology, management, marketing, and technical skills needed to rejuvenate the country's industrial sector. The new initiatives and measures taken by the government such as privatization, deregulation, decontrols, simplified sanctioning procedures, fiscal and other incentives for industrialization, exchange reforms, rationalization of tariffs, and development of physical and social infrastructure will help in increasing industrial investment and production in the future. An improvement in law and order will also make a positive contribution.

TRADE AND EXTERNAL DEBT

Trading partners

Pakistan's main trading partners are Japan, the United States, the United Kingdom, the former West Germany, China, Italy, South Korea, and Saudi Arabia. In 1990-91, exports went to Japan (12 percent), United States (12 percent), United Kingdom (six percent), West Germany (six percent), Hong Kong, Italy, and the United Arab Emirates (each about five percent) and South Korea, China, and Saudi Arabia (each about three percent). In the same year, contributions to total imports were 16 percent from the

United States, 14 percent from Japan, seven percent from Kuwait, 6.8 percent from West Germany, six percent from the United Kingdom, and the remainder from China, Saudi Arabia, Malaysia, Italy, and South Korea, each about three percent.

Trade policy

Pakistan is a producer of raw materials and must import capital goods for its industry, production system and agriculture. The design of trade policy in Pakistan has been geared to achieve three objectives: to contain the trade deficit within manageable limits; to ensure adequate availability of essential goods; and to direct investment and production to the various sectors that accord with national priorities and aspirations.

To limit the trade deficit, Pakistan governments in the past have relied more on restricting imports than promoting exports. In January 1991, the government announced a process of relaxation of import restrictions. The objective of providing for adequate supplies of essential goods has been implemented by allocating import licenses, lowering import duties, and restricting exports of capital goods. The third objective has not been successfully achieved, and the structure of protectionism resulting from trade policy discriminates against essential agricultural goods while favoring non-essential manufactured goods.

With increasing government controls on trade during the 1950s and under the Open General License (OGL) system, import licenses were required to import any product. During 1959-72, a so-called liberalization through multiple exchange rates and an export bonus scheme was pursued. The bonus voucher export scheme was finally abolished when the rupee was devalued by 131 percent in May 1972 from Rs4.76 : US$1 to Rs11 : US$1. During 1972-76, import licensing was simplified. Later in the period, the reduction and finally elimination of export duties on various products helped to unify the exchange rate for exports.

During 1978-82, different duty rates were imposed for commercial and industrial users, and the Raw Materials Replenishment Scheme (RMR) was introduced to provide exporters with access to raw materials, including some that were otherwise banned.

Renewed balance-of-trade problems besieged the economy as domestic inflation exceeded world price inflation and the rupee appreciated in real terms.

In January 1982, the rupee was decoupled from the dollar and the government adopted a managed floating exchange rate policy, which hovered around Rs20 : US$1. With the gradual depreciation of the rupee came a liberalization of imports with lifting of ban from 122 products in 1983. A negative list of banned imports was introduced, from which 124 products were removed in 1987-88 and 162 products in 1988-89. In 1989-90, the negative list consisted of items banned for religious or security reasons; luxury consumer goods; and items banned to protect selected industries.

Exports

In real terms, exports reached a peak in 1981, which was not achieved again until 1988. Exports are dependent on two agricultural commodities — cotton and rice — the production of which are subject to great variation due to the weather conditions. Exports in FY1990-91 were estimated at US$56,893 million (Table 1.17). Raw cotton, cotton cloth, and cotton yarn represented a major portion of exports accounting for US$3.2 billion in fiscal 1991, a 55 percent share of total export earnings of US$5.8 billion (Table 1.18 and Table 1.19).

Table 1.17: **Exports and imports, US$ billion**

	1986-87	1987-88	1988-89	1989-90	1990-91	July-Sept 1991
Exports	3.68	4.45	4.66	4.95	6.11	1.41
Imports	6.29	7.52	7.83	8.05	8.66	2.14
Deficit	-2.61	-3.07	-3.17	-3.1	-2.55	-0.73

Source: Economic Survey 1990-91

Table 1.18: **Trade and balance of payments, million US$**

Transaction	1990-91 revised estimates
Trade balance (-)	2,247
Exports (f.o.b.)	5,689
Imports (f.o.b.)	7,936
Private transfers	1,972
Workers remittances	1,742
Current account balance (-)	1,854
Net change in reserves	89

Source: Economic Survey 1990-91

Table 1.19: **Exports composition, percent share**

Exports	July-March 1989-90	July-March 1990-91
Primary commodities	13.3	8.8
Cotton manufactured	50.9	54.9
Traditional exports	16.2	16.9
All others	19.6	19.4
Total	100.00	100.00

Source: Economic Survey 1990-91

Imports

Pakistan's level of imports has increased steadily in accordance with the country's need for capital, intermediate, and consumption goods. However, the composition of imports has recently changed due to industrialization and variations in the international price of petroleum. The share of capital goods in total imports has increased from 30 percent to 36 percent during 1982-1991. Imports in 1990-91 are estimated at US$7,936 million, an increase of 7.1 percent over 1989-90 and 6.9 percent over the budgeted level of the year. During July-March 1990-91, total imports in cost, insurance and freight (CIF) terms increased by 9.6 percent over July-March 1989-90. The import of crude oil and

petroleum products substantially increased (50 percent) due to higher world prices of crude oil and products during the Gulf crisis (Table 1.20). Their share rose from 17.5 percent in 1989-90 to 23 percent in 1990-91 (July-March). The increase in oil and products (40 percent) emanated from higher unit prices though their import quantum declined. Excluding oil and products, imports increased marginally by 1.2 percent. The contribution of major import items to the increase in total imports is shown in Table 1.21.

Table 1.20: **Foreign debt and capital inflows, FY1990-91 (estimated)**

	in million US$
Debt outstanding	
Disbursed and outstanding	15,961
Undisbursed*	10,480
Transaction during period	
Commitments	3,221**
Disbursement	2,105**
Service payments***	
Principal	772
Interest	570
Debt service as %	
Export receipts	23.6
Foreign exchange earnings	14.5
GNP current prices	2.8

* Exclusive of grants
** Excludes interest on short-term borrowings and IMF charges
*** Inclusive of IMF's SAF loan
Source: Economic Survey 1990-91

Table 1.21: **Major imports**

Item	Value US$ million	% change	% change point contribution to total growth
Crude oil	503.85	63.6	3.84
Petroleum products	825.54	41.6	4.50
Machinery	1,095.44	11.0	1.16
Sugar	117.43	87.9	1.01
Wheat	127.18	-67.0	-5.07
Other	2,920.86	5.3	4.18
Total	5,590.30	9.6	9.62

Source: Economic Survey 1990-91

Outlook for trade

Pakistan's balance of trade has fluctuated substantially over the years due to changing energy prices and a weak export base. The trade balance in 1990-91 (revised estimates) showed a deficit of US$2,247 billion with imports at US$7,936 million and exports at US$5,689 million.

The target for exports in 1991-92 has been set at US$7.15 billion (Rs175 billion) and US$10 billion for 1992-93 (Rs250 billion). The six month review in 1991-92 showed an encouraging trend in exports. However, the deficit in balance of trade will be larger as imports are increasing at a higher rate. There is expected to be around US$9 billion of imports with a trade deficit approaching US$3 billion in 1991-92.

In the first quarter of the current fiscal year, 1991-92, the trade deficit has expanded to almost one billion US dollars over the corresponding period in 1990-91. The prospects for exports in the coming months look less promising as a cotton glut has depressed world's prices (US$0.60/lb) for cotton and yarn. The target of US$4 billion of cotton exports may not be attainable in 1991-92. Moreover, Pakistan has to import about two million tonnes of wheat at a cost of US$300 million.

There is estimated to be already a 33 percent shortfall in Pakistani workers' remittances during the first quarter of 1991-92 (US$400 million). The effects of unfavorable commodity prices could throw the government's 1991-92 fiscal forecasts of

the current account balance and the government's own finances seriously out of balance. Pakistan's balance of payment in 1991-92 can improve only if there is a decline in the unit value of imports and an increase in the growth of exports.

External debt

Pakistan is one of South Asia's leading debtor nations, with a total external debt of about US$23 billion as of December 1991, up from US$1.9 billion in 1980. Since the early 1950s, Pakistan has been facing shortages of domestic savings in comparison to its development needs. The total estimated commitments of external debt (medium and long-term) and grants are estimated to be US$44.33 billion as of July 1991, of which US$32.1 billion have been disbursed. As against this, repayment of external debt and credits amount to US$8.7 billion, with a balance of US$16 billion as disbursed and outstanding debt.

Pakistan's disbursed and outstanding debt and debt servicing liability have almost doubled over the last decade and have grown at an annual average rate of 6.2 percent and 8.3 percent respectively during this period. The increased volume of outstanding debt and magnitude of debt-servicing have posed serious problems of proper debt management. Disbursed and outstanding debt increased by 5.7 percent while debt servicing increased by 8.9 percent during 1990-91. The debt service ratio reached 30 percent in 1991. Paying the interest on past loans has become the biggest item of government spending. However, these debt service calculations do not include amortization of short term debt. If commercial lenders and foreign-exchange certificate bearers (US$600 million) are unwilling to roll-over present short-term credits, the real debt service burden could be much higher in 1992.

Foreign exchange reserves increased to US$375 million at the end of September 1991, from US$150 million in 1990.

Aid to Pakistan

The major source of external assistance to the country is the aid consortium, which includes a number of Western countries, Japan, and multilateral development agencies.

The consortium's assistance accounted for US$2.5 billion in 1990-91. Commitments of aid increased in 1989-90, with a US$3.42 billion inflow. However, during 1990-91 commitments of US$3.22 billion were six percent lower than the 1989-90 commitments; project aid declined 13 percent and non-project aid increased by 16 percent over 1989-90. In 1990-91, consortium, non-consortium (inclusive of the International Monetary Fund structural adjustment feasibility), and Islamic countries (excluding relief) contributed about 80.8, 16.2, and three percent respectively.

The IMF has placed Pakistan in a category of net debtor nations having a low-income economy with more than two thirds of its total liabilities outstanding in April 1991 (IMF World Economic Outlook 1991). The IMF is favorably considering (as of December 1991) release of its US$150 million from the last tranche of the four year (1988-92) US$870 million Structural Adjustment Facility (SAF), which had been withheld for more than a year. The IMF required that prices of petroleum and products should be increased by 41 percent to fulfill an earlier commitment made to it by Pakistan.

Pakistan's external debt situation has worsened during the 1990s, and it has been badly hit by revenue losses from the Gulf crisis; Pakistan's oil-import bill increased by US$1 billion in 1990-1991. The government has borne the higher cost of imported crude and petroleum products with the import of about 1.8 million tonnes (mmt) of crude and one mmt of refined products in the year 1990-91. Higher subsidies for fuel and fertilizer and the repatriation of some 60,000 Pakistani nationals from Iraq and Kuwait have also inflated the governmental expenditures. The worsening external payments position resulted in a rundown in foreign reserves from Rs5.8 billion (US$220 million) at the end of March 1990 to Rs2.9 billion (US$110 million) in mid December 1990, enough to pay for only about two weeks' imports.

In January 1990, Pakistan negotiated from the IMF two credit loans totalling US$1.2 billion. These will be repaid over five years at an interest rate of nine percent with the first payment not due for three years. In addition, Pakistan has been tapping commercial sources to cover imports and is seeking deferred payments terms from some oil exporters.

As a consequence of a continued deterioration in the balance of payments, Pakistan's annual loan requirement increased from US$2 billion to US$3.5 billion in 1989-90. Following the Gulf crisis, Pakistan's loan requirement reached US$5.5 billion in 1990-91; imbalance of trade deficits has increased by US$2 billion.

Availability of loans has been severely restricted due to the suspension of the United States aid package amounting to US$560 million for 1991-92, and due to pressure in Western donor countries to reduce aid during the current phase of stagflation in the world economy. Pakistan approached the World Bank in October 1991 to raise the ceiling of its present borrowings, by US$750 million to US$2 billion.

Two

INDIGENOUS ENERGY RESOURCES

ENERGY RESOURCES PLANNING

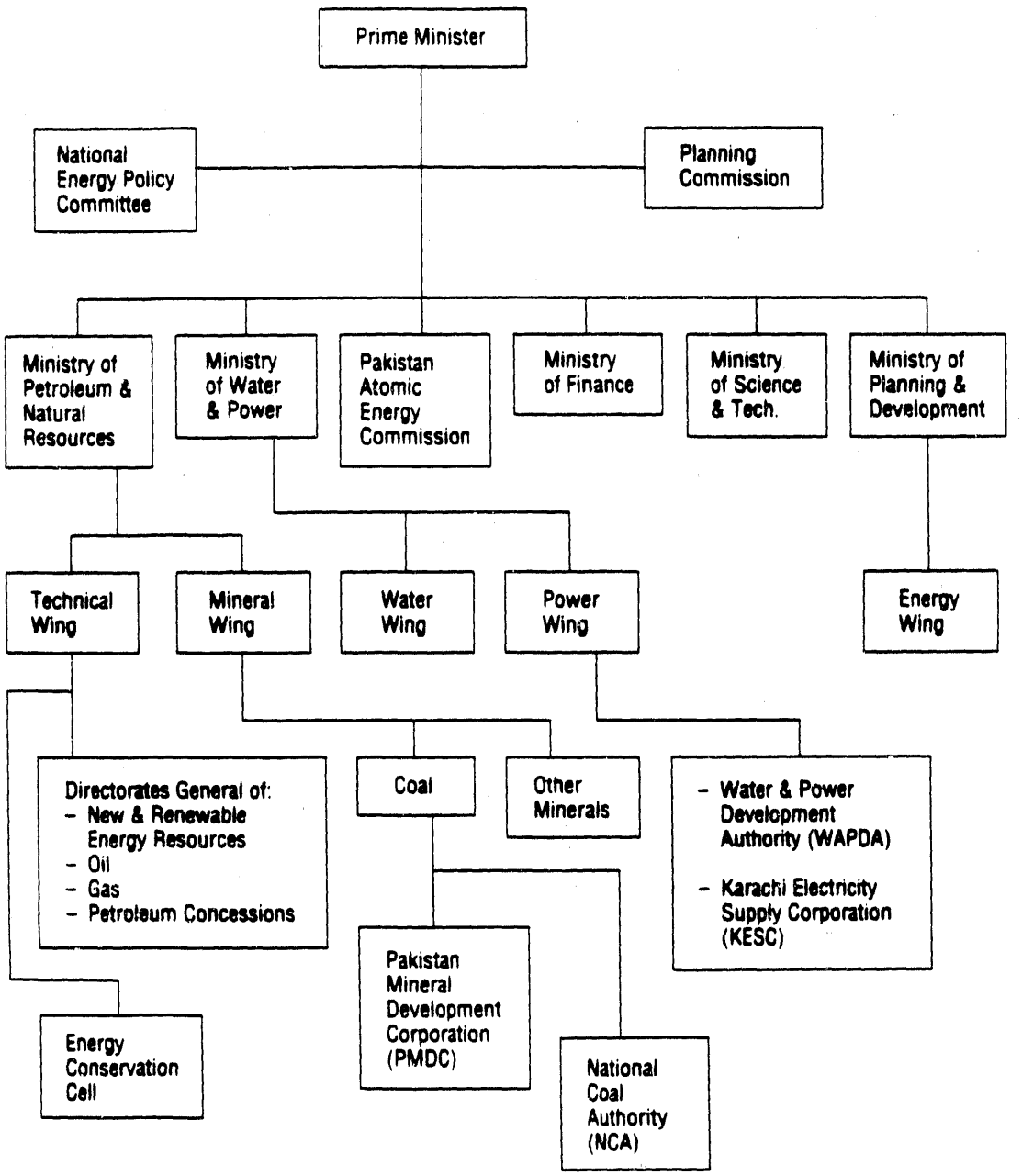
National economic planning is organized through the National Economic Council (NEC), with the Prime Minister as ex-officio chairman and the chief ministers of the provinces as members. The Planning Commission, also chaired by the Prime Minister, is the branch of the Ministry of Planning that prepares the national development plan (FYP). The draft FYP is reviewed by the Cabinet and the NCC. The integration of the provincial plan programs into the emerging plan framework is also carried out. The final plan is submitted to the Cabinet, the NEC, and the Parliament (National Assembly) for approval.

Responsibility for planning and implementing the development of Pakistan's energy resources is apportioned among central ministries: Planning and Development (energy department), Petroleum and Natural Resources (MPNR), Water and Power (MWP), Industry, and Science and Technology. These are tied with public sector agencies, which include the Water and Power Development Authority (WAPDA), the Pakistan Atomic Energy Commission (PAEC), the Oil and Gas Development Corporation (OGDC), and the National Energy Conservation Center (ENERCON).

Government has a multiple role in the energy sector. The exploration for and development of indigenous energy resources are given high priority within the national planning process. The role of energy in the country's modernization is considered within a centralized planning framework for a populous, diverse country.

Within the Planning Commission, there are five working groups relevant to the energy sector: petroleum, coal, electrical power, non-conventional energy sources, and energy use and conservation. There is also an advisory board on energy, which reports independently to the Prime Minister.

Figure 2.1: **Energy resources planning organization**



Source: Author, 1991

Table 2.1: **Five Year Plan investment**

Plan period	Total outlays Rs billion	Energy sector outlays Rs billion
First Plan 1955-60	4.86	0.60
Second Plan 1960-65	10.61	1.29
Third Plan 1965-70	13.20	1.76
Non-plan period 1970-78	75.54	13.84
Fifth Plan 1978-83	152.76	38.83
Sixth Plan 1983-88	242.41	78.91
Seventh Plan 1988-93	350.00	164.44

Source: Ministry of Planning 1989

The coordination between the ministries for the energy sector is provided by the energy department of the MWP, which acts as a secretariat for the National Energy Policy Committee (NEPC) and Energy Review Group (ERG). The ERG, comprising representatives from various ministries and organizations, is coordinated through the Ministry of Planning and Development. It coordinates energy sector activities in all phases of development, supply, and distribution, and meets at regular intervals to review the progress of energy sector projects. The Ministry of Petroleum and Natural Resources is responsible for exploration and development of oil, natural gas, coal, and non-fuel minerals. MPNR is composed of four directorates general dealing with petroleum concessions; oil operations; gas operations; and new and renewable sources of energy.

Investment plans

A core investment plan (CIP) is generally prepared by the government for the energy sector investment. The CIP includes high priority projects, which are designed to minimize the shortfall in forecast energy demand. The financing sources for the CIP include the annual development plan; the net revenues to be generated by sector entities; foreign loans and credits; and commercial loans.

The total energy sector investments during the Seventh Five Year Plan (1988-93) amount to Rs164.4 billion (in 1987-88 prices), which is 25.6 percent of the Seventh Plan outlay (Table 2.1). The largest share is allocated to power generation, followed by oil and gas, coal, energy conservation and renewable resources.

OIL

Pakistan has limited resources of oil and moderate resources of natural gas. Geologically, sedimentary rocks cover almost all parts of Pakistan, and, although petroleum source rocks and reservoir structures are widespread, a world class oil discovery has eluded Pakistan. A few localized and shallow structures in large sedimentary basins are productive. Petroleum source rocks and reservoir structures found in sedimentary basins in western part of Pakistan are of Eocene, Paleocene, and Jurassic age.

The first oil well was drilled within present Pakistan territories at Kondal in 1866, but, with a second well drilled during 1869, was found to be dry. In 1882 further drilling was initiated at Kharan in the Sibi district. This well was drilled to the depth of 430 meters and proved to be successful. It yielded about 5,000 barrels (bbls) of crude oil before being depleted. In 1893, Saxon and Company was given an exploration contract and succeeded in recovering 1,500 bbls of crude oil from this oil field during the same year.

More than 80 years after the first exploration for petroleum in Pakistan, a new phase of activity followed with the emergence of Pakistan as an independent nation in 1947. During the 1950s, Pakistan Oil Field Ltd. (POL), Attock Oil Company (AOC), and Pakistan Petroleum Ltd. (PPL) were actively engaged in exploring and developing petroleum resources.

The oldest existing oil field in Pakistan, the Khauor oil field, was discovered by the AOC in 1914. The Dhulian, Balkassar, and Joyamair oil fields were also established by the same company. The Meyal oil field was explored by POL in 1968 after the discovery of the Karsal oil field in 1956 (which ceased production in 1965). The average of oil wells drilled from 1947 to 1983 was very low.

The exploration activities of the PPl resulted in the discovery of the Sui gas field in the province of Baluchistan in 1952, which later proved to be a large gaseous reservoir. The PPl also explored five other gas fields at Zin (1954), Uch (1955), Khairpur (1956), Kandhkot (1956), and Mazarani (1959).

Oil reserves

Pakistan's reserves of oil are very limited and will last another seven years if no additional discoveries are made. Total reserves of oil are estimated to be about 154.55 mmb as of March 30, 1991. During the Sixth Plan, 57 wells per year were drilled, and in the Seventh Plan period 75 wells per year are being drilled.

Current production

Current oil production is from several fields in the north and south of the country (see Table 2.2 and Table 2.3). Average daily production from these oil fields was 65,599 barrels per day (b/d) during July 1990-March 1991, with a total production of 17.97 million barrels (bbl). The most productive oil field is Dhurnal in the north, which accounted for 38 percent of output in 1990-91.

For the Seventh Five Year Plan (1988-94), the target for domestic production is 76,000 b/d by 1993-94. Present daily production as of September 1991 was 73,950 b/d; since August 1991 the most recent addition to oil production is 8,950 b/d from the Occidental Petroleum's fields at Missa Kiswal and Pindoria.

Oil exploration and development in 1991

Against the target of 44 wells (revised target) for 1990-91, 28 wells were drilled; OGDC had drilled 18 and private companies had drilled 10 wells by the end of 1991. Oil discoveries were made by OGDC at Dhamraki and Meyun Ismail.

Table 2.2: **Oil production by region, barrels**

	July-March 1989-90	July-March 1990-91
Northern area fields		
Khaur	5,979	1,959
Dhulian	6,504	7,027
Joyamair	143,616	172,309
Balkassar	161,422	154,424
Meyal	759,208	727,558
Dhurnal	4,414,723	4,123,826
Bhabgli	484,709	405,281
Toot	290,270	258,257
Chak Naurang	119,805	517,765
Fimkassar	399,858	1,056,115
Dajhri	69,899	350,532
Adhi	44,571	554,124
Subtotal	6,900,564	8,329,178
Southern area fields		
Thora	2,081,219	1,340,809
Sono	609,516	594,230
Lashari-C	4,756,630	524,479
Tando Alam	624,328	524,479
Bobi	73,722	154,753
Pasaki	155,511	1,249,751
Khaskeli	298,370	277,631
Laghari	1,452,845	1,209,280
Dhabi	260,687	252,185
Mazari	1,461,869	1,367,733
South Mazari	657,350	786,837
Golarchi	49,839	26,388
Turk	162,473	170,872
Halipota	-	26,388
Matli	20,990	98,310
Liari	-	870,224
Sonro	-	91,866
Subtotal	83,375,349	96,645,095
Total	15,275,913	17,974,273
Average/daily	55,752	65,599

Source: Economic Survey 1990-91

Table 2.3: **Oil production, 1989-90 and 1990-91**

Region	Number of fields	Oil production July-March 1989-90 b/d	Oil production July-March 1990-91 b/d	% change
North	12	25,185	30,398	21
South	17	30,567	35,201	15
Total	29	55,752	65,599	18

Source: Ministry of Petroleum and Natural Resources 1991

Fourteen domestic and foreign oil companies were engaged in oil exploration and development during 1991. In the first nine months of 1991, 15 exploratory wells and 24 appraisal wells were drilled. Much of the better than expected results in 1991 stem from a wildcat success of 1:3 compared with the widely accepted international industry average of 1:10.

Offshore drilling was undertaken in 1988 by Petro Canada with Canadian aid funds in the Indus offshore basin and resulted in the discovery of small flows of gas and condensate. Six major companies are producing hydrocarbons in Pakistan. These include in the private sector Pakistan Petroleum Ltd. (PPL), Pakistan Oilfields Ltd. (POL), Pakistan Fauji Foundation, Union Texas Pakistan, and Occidental Petroleum. The public sector corporation includes the Oil and Gas Development Corporation (OGDC).

The Oil and Gas Development Corporation (OGDC)

The public sector enterprise, Oil and Gas Development Corporation (OGDC), was established in 1961 and is at present actively engaged in the exploration and development of oil and gas resources in the country. The OGDC concentrates on the general exploration and development work and exploratory potential by locating probable prospective points through geological surveys. Such preliminary surveys are followed by detailed surveys performed by international oil companies, after which drilling activities begin. It first discovered two oil fields at Dhodak and Toot and one

gas field at Pirkoh in 1977. The OGDC produced 8.7 million barrels (mmb) of oil in 1990-91 compared with a target of 8.6 mmb and about 240 million cubic feet per day (MMcf/d) of gas compared with a target of 254 MMcf/d. The OGDC made a profit of Rs1.5 billion (US$62 million) in 1990-91 compared with Rs554 million (US$21 million) in 1989-90, its first year as a self-financing operation.

The OGDC discovered six oil and gas fields in 1991; the most recent includes the Missa Kiswal strike, which may prove to be its largest oil discovery at 2,950 b/d. Other discoveries are at Buzdar near Hyderabad and Nur, 52 km southeast of Thatta.

The OGDC drilled a record 11 exploratory wells in one year and plans to continue its record pace of exploratory drilling. Located 40 km southeast of Hyderabad, Sindh, the first well at Meyun Ismail produced oil from the Lower Goru Formation's Cretaceous sandstone at a depth of 2,305 to 2,350 meters. This is very promising as it is the first time that oil has been struck in Cretaceous rocks in Pakistan.

Oil flowed at 1,320 b/d of 44° API gravity crude with 450 psi flowing wellhead pressure. Its low gas:oil ratio will expedite the development of the field. The high quality crude will be sent to the National Refinery.

The OGDC's 1991-92 US$141 million annual development plan involves drilling of 12 exploratory and 23 development wells. The entire investment cost is to be financed through the OGDC 's own resources and borrowings from the World Bank and the Asian Development Bank (ADB). The ADB has approved a loan of US$53 million for the OGDC's US$88 million project to develop southern Sindh oil fields by 1993-94 at Thora, Sono, Lashari, and Kunar, and gas/condensate fields at Bobi and Daru.

Discovered by the OGDC, these fields are near the Tando Alam field, also being developed with ADB funds. The multiple field projects calls for drilling 11 development wells, procuring and installing equipment and material related to drilling, field gathering facilities, gas lift system, central gathering facilities at Tando Alam, and a gas processing plant.

The recoverable reserves from these fields are estimated at 48 mmb of oil and condensate and 55 billion cubic feet (bcf) of gas. The development will save Pakistan US$47 million per year in imported oil costs. In addition, the project will provide for

transfer of foreign technology to improve drilling efficiencies and implement enhanced oil and condensate recovery with a gas lift system and gas recycling. The OGDC plans to apply the technologies to other fields with similar geological conditions in the country.

The private sector

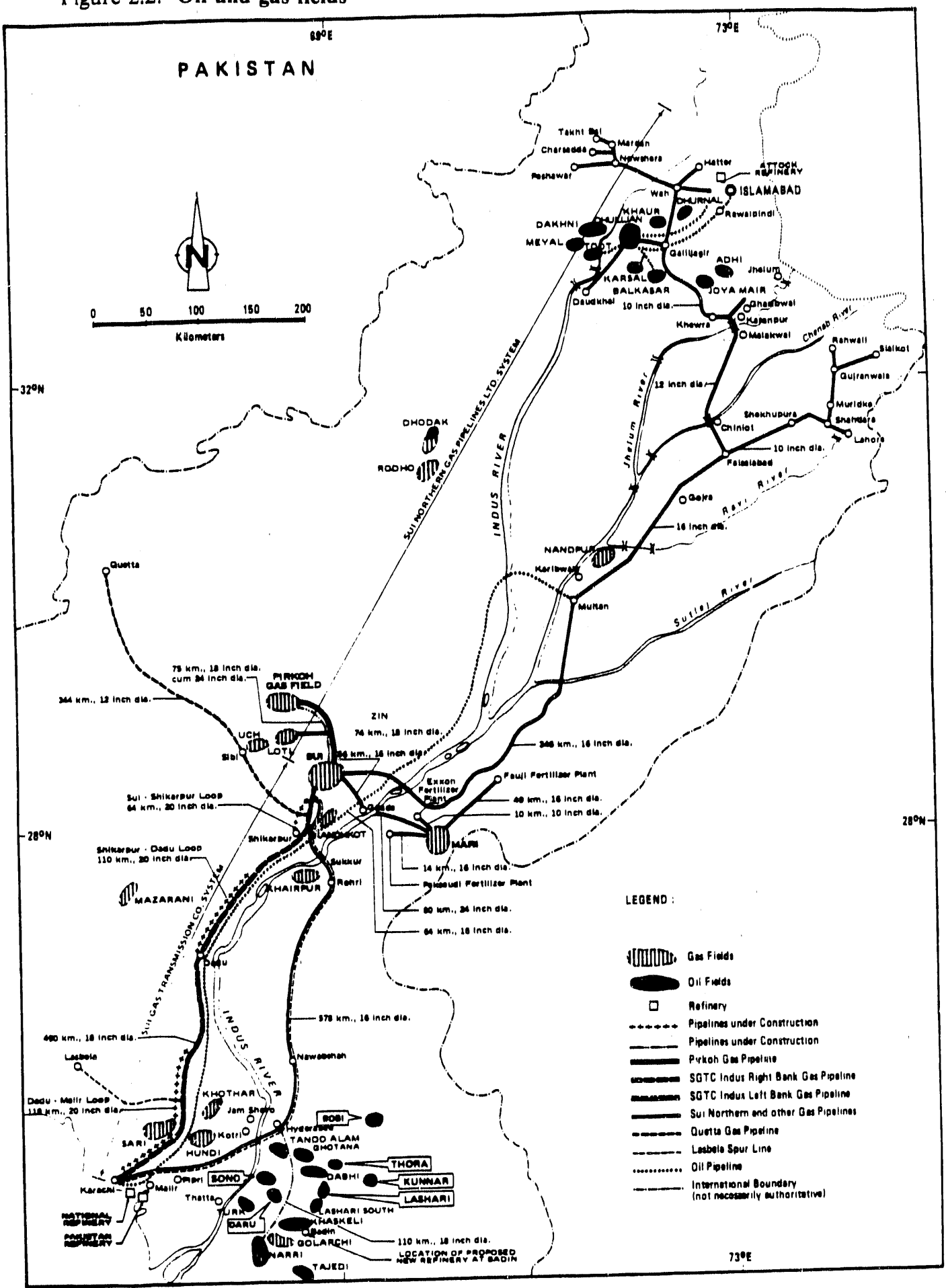
Pakistan Petroleum Ltd. (PPL) is playing an important role in developing the Sui gas field. Similarly, Pakistan Oil Fields Ltd. (POL) is enhancing and upgrading outputs of petroleum in the Potowar area. Pakistan Fauji Foundation has invested 51 percent of its finances in the Pakistan Stanvac project, while the remaining 49 percent is used for the expansion of the Mari gas field, which is meeting the present requirements of three fertilizer plants in its vicinity. These plants belong to Exxon Chemicals (now bought by the employees of the company), Pak-Saudi Fertilizer Company, and Fauji Fertilizer Company.

Union Texas and Occidental Petroleum are the major producers of oil in Pakistan. They have developed oil fields in the southern and northern region of the country respectively.

Union Texas Pakistan (UTP): is a major producer of oil in the southern region and has plans to invest US$30 million in the next 18 months (1992-93) to accelerate exploration in the Badin Block, Sindh. UTP is a pioneer in oil development in the Sindh province, and it has seen Pakistan as one of its international linchpins. The UTP has boosted its productive capacity in Sindh to 18,000 b/d of oil and 151 MMcf/d of natural gas.

The government has rejected a request from the UTP to alter the terms on the remaining period of lease in the Badin Block. The UTP wanted to change the production split to 35:65 in its favor, but the government felt that any change from the normal 50:50 split would set a bad precedent.

Figure 2.2: **Oil and gas fields**



Occidental Petroleum Company (Oxy): is a major producer of oil in the northern region. It is operating in the Soan Potawar block with a 40 percent interest; other interests are held by the OGDC (50 percent), Pakistan Oil Fields Ltd. (seven percent), and Attock Oil Co. (three percent).

Oxy's major discovery is at Dhurnal, discovered in 1986, with reserves of 50 million bbl, with another at Bhangali (1989). Dhurnal and Bhangali together produce 15,000 b/d of oil and 35 MMcf/d of gas. The Bhangali well tested 3,110 b/d of 32° gravity oil and 7.2 MMcf/d of gas from an Eocene Sakesar Formation.

Oxy has discovered a moderate size oil and gas field at Pindori, 25 km from Dhurnal. The first well flowed 5,906 b/d of 41° gravity oil and 9.6 MMcf/d of gas from two zones at Eocene Sakesar Formation. This field is expected to sustain a production of 10,000 b/d.

NATURAL GAS

Natural gas is the major source of energy in Pakistan, supplying about 35 percent of total energy needs yearly. Natural gas is used for every purpose: power generation, feedstock in steel mills, fertilizers, cement industry, domestic cooking and heating, and LPG and CNG in motor vehicles.

The present allocation of natural gas is 32 percent for power generation, 26 percent for existing and proposed fertilizer plants, 25 percent for general industry, five percent for cement factories and commercial sector, and 12 percent for household consumers. Gas supplies, which were growing at an annual five percent rate during the 1970s have now reached a rate of 15 percent. Gas production grew from 880 MMcf/d in 1982 to about 1500 MMcf/d in 1991.

Natural gas was discovered in Pakistan in 1952 at Sui by PPL and at Mari by Pak-Stanvac. These two fields still remain the largest gas fields in Pakistan, though a number of other fields – Kandhkot, Pirkoh, Dhodak, Sari-Hundi, and Loti – have been

Table 2.4: **Natural gas production**

Year July-March	Number of fields	Gas production million m^3	% change
1989-90	20	10,441.51	n/a
1990-91	20	10,817.61	3.6

Source: Ministry of Petroleum and Natural Resources 1991

discovered and developed over time. The total proven reserves of these gas fields is estimated at 20 trillion cubic feet (Tcf) with another two Tcf of probable reserves.

The quality and composition of the gas varies greatly from field to field. High nitrogen and carbon content or both have made fields at Uch, Zin, Jacobabad, Khairpur, and Mazarani uncommercial.

Gas reserves

The recoverable reserves of natural gas from dry gas fields and associated gases from the oil fields were estimated at 558 bcm as of March 31, 1991.

Production

The production of natural gas during 1990-91 was 14 bcm. During the first nine months of 1990-91, production was 10.82 billion meters compared to 10.44 cubic meters (m^3) during 1989-90; the rate of growth has been 3.6 percent. Comparative figures for 1989-90 are given in Table 2.4.

The Sui Gas Field

Discovered in 1952 by PPL, the Sui Gas Field was brought into production in 1955. The Sui Gas Field is a giant field and has changed the pattern of commercial energy consumption in Pakistan.

The field is a large and symmetrical anticline dome with folds in all directions. The gas trap is anticlinal and production of gas is free flowing. The Sui gas pool is estimated to cover an area of 187.5 km^2 with a maximum gas column of 245 meters. The

original reservoir pressure was 1,965 psi measured at 1,000 meters below mean sea level. From the reservoir operation and effects of reservoir stimulation, it is inferred that a gas expansion and water drive is operative, and secondary recovery methods at present are not necessary.

As of January 1991, there were 86 wells in the field. The first well was an observation well, and 63 wells are currently being produced. The field consists of three gas bearing formations – the uppermost Habib Rahi; the basal member of the Eocene Kirthar formation; and the underlying Sui Upper Limestone (SUL) and Sui Main Limestone (SML), also of Eocene age. The gas contained in the Habib Rahi Limestone has a very high percentage of inerts. The main producing zone, Sui Main Limestone (SML), at an average depth of 1,250 meters (4,100 feet) in the Laki formation of lower Eocene age, has been the principal natural gas supply source for the country.

Composed mainly of foraminiferas, the producing zone is believed to have originated in shoal reef and is relatively clean of shales and clays. Above the producing zone, the Ghazij shale forms a sealing cap. Net pay varies from 250 meters at the top of the formation to about 33 meters at the flanks. The gas column rests on water with a transition zone between the gas and water. Original gas-water contact has been identified at 1,310 meters below sea level. Bottom-hole pressure data indicates no definite water movement, and electrical logs show no real evidence of a rise in the gas-water contact. The initial gas in place in the Sui Main Limestone (SML) is about 12.25 Tcf. Cumulative production from the SML as of January 1, 1987 is about 3.7 Tcf (90 million tonnes of oil equivalent (m toe)).

SML gas is considered 'standard gas' in Pakistan. In the raw form, it contains 90.1 mol percent hydrocarbons, 2.5 percent nitrogen, 7.4 percent carbon dioxide, 92.2 grains/100 standard cubic feet (scf) hydrogen sulfide, and 3.8 grains/100 scf free sulfur. Its heat value is 933 btu/scf. The gas is treated in MEA purification banks and dehydrated by the TEG and desiccant processes. As a result of purification, net hydrocarbon content increases to 9.56 percent, nitrogen increases to 4.1 percent, carbon dioxide decreases to less than 0.1 percent; hydrogen sulfide and free sulfur are eliminated. Purified SML gas has a heat value of 994 btu/scf.

The PPL's plan for the development of this field include the drilling of additional 18 wells, comprising three wells by 1992, five wells in 1994, 1998 and 2000, to maintain a plateau production of 835 MMcf/d. Present production is 750 MMcf/d from 62 wells. Since production began in 1955, SML reservoir pressure has declined by about 415 psi down to 1,550 psi by the end of 1981. For PPL to meet its contracted delivery pressure commitment of 1,150 psi, simulation studies indicate the need for installing 90,000 BHP field compression facilities over the next ten years. The first phase of 75,000 BHP became operational in mid 1985.

The other productive zone in the Sui field is the Sui Upper Limestone (SUL) with an average depth of 3,900 feet and consisting of alternating white to light brown limestone separated by calcareous shale. Nine porous producing zones have been identified, but logging and tests show only five to be economically productive. The SUL is separated from SML by Ghazij shales. SUL is a depletion type reservoir composed of several separate members. SUL gas has a 93.5 mol percent hydrocarbon content, 5.3 percent carbon dioxide, and no free sulfur. The low carbon dioxide and absence of sulfur eliminates the need for purification. Dehydration, however, is necessary. SUL gas has a relatively high heat value of 984 Btu/scf. The gross recoverable reserves have been estimated at 0.80 Tcf (0.74 Tcf SML) suitable for a production level of 100 MMcf/d.

The Mari Gas Field

The field is an anticlinal structure covering an area of about 450 km^2. The first well at Mari was drilled in August 1957, and up to January 1991 a total of 41 wells have been drilled of which 21 wells have been developed. The gas producing horizon is located in the Tertiary age rock strata of the Lower Kirthar Formation.

The field supplies feedstock and energy needs of three nearby fertilizer plants: Exxon Chemical Ltd, Pak-Saudi, and Fauji. Mari gas has a 71.4 mol percent hydrocarbon content, 19.5 percent nitrogen, nine percent carbon dioxide, and 0.1 grams/100 scf hydrogen sulfide. Although the high inert content results in the relatively

low heat value of 723 Btu/scf, the presence of nitrogen and carbon dioxide is beneficial in the use of this gas as fertilizer feedstock.

In its present use as feedstock, no purification is needed in the Mari gas; for future use as thermal plant fuel, removal of carbon dioxide, though not necessary, is recommended. Dehydration is nevertheless required. An anomaly between the field pressure/production history and volumetrically estimated reserves has been indicated. This could result from either a very active water drive or a very conservative volumetric reserve estimate, but production history is as yet too limited to be certain.

The more recent core lab report on the Mari reservoir has also used the volumetric approach, in view of insufficient field history to enable estimation by pressure decline. Three production scenarios have been recommended, the maximum of which is 410 MMcf/d (average day) and 545 MMcf/d (maximum day) with field compression starting in 1989. Production at Mari has more than doubled over the decade, rising from 125 MMcf/d in 1980 to 280 MMcf/d in 1991.

The production of the Mari field will be expanded to 400 MMcf/d by 1995 at a cost of Rs1.4 billion, with a foreign exchange component of US$27 million to be funded by the International Finance Corporation (IFC).

The Kandhkot Gas Field

The Kandhkot field is located just south of Sui. Its productive area consists of two separate features, in each of which one well has been drilled so far by the PPL. Productive horizons are SML and SUL.

Kandkhot gas contains 80.9 mol percent hydrocarbon, 16.6 percent nitrogen, 2.5 percent carbon dioxide, 30.8 grains/100 scf hydrogen sulfide, and 1.2 grams/100 scf free sulfur. The high percentage of inert nitrogen results in the relatively low heat value of 842 Btu/scf. The high sulfur and marginally high carbon dioxide would require MEA purification; TEG dehydration would also be necessary. Seventeen wells have so far been drilled and production per well is estimated at four MMcf/d.

Present plans call for further seismic data to be acquired between the main east and west portions of the field to resolve the difference of gas/water contacts in the two

areas. Based on present information, proven recoverable reserves have been estimated at 1.37 Tcf (1.2 Tcf SML) and additional possible recoverable reserves of 0.19 Tcf (0.17 Tcf SML). Production capability at 40 MMcf/d per well gives a total production of 68 MMcf/d from 17 wells.

The Pirkoh Gas Field

The Pirkoh field is an east-west anticline with structural closure over an area exceeding 100 km^2. OGDC have drilled about 23 wells on this field at an average production of 5-6 MMcf/d per well. Pirkoh gas contains 82.6 mol percent hydrocarbons, 11.1 percent nitrogen, and 6.3 percent carbon dioxide. The gas is free of hydrogen sulfide or sulfur. Its heat value is 840 Btu/scf. High carbon dioxide content may necessitate MEA purification. TEG dehydration would also be necessary. A volumetric reserve estimate using a larger gas productive area and the production test results from the twenty three wells put the field's proved gross recoverable reserves at 1.12 Tcf (1.014 Tcf SML) with additional possible recoverable reserves of 0.78 Tcf (0.70 Tcf SML). The field's production capability is estimated at 200 MMcf/d based on a 35 well development program with estimated yields of five to six MMcf/d per well.

The Dhodak Gas Field

The Dhodak field is approximately 280 km north-east of the Sui field. Three wells drilled along the axis of the structure have tested gas and condensate from the Ranikot (Paleocene) and Pab (Cretaceous) sandstone reservoirs. These three wells were drilled on the crest of the structure and were thus unable to provide subsurface confirmation of the dips in the structure's flanks.

Production tests indicate potential condensate recovery of 50 bbl/MMcf/d of gas. Hence, this field is considered a source of condensate recovery of 50 bbl/MMcf/d of gas. Analyses from both Ranikot and Pab indicate a dew-point of the gas equal to the original bottom-hole pressure. Hence, retrograde condensation is expected to occur as reservoir pressure declines. Currently, there is no evidence of a water drive strong enough to maintain the reservoir pressure existing in the field.

Dhodak gas consists of 94.0 mol percent hydrocarbons, 4.23 percent nitrogen, 1.7 percent carbon dioxide, and is free of hydrogen sulfide and sulfur. The high hydrocarbon content gives high heat value of 1,150 Btu/scf, and the low carbon dioxide and absence of sulfur would eliminate the need for purification. The gross remaining recoverable reserves of gas are estimated to be 0.67 Tcf (0.83 Tcf SML). OGDC has completed the drilling of a fourth well and is analyzing the other three wells to ascertain their production potential. OGDC plans to drill two additional wells on the flanks of the structure, and the mode of development of the field would depend on the results of these two wells. As a result, Dhodak cannot be considered as a source of gas supply in the short term.

The government has decided to delay a decision on the method of full field development for the next few years, during which time a pilot gas reinjection project yielding about 3,000 b/d condensate would be implemented and field behavior would be observed. It is, however, expected that a small quantity of gas (eight MMcf/d) would be made available during the pilot stage for the nearby DG Khan cement plant. In addition, it has been recommended that a LPG plant be installed because of the relatively high propane-plus in the Dhodak reservoir fluid.

The Loti Gas Field

The Loti gas field, located in the Dera Bugti district of Baluchistan Province, is about 52 km northwest of the Sui gas field. The uppermost gas productive reservoir in the Loti field is the Sui limestone. Below this limestone, the Ranikot Formation is nonproductive, but the underlying Pab formation is gas bearing. The Sui limestone is subdivided into two units, and the Pab sandstone has also has been subdivided into two units similar to the subdivisions used in the Dhodak and Pirkoh fields.

The overall anticlinal Loti structure has a thrust fault limiting the potential extension of the gas to the north and a north-south gravity cross fault that drops a portion of the western end of the field down below the indicated level in the Sui and Pab reservoirs. Therefore, the Loti closure is concentrated in the area of current drilling. The rock quality deteriorates significantly to the east and southeast; no gas-productive

Table 2.5: **Drilling targets for the Seventh Five Year Plan, 1988-93**

Activity	Public sector OGDC	Private	Total
Exploration	65	60	125
Appraisal and development	100	150	250
Total	165	210	375

Source: Planning Commission, Seventh Five Year Plan 1988-93; Perspective Plan 1988-2003

reservoir rock was present in Loti-4, and it is projected to be absent in the vicinity of the potential Loti-7 location.

Similarly, unit 2 of the Sui also deteriorates in the southern portion of the field in the vicinity of Loti-3. Below the unproductive Ranikot formation, the Pab has been subdivided into two units, but only the uppermost of these is considered to have proved gas-bearing reservoir sands. The lower units are more shallow and experience more washout problems. While testing is limited, there are some zones that contain apparent log-calculated net pay.

The gross recoverable reserves are estimated at 0.525 Tcf based on the data of the seven wells. However, this estimate could be increased with additional appraisal drilling particularly along the south-southeast direction towards the Sui structure.

Production and exploration outlook

Total oil and gas production during the year 1990-91 was: oil 65,599 b/d, increasing 18 percent from 55,752 b/d in 1989-90. Gas production increased by 3.6 percent from 1,349 MMcf/d in 1989-90 to 1379 MMcf/d in 1990-91. By September 1991 oil production reached 73,000 b/d and gas production reached 1550 MMcf/d.

Exploration outlook in the Seventh Five Year Plan is for the private and public sectors to drill 75 wells each year during 1988-93 period, totalling 375 wells. The details of exploration activities is given in the Table 2.5.

Regional gas pipeline network

There has been agreement to form a gas pipeline network linking Iran and Pakistan. Natural gas that is in plentiful supply in the Iranian offshore region bordering Pakistan will be piped via 800 km of pipeline to Karachi through the Makran coast off the Arabian Sea.

COAL

Coal is one of Pakistan's commercial energy resources. There is a general uncertainty about the size and quality of coal reserves. There are a number of coal fields, most of which have been known for some years and most of which are exploited to some degree. The coal produced is of the semi-bituminous type, ranging between 8,000 and 10,000 Btu per pound. It is friable and relatively high in sulfur and ash content. Most of it is suitable for direct use in the firing of brick kilns and boilers and for use in the form of coke briquettes in foundries, lime kilns, and sugar mills.

In terms of quality and location, the coal is suitable for use in power generation and even by certain large industrial plants. However, its exploration and development has been limited in the past by government subsidizing of fuel oil and natural gas. As a result, not only did coal use not expand during the 1980s but also the limited use was further reduced by the shift of householders to natural gas and fuel oil. Currently, coal production of about 2.7 million tonnes (mmt) per year is mainly used by brick kilns.

Since 1986, the government has been reducing the subsidy on natural gas and petroleum products. As a result, the price of coal is becoming more competitive with other fuels, introducing new prospects for the expansion of the domestic coal industry. However, several bottlenecks remain. First, there is no stable demand except that of the brick manufacturers. Second, switching from oil and gas to coal normally takes place only if there is a significant margin in the economics of coal over other fuels. This is due to the technical inconvenience of using coal as compared with other fuels. The required margin is now becoming increasingly large due to concerns over environmental issues associated with coal use.

Table 2.6: Coal reserves by region, million tonnes

Region/coal field	Measured	Indicated	Inferred	Total potential
Baluchistan				
Mach-Abegum[1]	-	-	22.5	22.5
Sor Range-Dehari[2]	0.9	5.7	4.9	1.5
Sor Range-Dehari-Sinjidi*[1]	-	-	2.6	22.6
Khost-Sharigh-Harnai[2]	1.8	2.6	-	4.4
Khost-Sharigh-Harnai*[1]	-	-	42.6	42.6
Pir Ismail Ziarat[1]	-	-	11.0	11.0
Duki[1]	12.8	10.0	20.6	43.4
Duki*[1,4]	0.2	2.1	3.9	6.2
Chamalang-Bala Dhaka[1]	-	-	5.0	5.0
Subtotal	15.7	20.4	133.1	169.2
Punjab/NWFP				
Eastern-central Salt Range[3,1]	0.5	1.0	6.2	7.7
Eastern-central Salt Range[1,4]	4.0	36.0	13.0	53.0
Makerwal-Gullakhel[2]	3.0	7.0	9.6	19.6
Western Salt Range[1]	-	-	0.4	0.4
Subtotal	7.5	44.0	29.2	80.7
Sind				
Lakhra[5]	143.3	30.7	-	174.0
Lakhra*[1]	-	-	-	300.0
Sondra Thatta[1]	31.0	93.0	376.0	500.0
Jhimpir-Meting[1]	-	-	25.0	25.0
Subtotal	174.3	123.7	701.0	999.0
Total	197.5	188.1	863.3	1248.9

* Private

Sources: [1] Geological Survey of Pakistan
[2] Pakistan Mineral Development Corporation (PMDC)
[3] Punjab Mineral Development Corporation (PUNJMIN)
[4] Chemical Consultants, Inc. (CHEMCON)
[5] Water and Power Development Authority (WAPDA)

The exploration and development of coal resources are facing severe legal and institutional constraints. On the legal side, the laws governing coal exploration are not adequate to encourage private investors to engage in significant exploration activity. On the institutional side, most major deposits are being held by the public sector enterprise, The Pakistan Mineral Development Corporation (PMDC), and are not available to the private sector.

The government is now reviewing the possibilities of releasing certain deposits to be explored and developed by the private sector and forming joint ventures between PMDC and private (local and foreign or both) companies to undertake investments in the coal sector. The government is also considering including domestic coal to supply part of the future requirements of the power generation. Currently, it is estimated that about 1400 megawatts (MW) of new power generating capacity to be installed during 1990-2010 will be based on domestic coal.

NUCLEAR ENERGY

In 1973 a nuclear energy plant with 137 MW capacity was built by Canadians at Paradise Point, Karachi, off the Arabian Sea coast. It has been supplying electricity to the Karachi Electric Supply Corporation, but has been intermittently shut down due to technical and heavy water leakage problems.

A new facility on the Indus River at Chasma, Punjab is being planned that will produce 900 MW. The government expects the French government to proceed with the sale of a 900 MW nuclear power plant which has been stalled since the Benazir Bhutto government was sacked in August 1990. The plant will be completed by 1997 at Chasma and will provide electricity to the Punjab. The government is also finalizing an agreement with China for the construction of a 300 MW nuclear power plant. Another facility at Kundian, Punjab is also being planned as a nuclear power station.

Pakistan continues to develop its technological capability in the field of nuclear engineering. In January 1991, it was announced by the Pakistan Atomic Energy Commission (PAEC) that it will upgrade an old five MW reactor (originally supplied by the United States in 1965) to 10 MW capacity.

HYDROELECTRIC POWER

The major energy resource in Pakistan is its hydroelectric potential, which is mostly in the northern regions of the country. Pakistan's hydroelectric potential is estimated at 30,000 MW, but this figure is probably conservative. Less than 3,000 MW have been developed so far.

A significant portion of this is in the Indus Kohistan and the sub-Himalayan regions of northern and northwestern Pakistan. These sites are not easily accessible and have a limited working season and difficult geological conditions. However, with the opening of the Karakorum Highway along the Indus River, the feasibility of some of the sites has been assessed by Montreal Associates under the Canadian International Development Agency (CIDA).

RENEWABLE RESOURCES

Renewable energy resources, derived almost entirely from biomass and fuelwood constituted about 32 percent or 11.5 mtoe of total energy supply in Pakistan. The contribution of solar, wind and mini-hydropower generation was less than five MW in 1987-88.

The Seventh Plan allocation for renewable energy investment is Rs310 million (US$12 million). Small-scale generation by renewable sources of energy for remote areas is being planned, particularly in the northern and western mountainous regions. Mini-hydropower plants and non-conventional energy sources such as biogas, wind-driven turbines and photovoltaic energy are being planned for remote areas where demand is low. Community-based generation is also being contemplated with supplies to the households which contribute to traditional mutual-help systems of village councils.

Biomass and fuelwood

According to the Planning Commission's estimates (1987-88), about 90 percent of the rural households and 60 percent of urban households meet their energy needs by the use of biomass and fuelwood.

To meet the fuelwood requirement, the Sixth Plan target included fuelwood planting of trees on 60,000 hectares annually. However, only 6,000 hectares were planted because of institutional and funding constraints which led to delays.

ENERGY CONSERVATION

The government has recognized that increases in national economic output have been associated in the 1980s with very high increases in energy consumption. Subsidization of energy prices has led to inefficient and wasteful uses of energy. Much power generation is wasted at the generation and transmission phases, and more efficient power generation units are being installed.

The Seventh Plan includes a policy to make conservation and the efficient use of energy a common practice in all sectors and reduce power system losses. The Seventh Plan allocation for energy conservation investment is Rs500 million (US$20 million). The aim is to rationalize energy consumer prices, remove structural anomalies, generate funds for new energy investments, provide incentives for energy conservation and to encourage desirable substitution among different fuels. Seasonal tariffs and time-of-day pricing will also be introduced in sectors where it is viable to transfer the demand from peak periods to non-peak periods.

Measures have been taken by the government to improve sector and instituitional capabilities for energy conservation. Draft legislation has been prepared to provide authority to establish energy efficient standards and carry out other energy conservation activities. The final draft will be completed during the Seventh Plan.

An Energy Conservation Cell has been set up in the MPNR to formulated a conservation program. A National Energy Conservation Centre (ENERCON) has also been established to advise major industrial users on how to save energy. A recent loan from the Asian Development Bank (ADB) of US$215 million has been procured to improve power transmission and distribution work. A public sector consulting organization, ENAR Protech Services, has been strengthened in its energy auditing capacity by a World Bank funded project.

Energy efficiency codes and standards are being established during the Seventh Plan for ail major thermal and electricity consuming industrial, commercial, domestic and agriculture equipment. Use of high efficiency sodium vapor lamps will be increased for street lighting and outdoor public lighting.

A detailed assessment has been made of energy conservation potential resulting from thermal power plant rehabilitation in the WAPDA and KESC systems.

Previous measures taken to manage energy demand include a requirement in 1983-84 to convert public sector cement kiln from natural gas to oil; the scheduling of maintenance of fertilizer plants to coincide with the critical energy supply months of December-March; staggering of working hours; and the allocation of gas from Mari field exclusively to the power sector.

These measures, however, are specific to immediate problems and do not include long-term improvements in efficiency. Appropriate incentives are being provided during the Seventh Plan to encourage energy conservation and the rational use of energy.

About 70 detailed energy surveys of PSUs were completed under ENERCON. Energy savings recommended in the Seventh Plan projections are based on measures involving regulation, reinforced by price increases, and range from a four to 10 percent reduction per unit of activity.

Three

ENERGY IN THE ECONOMY

INTRODUCTION

Pakistan's energy economy has been characterized by a policy of self-sufficiency and by the coexistence of public sector units and semi-autonomous and private sector enterprises. The public sector produces and consumes energy on a large scale, while the private sector is a small-scale energy producer and user. Prior to the Sixth Plan (1983-88), the government did not make an adjustment on the scale required in the energy sector. Major energy projects in Pakistan traditionally have had a long gestation period and suffer from delays. Consequently, this has led to a high rate of growth in energy demand relative to economic output, low indigenous production, and deficiencies in capital stocks in the energy sector.

Pakistan has limited but varied resources in terms of energy production. Pakistan's commercially exploitable domestic energy resources consist of natural gas, oil, coal, and hydroelectric power. In addition, the country has a large base of traditional and renewable energy resources such as biomass, animal wastes, wind, and solar energy. Pakistan's energy demand and supply have increased significantly over the past few decades. Several factors — population growth, agricultural expansion, industrial growth, urbanization, and changes in life style of the people — have boosted the demand for energy. Pakistan's per capita consumption of commercial energy has increased substantially during the last decade, but still remains below most developing countries in Asia. Per capita consumption of commercial energy in Pakistan has gone up 10 times since 1947.

In 1988-89, the total energy consumption was estimated at over 30 million tonnes of oil equivalent (mmtoe). Commercial energy resources contributed 22.72 mmtoe and the balance came from traditional resources of fuelwood, biomass, and animal wastes. In 1990-91, oil accounted for 40 percent of the total energy use, while natural gas accounted

Table 3.1: **Commercial energy by source**

Source	1988-89 %	1990-91 %
Petroleum	41.0	40.0
Natural gas	34.0	35.0
Hydroelectricity	18.0	18.0
Coal	6.0	5.0
LPG	0.5	1.0
Nuclear power	0.5	0.5

Source: Author's estimates; Economic Survey 1988-89 through 1990-91

for 35 percent, coal five percent, hydroelectric power 18 percent, nuclear power 0.5 percent, and liquified petroleum gas (LPG) one percent (Table 3.1).

ENERGY SUPPLY AND DEMAND

About 75 percent of the commercial energy requirement is obtained through oil and gas (Table 3.2). With the present mix of energy supply, the dependence on imported energy stands at about 25 percent, which is a great deal less than the import dependency of close to 60 percent in the 1970s. The challenge, however, is to sustain this low level dependency in the future. The country's oil reserves will last another seven years at the present rate of production and natural gas another 15 years unless additional oil and gas discoveries are made in the country. Self-sufficiency in oil will decline from 40 percent in 1991 to 10 percent by 2000; self-sufficiency in gas will decline from 100 percent in 1991 to 60 percent by 2000.

Since the 1950s, Pakistan has had a much faster rate of growth in energy demand compared to the growth in the energy supplies. During the Fifth Plan (1978-83), the growth in energy consumption was about 1.4 times higher than the growth in real GDP; one of the major objectives of the Sixth Plan (1983-88) was to bring down the elasticity of energy demand.

Table 3.2: **Energy supply by source (mmtoe/% share)**

Source	1984-85	1985-86	1986-87	1987-88	1988-89
Oil (excluding exports)	6.93	7.45	8.20	9.03	9.52
	40.76	41.05	41.36	41.16	41.90
Gas (excluding feedstock)	6.02	6.26	6.77	7.52	7.84
	35.40	34.52	34.18	34.28	34.50
Coal	1.00	0.98	1.01	1.23	1.18
	5.89	5.43	5.10	5.61	5.20
Hydroelectric power	2.91	3.28	3.63	3.97	4.03
	17.90	18.08	18.28	18.08	17.75
Nuclear	0.70	0.92	1.07	0.50	0.55
	0.42	0.51	0.54	0.23	0.03
LPG	0.75	0.75	1.07	1.40	1.41
	0.44	0.41	0.54	0.64	0.62
Total	17.01	18.13	19.14	19.83	22.72
Annual growth rate %	5.84	6.63	9.33	10.58	3.63

Source: Economic Survey 1990-91

Energy targets in the Sixth Plan (1983-88)

During the Sixth Plan, the goal of strengthening the diminishing infrastructure was pursued by improving sources of energy, reducing losses in transmission and distribution, and through greater equity in the distribution of energy. The energy consumption during the Sixth Plan increased at a rate of 6.6 percent per year compared to a GDP growth rate of 6.8 percent. Electricity generation increased annually at 13.6 percent; coal production at 11.8 percent; oil and petroleum products at 8.5 percent; and natural gas at 6.5 percent during the Sixth Plan.

However, commercial energy supply fell five percent short of the target of 25.82 mmtoe to 24.6 mmtoe in 1987-88, the last year of the Sixth Plan. In the power sector, only 2,018 MW capacity of generation instead of the targeted 3,795 MW was added: a shortfall of 53 percent. There was a shortfall of eight percent in per head electricity delivery: 233 kilowatt hours (kWh) compared to the target of 253 kWh. Only 74 percent

of the target in providing gas connections was achieved; and gas was provided to 2.32 million additional consumers from a target of 3.15 million.

Since the 1960s, chronic power shortages, load shedding, and paucity of fuel products have been frequent occurrences in many parts of the country. Energy shortages average over 10 percent and between 15 percent and 40 percent in some provinces such as Baluchistan and rural Sindh. The energy shortage has many effects on the Pakistani economy. One of the most crippling is the loss of productivity that an insufficient and unreliable supply of energy causes in the industry, agriculture, and service sector. Despite present austerity measures, total energy requirements are 10 percent higher in 1990-91 than in 1989-90. Pakistan's scarce energy resources coupled with limited financial resources, stalled projects, slow pace of execution, and mismanagement have all contributed to energy shortages. There are a number of technical, financial, and managerial and policy difficulties in the energy sector in Pakistan that make the prospects for an adequate supply in the near future unlikely.

Forecasts for energy supply 1988-1993, 1988-2003

The tentative projections made by the Planning Commission indicate a steady growth in energy supply with an average annual rate of seven percent from 1987-88 to 2002-03. The total supply is projected to increase from 36.1 mmtoe in 1987-88 to 99 mmtoe by 2002-03 (Table 3.3). In the 1990s, the dilemma facing Pakistan is a continuing much faster rate of growth in aggregate energy demand compared to the growth in the energy supplies.

The Planning Commission has estimated an average growth rate of 6.5 percent for the Perspective Plan period (1987-88 to 2002-03). The total end-use energy consumption is forecast to reach 64.2 mmtoe in 2002-03 compared to 28.2 mmtoe in 1987-88. The commercial energy will triple to 54.1 mmtoe in 2002-03 compared to 17 mmtoe in 1987-88, based on an energy consumption-to-GDP elasticity of approximately 1.2. The projected energy consumption by source is shown in Table 3.4.

Table 3.3: **Energy supply by source, 1987-88 through 2002-03**

Source	1987-88 mmtoe	1992-93 mmtoe	2002-03 mmtoe	AGR* in Perspective Plan 1988-1993 %	AGR* in Perspective Plan 1988-2003 %
Oil	9.9	15.0	36.5	8.5	9.1
Gas	9.1	15.2	15.9	10.8	3.8
Hydroelectric power	3.2	3.7	10.0	2.9	7.9
Coal	2.3	3.6	19.3	9.4	15.2
Nuclear	0.1	0.1	1.8	0.0	21.3
Others	-	-	0.7	-	-
Commercial	24.6	37.6	84.2	8.8	8.5
Non-commercial	11.5	13.7	14.8	3.7	1.6
Total	36.1	51.3	99.0	7.2	7.0

* AGR annual growth rate
Source: Planning Commission, Seventh Five Year Plan 1988-93

Table 3.4: **Energy consumption (end use) by source**

Source	1987-88 mmtoe	1992-93 mmtoe	2002-03 mmtoe	AGR* in Perspective Plan 1988-1993 %	AGR* in Perspective Plan 1988-2003 %
Gas	5.2	8.5	8.6	10.3	3.4
Electricity	2.2	3.5	9.1	9.7	9.9
Coal	2.2	3.5	5.9	5.9	8.2
Oil and lubricants	7.3	9.4	29.8	5.2	9.8
Others	0.5	0.5	0.7	0.1	2.3
Commercial	17.0	24.3	54.1	7.4	8.0
Non-commercial	11.2	13.2	14.4	3.3	1.7
Total	28.2	37.5	68.5	5.9	6.1

* AGR annual growth rate
Source: Planning Commission 1990-91

Based on this, the Planning Commission has estimated an average growth rate in energy consumption of 6.5 percent over the Perspective Plan period (1987-88 to 2002-03). The output of oil, natural gas, and electricity would have to be consistent with the GDP growth rate of 6.5 percent during the Seventh Plan and the Perspective Plan periods.

ENERGY CONSUMPTION BY SECTOR

The consumers of energy are the domestic, commercial, industrial, agriculture, transport, fertilizer, and government sector. During the Sixth Plan (1983-88), the pattern of energy consumption changed as the share of industry and agriculture increased from 28.4 percent and 3.5 percent to 32.3 percent and 6.3 percent respectively. However, during the 1990s, there is a greater growth in the demand for electricity and natural gas in the domestic household sector and for petroleum products in the transport sector.

Industry

The industrial sector uses about 30 percent of the total energy consumption. The dominant fuel in the industrial sector is natural gas, accounting for more than 30 percent of the energy used in this sector. Coal with 26 percent share, oil with 19 percent, and electricity with four percent represent the other major fuels used in the industrial sector.

The dominance of industrial sector consumption is an important feature, particularly the PSUs who have preferred access to energy supplies. A medium size industrial sector has been built up over the past 30 years through high capital investment, and industry is the main consumer of every energy source, partly because of high energy intensities. Difference in scale as well as private and state ownership lead to differences in technology and hence energy efficiency.

The energy consumption in the industrial sector has grown from 4.84 mmtoe in 1983-84 to 6.71 mmtoe in 1988-89 at a compound growth rate of 6.76 percent per year. In the industrial sector, consumption by source has increased in electricity at a growth rate of 9.86 percent, oil at 13.41 percent, and coal at 7.57 percent per year from 1983-84 to 1988-89.

Industry in Pakistan also must contend with the unreliability of the entire power system. During load-shedding, for example, the domestic household and agricultural sectors have priority over the industrial sector. It is estimated that a 10 percent power shortage in the industrial sector can cause an annual production loss of Rs18 billion (US$700 million). By way of comparison, total industrial production is about Rs121 billion (US$5 billion).

Transport

The energy consumption in the transport sector has grown from 3.18 mmtoe in 1983-84 to 4.58 mmtoe in 1988-89 at a compound growth rate of 7.6 percent per year. The mode within the transport sector has shifted in favor of road freight, with rail declining at a rate of 4.5 percent per year from 1979-80 to 1989-90. Rural to urban migration by the populace and changes in life style has also contributed to changing energy consumption in the transport sector.

The largest demand in the transport sector is for petroleum products, which have increased from 41 percent in 1972-73 of the total demand to 53 percent in 1984-85, and to almost 70 percent in 1990-91. Within the transport sector, diesel accounted for 66 percent in 1984-85 and 70 percent in 1988-89. The growth rate in diesel consumption has been at 9.25 percent per year since 1983-84.

The strong demand for diesel and to a lesser extent for kerosene results from the attempts to impose a price structure through differential taxes and subsidies on the various petroleum products. The large difference between the price of diesel and gasoline has contributed to high diesel demand and imports.

The Seventh Plan forecasts an increase in demand of 10 percent per year for petroleum products in the transport sector. This includes a 16 percent rise per year for fuel oil arising from demand from power generation in the absence of adequate supplies of natural gas; the demand for diesel oil is 12.5 percent per year.

Domestic

Energy consumption in the domestic sector has grown from 2.6 mmtoe in 1983-84 to 4.4

mmtoe in 1988-89, a growth rate of 11 percent per year, and is continuing to grow rapidly at 12 percent yer year. Growth would be higher if the energy infrastructure were made accessible to a greater proportion of the people. A high rate of population growth, massive urbanization, and changes in life style have led to the high growth in demand.

According to the Planning Commission's 1987-88 estimates, commercial energy is used by about 10 percent of rural households and 40 percent of urban households to meet their energy needs.

In 1990-91, the residential sector consumed 10 mmtoe of energy, of which about half was from traditional fuels. The remaining 50 percent was supplied from oil (17 percent), gas (16 percent), and electricity (15 percent). The domestic household sector is a major user of electricity. The consumption of electricity has grown at an annual rate of 14 percent per year since 1983-84. Its total use of electricity was 2.1 mmtoe in 1988-89 as compared to 1.1 mmtoe in 1983-84. The demand in the domestic sector for electricity during the 1990s is projected to grow at a rate of 15 percent per year.

The domestic sector is also a large consumer of natural gas, LPG, and kerosene. The consumption of natural gas has grown from 0.75 mmtoe in 1983-84 to 1.22 mmtoe in 1988-89, a growth rate of 10 percent per year. The demand in the 1990s is projected at 10 percent per year.

Rural

Noncommercial sources of energy dominate the rural energy supply pattern. The rural sector in Pakistan uses relatively little commercial energy, although its consumption of electricity has been increasing since the 1980s. The share of noncommercial sources in rural energy consumption is declining because of deforestation, caused primarily by the unrestrained use of fuelwood and the absence of a well planned program for afforestation to replenish fuelwood supplies. The availability of fuelwood has declined considerably. Plans for commercial cultivation of fuelwood, energy plantations, and its conversion to charcoal were studied in the early 1980s, but no progress has been made in this regard. The development of infrastructure to meet rural energy needs and the potential for substitution between traditional and commercial fuels is virtually stagnant.

The availability of commercial energy in the rural areas is very low compared to the urban areas. Natural gas, petroleum products, oil and lubricants, and electricity delivered to rural households represent 16.6 percent of the total energy supply.

The rural share of total domestic consumption of electricity is about 20 percent. Although one-third of villages has so far been electrified, only 15 percent of the population in rural areas have access to electricity compared with 81 percent of the urban population. Electricity consumption in the agricultural sector (including rural industries) doubled between 1985-86 and 1990-91, showing the increasing importance of food processing and cottage industries.

Recently the demand for electricity in the rural sector has outstripped supply. About 30 percent of electricity in the rural areas is used by 300,000 electric-driven tubewells for pumping ground water for irrigation and water supply. The proliferation of electric tubewells has been at the expense of low speed diesel oil pumps, which are being phased out.

The rural sector uses about 25 percent of the total consumption of high speed diesel oil in agriculture; about 90 percent of low speed diesel oil used in the country is for agricultural irrigation by tubewells. Almost all the kerosene consumed in the rural sector is for lighting and cooking, and there is very little use of LPG.

The Seventh Plan target is to provide electrification to 10,336 villages by 1992-93, bringing the proportion of electrified villages to 55 percent compared to 34 percent in 1987-88. At least half of all the new connections in the period are to be provided in rural areas.

By 1993, secondary transmission and distribution of power in the WAPDA system will be extended to the rural areas. Electricity will mostly be provided to low income groups.

The supply of natural gas to rural areas is negligible. The Seventh Plan proposes to provide at least 50 percent of new gas connection in the rural areas by 1992-93. It also aims for streamlining the supply of LPG in the rural areas.

The economic reforms introduced in 1991 giving tax exempt status to rural industries will lead to increasing demand for commercial energy. Energy intensities in

the rural industry sector far exceed those of the country's industrial sector as a whole.

Energy efficiency in households could be increased by the use of improved cooking stoves (chullah). The thermal efficiency of chullah can be improved from 10 percent to 25 percent at a nominal cost, as has been done in India for the past decade. Biogas digestion is the most efficient way to use biomass fuels, since biogas has a thermal efficiency of up to 60 percent compared to 10 percent for direct burning. Energy efficiency in rural transport could be achieved by the use of small pickup trucks instead of walking tractors used for various transport purposes, which are half as efficient.

OIL AND PETROLEUM PRODUCTS

Petroleum products meet about 41 percent of total energy requirements in Pakistan. About 60 percent of demand is met through the combined production from three refineries. The balance is currently being imported. The share of petroleum products in the total supply of commercial energy has been increasing rapidly in the past, and this trend has continued even during the steep increases in oil prices in the 1970s.

Pakistan's energy position was made precarious as a result of having to buy some of its requirement of crude oil and products from the open market during the recent Gulf crisis. Pakistan's crude and product import bill increased from US$800 million in 1989-90 to US$1.8 billion in 1990-91 (Table 3.5).

In spite of price increases of 40 to 60 percent caused by the Gulf crisis, fuel rationing, and austerity measures, the demand for products continued to rise in 1990-91. The demand for petroleum products during the 1990s is expected to grow at the rate of 10 percent per year.

By 2003, Pakistan will be using four times more oil and petroleum products than at present. The Planning Commission projected the share of petroleum products in energy supply to increase from 203,425 barrels per day (b/d) in 1987-88 to 308,220 b/d in 1992-93 and 750,000 b/d in 2003 at an annual growth rate of 9.1 percent. The annual growth rate of energy consumption is estimated at 10 percent during the early 1990s.

Table 3.5: **Imports of oil and petroleum products, 1987-88 to 1990-91 (Rs billion)**

Year	Crude oil	Petroleum products	Total
1987-88	9.0	9.5	18.5
1988-89	7.0	11.5	18.5
1989-90	9.0	15.5	24.9
1990-91	13.5	24.3	37.8

Source: Federal Bureau of Statistics 1990-91

Table 3.6: **Costs of oil and petroleum products imports, 1989-90 to 1990-91**

Oil and products imports	July-March 1990-91	July-March 1989-90	% change
Crude oil, tonnes	3,062,601	2,579,085	18
Crude oil, b/d	85,072	71,641 (71,408 yearly basis)	18
Cost, Rs per tonne	2,543	3,614	-29
Cost, million US$	504	308	64
Petroleum products, tonnes	3,075,155	3,755,029	-18
Petroleum products, b/d	85,421	104,306	-18
Cost, Rs per tonne	5,920	3,312	79
Cost, million US$	825	583	42
Total cost, million US$	1,309	891	46

Source: Author's estimates; Economic Survey 1990-91

The GDP growth rate of seven percent envisaged by the present government will mean substantially higher energy demand than the Planning Commission's estimates of supply.

Even if the domestic crude production increases from the present level of 65,000 to 175,000 b/d in 2003, there would still be a very large gap between oil demand and domestic production. The demand for crude oil is projected to increase from 140,000 b/d in 1990-91 to 478,770 b/d in 2003. With consumption projected at 750,000 b/d in 2003, the import of oil and products is forecast to reach 600,000 b/d, thus implying the need for a four-fold expansion in refinery capacity to 600,000 b/d from the existing refining capacity of 150,000 b/d.

Together with the rapid increase in petroleum product consumption, the structure of petroleum product demand and supply is likely to undergo changes because of the shift to a more energy intensive life-style. Recently, Pakistan's Minister of Petroleum and Natural Resources stated at the International Petroleum Seminar (Islamabad, November 1991) that by the year 2000 Pakistan would require one million barrels of oil per day, a considerably larger amount than that forecasted by the Planning Commission.

The new petroleum policy is expected to assist in delaying the depletion of oil reserves; however, with the projected petroleum demand growth, imports will play a more critical role. Reliable access to petroleum supplies abroad would have to be sought through joint ventures with oil-rich countries in West Asia and the Gulf.

Investment of US$20 billion is needed in exploration and development and refining in order to meet the petroleum needs of Pakistan during the 1990s. Pakistan will face pressure on its balance of payments to meet the oil demand. Pakistan has pursued a vigorous oil exploration policy, resulting in an increase in the level of oil production from 10,000 b/d in 1980 to 65,000 b/d in 1991. Thereafter, the rate of oil production will increase only at a pace compatible with the reserves. The most productive oil field is Dhurnal in the north, which accounts for about 30 percent of the total oil production.

Pakistan's oil and product demand in 1991-92 is estimated at 260,000 b/d. A saving of US$1.6 billion a year in imports is attributed to increased domestic production from 55,752 b/d in 1989-90 to 65,599 b/d in 1990-91. The import bill for oil and products will be US$1.6 billion in 1991-92 and US$2 billion in 1992-93. Pakistan's import bill for oil and petroleum products has doubled in four years and now accounts for more than 30 percent of total imports (Table 3.5 and Table 3.6).

Fuel oil demand for power

The demand for oil for power generation will rise considerably in the next five years. Fuel oil imports, which constituted 35 percent of the total oil consumption in 1990-91, is mainly used for power generation by the WAPDA and the KESC. The total demand for

fuel oil was 4.6 million tonnes (mmt) in 1990-91, 55 percent of which, 2.5 mmt, was imported in 1990-91 at a cost of US$240 million.

It is estimated that fuel oil demand for power generation will be almost half of the total oil consumption in 1995-96; it will increase to 8.9 mmt by 1995-96, a 96 percent increase over 1990-91. The government expects to cater to the utilities' demand with local fuel oil production of 2.1 mmt and imports of 6.8 mmt in 1995-96. The import bill for fuel oil alone in 1995-96 is estimated at US$640 million.

NATURAL GAS

Natural gas has been the main commercially exploitable energy resource in Pakistan since the 1960s. Because of its predominant importance, its use has been growing much more rapidly than that of any other energy source in the economy. It has significant operating advantages over other fuels and a wide range of potential uses. It is, moreover, the main existing and potential alternative to hydroelectric power as a primary source of electricity generation. In the longer run, gas may find new markets such as petrochemicals, which yield higher netbacks than sale to power generation in Pakistan.

Gas prices in Pakistan are only loosely connected to market value and supply costs. The value of gas in power generation has to be seen in the context of its value in other uses, most notably in the domestic heating and fuel market, in industry, and as feedstock for fertilizer or methanol. High values are achieved in household heating and specialist industrial process heat application, and only low values are realizable in fertilizer production. Thus, natural gas in Pakistan is not only used for heating but also for its chemical content. By far the most important of the latter is the fertilizer industry, for which annual demand is growing at 15 percent. The fertilizer industry in Pakistan is totally dependent on natural gas for nitrogenous fertilizer production (see Seven: The Fertilizer Industry).

Another potential priority use for gas is in the production of petrochemicals. Known gas deposits for this purpose are lean since they have a relatively small proportion of the heavier hydrocarbons such as methane and propane in their chemical

composition. However, both Sui and Mari gas have a sufficient methane content to be transformed into acetylene, which is the basis of one large range of chemical products.

Recoverable reserves of natural gas are estimated at approximately 530 billion cubic meters, with the extraction rate running at around 12.5 billion cubic meters per year. The largest gas fields are at Sui in Baluchistan, producing around 57 percent of the total gas supply in 1990-91, and at Mari, Baluchistan, which represents another 21.9 percent of the gas production.

COAL

Coal is the second major energy source in Pakistan and accounts for six percent of total energy consumption. The coal industry has not been developed to any significant extent. With an estimated reserve of about 580 million tonnes, the level of coal production has remained at between two to three million tonnes during the last five years. Most of the coal is of poor quality and is mainly used in brick kilns and the domestic sector.

Pakistan is a net importer of coal; about 750,000 tonnes of metallurgical grade coal was imported from Australia, Canada, and China for use in the steel industry in 1990-91. There has been a 21.7 percent increase in imports from Australia for January-September 1991 of 639,000 tonnes, compared to 525,000 tonnes in January-September 1990.

The government is encouraging the expansion of domestic coal supply, particularly in the areas with high quality deposits. The government is finalizing a new policy on coal to encourage private and foreign investment in the development of deposits. Adequate royalties will be paid for transfer of advanced technologies and technical know-how for the investors in the coal development.

ELECTRICITY GENERATION

Electricity generating capacity is being expanded rapidly, but still lags behind demand, which has been growing due to an impressive rural electrification program and economic growth and industrialization. The installed generating capacity in 1991 was 8,508

megawatts (MW), of which hydroelectric power represented 38 percent. The rest of the generating capacity is mainly based on oil.

ENVIRONMENTAL ASPECTS OF ENERGY USE

The fact that the household sector is still dependent on biomass for the major share of its consumption has had serious environmental consequences. An extreme example is soil erosion on the northern and western mountains regions caused by biomass collection and deforestation in areas with sparse forest resources. This has given the Kabul River and other western tributaries of the Indus River one of the highest sediments load in the Indus Basin. The effect of this has been the almost complete silting-up of the Warsak dam reservoir, used for hydroelectricity generation. The Indus River itself has a high sediment load, and the Tarbela dam's generation is also affected by the silting.

The consumption of fossil fuels discharged an estimated 13.1 million tonnes (mmt) (in carbon equivalent) carbon dioxide emissions in 1986. The ESCAP projects the total carbon emissions to reach 31 mmt by 2000 for the base case scenario, to 26.5 mmt for an energy efficiency scenario; and, by 2010, the projection for the base case is 48.9 mmt, for the energy efficiency scenario 37.7, and for a low carbon scenario 35.2 mmt.

Efficiency improvement, fuel switching, and conservation in the energy sector will reduce these emissions. Carbon dioxide alone, however, might not be judged important enough to change energy development plans in Pakistan. Different strategies will lead to differently perceived and valued outcomes. These strategies include maximum gas use; maximum use of nuclear energy; and conservation and the use of renewable energy.

In 1983, the government approved the Pakistan Environmental Protection Ordinance, which provides a general framework for environmental protection in the country. An Environment and Urban Affairs Division under a Minister of State oversees the operation of the environmental aspects, and provincial environmental protection agencies have been established.

The ordinance requires that environmental impact assessments be prepared for major projects which may result in significant environmental impact and that regulations be developed for the protection of land, air, and water resources.

The government plans to release before the end of the Seventh Plan an environmental action plan for the energy sector which would include the adoption of environmental standards for protection against air and water pollution; the adoption of guidelines for the assessment of environmental impacts resulting from energy production activities; development of capacity in key institutions in the energy sector to address environmental issues; and adoption of improved health and safety and emergency management guidelines for energy industries.

The new petroleum policy of November 1991 promotes measures for protection of environment by reduction of lead in gasoline. It calls for the use of CNG in motor vehicles. The government is also setting up a task force to deal with fire and other hazards at oil and gas fields and installations. The importing of equipment needed for energy conservation will be free of custom duty.

THE OUTLOOK FOR ENERGY

The Pakistani government has accorded a high priority to the development of indigenous energy resources to alleviate the energy supply shortages constraining economic development and to reduce the heavy dependence on imported energy. Factors that will contribute include the pace of privatization, access to capital, and environmental issues.

Pakistan is pursuing a two-part upstream strategy in pursuing energy self-sufficiency: expanding the natural gas infrastructure to substitute gas for oil and enhancing domestic crude production. The strategy aims to boost the share of natural gas in the energy mix from 35 percent in 1991 to 45 percent by the end of the 1990s and for decreasing the share of oil from 41 percent to 30 percent during the same period.

A recent International Monetary Fund (IMF) report on Pakistan's energy sector estimates that demand for commercial energy has been growing at eight percent a year. Other estimates of future consumption indicate that the combined effects of rapid population growth and economic development will intensify this trend in 1990s. Given the limited institutional capabilities and technical and operational matters, there seems to be likelihood of chronic energy shortages for economic development in the 1990s.

The demand for oil and petroleum products in the country during the Seventh Five Year Plan (1988-93) is projected to exceed supply (domestic and imported) by about 4.41 mmt in 1988-89 and by about 7.42 mmt in 1992-93. Imports of crude oil and petroleum products are projected to increase from about eight mmt in 1988-89 to about 12 mmt in 1992-93.

The demand for gas is also projected to exceed supply by about 325 million cubic feet per day (MMcf/d) in 1988-89, rising to about 455 MMcf/d in 1992-93. To reduce the imports of energy to manageable proportions, the government plans to accelerate the development of indigenous energy resources; correct distortions in energy pricing; streamline the institutions and agencies in the energy sector and promote private sector involvement in the development, production, refining, and delivery of energy.

Pakistan needs an estimated US$25 billion investment in the energy sector over the next 10 years to cater to its rising energy demand. However, the investments are difficult to come by as government policies on product pricing and multiple-window operations discourage investors.

The new petroleum policy promises amendments to existing laws to facilitate exploration and a range of activities including refining, import and export, as well as storage, marketing, and distribution.

Pakistan's estimated needs for capital investment in the petroleum sector is US$20 billion over the next 15 years. However, investors tend to be cautious because of the high risk involved and the fact that Pakistan has yet to discover a large oil field. Some of the problems in the petroleum sector pertain to delays in granting concessions, weak infrastructure, refining, and other facilities. For local companies, financing has been difficult, especially the foreign exchange component of exploration and development.

The government announced a package of incentives in this capital-intensive industry in December 1991. In 1991, only 16 exploratory wells were drilled in Pakistan and there were four oil and gas discoveries; the discovery ratio is 1:4 compared with world average of 1:10.

Shortfall in power generation in the past led to extensive load shedding, which in turn has become a political issue. The present government is doing all it can to avoid actual power cuts, but this is often at the expense of considerable voltage reduction. As in previous years, installation of new power generation capacity takes the largest share of annual development plan, accounting for 25 percent of the total in 1990. It should be noted, however, that through surcharges and other fiscal means the government takes more from energy generation to pay for its current expenditure than is put back in investment.

Although the output of domestic energy resources is expected to increase, their share in the total supply will decline resulting in a greater share of supply from imports. Among the domestic sources, oil and gas production is not expected to increase substantially; hydroelectric power and coal, on the other hand, are expected to grow in terms of both level and relative share in total energy supply. In addition, imported coal is expected to become a more important source of energy supply. The share of coal, both domestic and imported, is anticipated to increase from about seven percent in 1988 to 20 percent by 2010. Also, the share of petroleum products in the total energy supply will increase from 39 percent to 50 percent. The share of natural gas will drastically decline from more than 30 percent in 1988 to about 12 percent in 2010.

Four

THE OIL INDUSTRY

ORGANIZATION

The oil industry in Pakistan has been regulated since 1947. Both public sector agencies and private sector enterprises co-exist in a mixed economy of exploration, development, and marketing of petroleum and products. There has been a recent trend towards deregulation in the industry sector.

The central government oversees the activities and operations in the oil sector from planning, investment, and price controls. The Ministry of Petroleum and Natural Resources (MPNR) has the prime jurisdiction over the oil sector. There are four directorates in the MPNR: petroleum concessions; oil operations; gas operations; and new and renewable sources of energy.

The directorate of oil operations is responsible for oil pricing policy, including determination of ex-refinery and retail prices, inland freight margins, distributors, and dealers' margins. It is also responsible for administration of the government policy regarding petroleum development and marketing, supervision of refineries, and scheduling of oil tanker movements in and out of the country.

PETROLEUM PRODUCTS DEMAND (1988-93)

The demand for petroleum products depends on the government fuel use policy, which was adopted in 1988 within the Seventh Five Year Plan (FYP) (1988-93). The policy aims to replace the base year requirement of high speed diesel oil (HSD) in power generation with natural gas; substitute kerosene in the domestic sector with natural gas and liquified petroleum gas (LPG); and use furnace oil for thermal generation until coal-fired and nuclear generation plants can be implemented.

With this policy, the demand for petroleum, oil, and lubricants (POL) is projected at 293,835 barrels per day (b/d) (14.3 million tonnes (mmt)) in 1992-93 compared to

178,767 b/d (8.9 mmt) in 1987-88, the base year. This translates into an annual growth rate of 10 percent during the Seventh FYP (1988-93) against an average growth rate of 9.7 percent during the Sixth FYP (1983-88). However, with energy conservation, the POL demand can be reduced to 281,506 b/d (13.7 mmt) in 1992-93, translating into an annual growth rate of 9.1 percent instead of 10 percent.

During the 1990-91 Gulf crisis, a combination of high prices, shortages, and austerity measures contained the growth in the consumption of POL to below 10 percent.

CONSUMPTION

Consumption of petroleum products in Pakistan more than doubled during the 1980s. The total petroleum consumption in 1989-90 was 124,887 b/d. The share of value-added large-scale manufacturing by the petroleum product industry was 6.8 percent of the manufacturing sector share (17.5 percent) in the GDP of 1987-88 and is estimated at six percent in 1990-91 and 5.9 percent in 1992-93.

The pattern of consumption has also changed as natural gas replaces petroleum in the power and industrial sectors. As a result, the transport sector has become the major consumer of petroleum products accounting for more than 60 percent of the total petroleum consumption in 1988.

The regional distribution of petroleum consumption has remained relatively unchanged except for some variations due to the introduction of natural gas. About 40 percent of the total petroleum consumption takes place in the Punjab area with another 34 percent in the Sindh region. Baluchistan has experienced a rapid growth in petroleum use, but still accounts for less than five percent of the total consumption.

Projection of petroleum consumption remains quite uncertain as government is debating the merits of importing coal and gas and is facing some constraints regarding development of hydroelectric resources. Nevertheless, the present projections indicate a growth rate of 6.5 percent for petroleum consumption during the 1990s. The growth is expected to be higher for gasoline and kerosene. The demand for fuel oil is expected to remain restricted by the limited use in the power sector. However, this is now changing because of the recent decision by the government to proceed with the installation of

2,400 MW of new oil-fired generating capacity. Furthermore, the increasing uncertainty regarding the future availability of natural gas is forcing the public and private sector to rethink the fuel choice strategy to be pursued during the 1990s.

PRICING

Petroleum product prices are controlled by the government and the issue is considered to be a politically sensitive one. Despite the need to increase revenues for expansion and reinvestment, the three refineries have not been able to convince the government to raise the tariff to a level where it can manage the demand for petroleum products. The projected revenues of the refineries will be insufficient to fund the planned expansion in the 1990s to meet the million barrels per day demand during 1999-2000.

In December 1991, the government began to phase out the existing pricing and processing fee formula and to link domestic and import prices for crude oil. Until 1973, petroleum prices were set according to international prices as reflected in the prices of petroleum imports. After the first oil shock in 1973-1974, the government decided to regulate petroleum prices based on an agreed rate of return on each oil company's equity. In this way, the government compensated the oil companies if there were a shortfall and received the excess revenue if there were a surplus. The problem with the current pricing arrangement has been that there is little incentive for private oil companies to increase the efficiency of their operation or to undertake investments that would result in a more efficient operation.

The government has now formulated a new pricing formula which is expected to improve the economic efficiency of the sector substantially. According to the new pricing formula, the following mechanism would be pursued to set the price of petroleum products:

- ex-refinery prices are set in proportion to the average border prices of the previous year plus appropriate transport costs for inland refineries;
- the crude oil price at the refinery gate is set at a netback level which would allow each refinery to achieve a reasonable rate of return (about 18 percent) on equity; and

- refinery margins will be re-examined on an annual basis or at the refineries' request or when government views it as necessary.

The above pricing formula went into effect in 1989 and has thus far been viewed as satisfactory by the oil companies and the government. However, the new pricing formula is considered inappropriate for the Attock refinery, which is the only refinery with access to the locally produced crude oil. The pricing arrangement for this refinery is complicated by the fact that the production of domestic crude oil varies sharply from year to year, resulting in fluctuating refinery costs. The government is carrying out certain refinery planning studies to assess the most economic product mix and the associated pricing formula for the Attock refinery.

In order to provide consistency between the ex-refinery pricing and consumer prices for petroleum products, the government has adopted various policies regarding different products. During 1973-1981 the government subsidized the prices of certain products; since 1982, the government has decided to pass on to consumers the additional cost of crude and product supply. However, the pricing system was set so that there was a cross-subsidy between products, though the sector as a whole was not subsidized. The cross-subsidy was mostly from gasoline and diesel oil to kerosene and fuel oil.

Following the Gulf crisis of August 1990, the rise in the international price of oil resulted in the increase in the border price of kerosene to slightly above the domestic price. However, the government still has a comfortable cushion from the positive margin on other products. Later on, as international petroleum prices started to decline in early 1991, the government decided not to lower the domestic prices to the same proportion. As a result, the prices of all petroleum products in December 1991 were above their equivalent border prices.

REFINING

Pakistan has a mix of products processed by refineries, and refining capacity is 150,000 b/d, with 5,000 b/d standby capacity. The refinery throughput consists of 64,000 b/d of domestic crude oil, and the balance of 86,000 b/d is imported. The petroleum products

Table 4.1: **Oil refining capacity, 1991**

Refinery	Imported crude capacity b/d	Domestic crude capacity b/d	Total
Pakistan refinery (PRL)	39,000	11,000	50,000
National refinery (NRF)	47,000	16,000	63,000
Attock refinery (ARL)	-	37,000	37,000
Total	86,000	64,000	150,000

Source: Economic Survey 1990-91; Planning Commission, Seventh Five Year Plan 1988-93 and Perspective Plan 1988-2003

demand is about 250,000 b/d, and about 100,000 b/d to 110,000 b/d of products are imported.

There are presently three oil refineries in Pakistan, two in the private sector — the Attock Refinery Ltd (ARL) and the Pakistan Refinery Ltd (PRL) — and one in the public sector — the National Refinery Ltd. (NRL).

There are plans for construction of three additional refineries by the mid 1990s. Pakistan signed a memorandum of understanding with Iran in August 1991 to build a refinery at Port Qasim with Iranian crude oil supplies at 120,000 b/d. Bin Qasim Refinery will be based on Iranian crude and will process 120,000 b/d of oil. There is significant cooperation in refining between Iran and Pakistan. Another refinery with 30,000 b/d capacity is being planned at Golachari, Sindh, and is estimated to cost US$150 million. This will use crude oil from the fields in Badin and adjacent areas in Sindh. The third refinery is being planned with 30,000 b/d capacity at Multan, Punjab, in collaboration with the Abu Dhabi National Oil Company (ADNOC).

Production capacity

The total crude processing capacity of the existing refineries is 6.1 million tonnes per year (tpy), from which 2.1 million tpy belongs to the NRL and is located at Karachi. PRL is also located in Karachi and has a total capacity of 2.5 million tpy. ARL has a capacity of 1.5 million tpy of crude distillation and operates exclusively on domestic crude supplies from the fields in Dhurnal, Meyal, Toot, Adhi, and Balkassar.

The other two refineries operate on imported crude from Saudi Arabia, Iran, Abu Dhabi, and Oman as well as domestic crude supplies from the oil fields in the southern Sindh. The management of the public sector refinery rests with the State Petroleum Refining and Petrochemical Corporation (PERAC) under the administrative control of the Ministry of Production. The marketing of petroleum products is handled by another public sector company, Pakistan State Oil (PSO).

National Refinery Ltd.

NRL was initially established by a private company in 1966 with a distillation capacity of 600,000 tpy. In 1972 the refinery was taken over by the government and its management is under the State Petroleum Refining and Petrochemicals Corporation (PERAC). At present, PERAC owns 16 percent of the refinery's equity with the balance of shares held by the Islamic Development Bank (15 percent), government agencies and financial institutions (58 percent), and the remaining 11 percent by other investors.

The installed capacity of the fuel refinery increased from 600,000 tpy in 1977 to 2.1 million tpy in 1990. The expansion of the refinery was undertaken in collaboration with Industrial Export of Romania at a cost of US$65 million. In 1979, a 25,000 tpy aromatic complex was added. NRL is the most complex refinery in Pakistan and produces a complete range of petroleum products. Also, in 1985 a major expansion of the lube oils complex was completed, which increased the production of lube oil from 90,000 tpy to 190,000 tpy and of asphalt from 115,000 tpy to 230,000 tpy. This lube oil expansion project was implemented on a turn-key basis by Industrial Export of Romania and cost about US$30 million.

NRL has a total crude oil storage capacity of 168,000 tonnes and a product storage capacity of 92,000 tonnes. The petroleum products are transferred through an underground pipeline to installations in Keamari, Korangi, the Karachi Airport, and the Keamari port for export of naphtha and fuel oil. The lube-based oils are transferred both by pipeline and road tankers to the blending plants located in Karachi. The facilities of oil marketing companies are used for rail transport of lube oils to the upcountry blending plants.

The NRL had sales of Rs8.6 billion with a profit of Rs374 million in 1990; the share holder's equity is Rs811.5 million.

Attock Refinery Ltd.

The Attock refinery is the oldest refinery in the country. It was established in 1922 by the then Steel Brothers of England. The ARL is presently owned by Attock Oil Company (52.5 percent), the government (35 percent), the International Finance Corporation (IFC) (7.5 percent), and the remaining five percent by private investors.

The initial capacity of the refinery was 500,000 tpy, but was expanded to 1.5 million tpy in 1978. The expansion was based on the assumption that domestic oil production from the Meyal and Toot fields would significantly increase local crude supply. However, the anticipated increase did not materialize and the refinery ran at between one-third and a half of its total capacity until 1985.

In 1986 and 1987, with the development of the Dhurnal oil field, production increased substantially, but the level is still fluctuating, complicating its efficiency. The refinery has a simple configuration, but produces the entire range of petroleum products except high-octane gasoline. It has a crude oil storage capacity of about 22,000 tonnes and refined product storage capacity of 61,000 tonnes.

The throughput capacity of the Attock refinery will be expanded from its present 30,000 b/d to 48,000 b/d in a US$50 million expansion plan to be completed by 1994. A Saudi businessman, Ghaith Pharaon, has the major share in the Pakistan Oilfields Ltd (POL) and the Attock refinery.

Pakistan Refinery Ltd.

PRL was commenced in 1962 by a consortium of foreign oil companies. The shareholders at that time were Shell (15 percent), Burmah Oil (15 percent), Esso (18 percent), and Caltex (12 percent). The remaining 40 percent was owned by the government. Product off-takes were proportional to the shares. The 40 percent off-take by the government is used to supply the requirements of defence and the railways and are provided directly by the refinery at the government approved ex-refinery prices.

In 1976, Esso voluntarily withdrew from oil refining and marketing operations in Pakistan and sold its interest to the government of Pakistan, which, in turn, transferred Esso's assets and liabilities to the Pakistan State Oil Company (PSO). Thus, the present ownership is Shell (15 percent), Burmah Oil (15 percent), Caltex (12 percent), PSO (18 percent), local institutions (12 percent), and local private investors (28 percent).

PRL is a simple hydro-skimming refinery consisting of crude oil distillation, catalytic reforming and hydro-treating units, and a tetraethyl lead blending plant. It has no secondary processing facility. All the reduced crude produced is converted into marketable fuel oil by blending with kerosene and diesel oil cuts. It has a crude oil storage capacity of 185,000 tonnes and a products storage capacity of 99,000 tonnes. The required products are transferred through pipeline to the marketing companies' oil installations at Keamari, the Pak-Arab Refinery Company's installation at Korangi, the Karachi Airport, and the Keamari port for the export of certain surplus products.

Refining capacity for domestic crude oil

Domestic crude oil refining capacity of refineries at Karachi is about 24,000 b/d. The total crude oil production at the Southern Sindh oil fields has reached about 32,000 b/d in 1990-91. The lack of refinery capacity for the refining of domestic crude oil necessitated the export of about 6,000 to 10,000 b/d of crude in the 1990s. Recognizing the constraints on the refining capacity of domestic crude and growth in the demand of petroleum products in the country, the government is planning to increase domestic crude oil capacity. Both the refineries at Karachi, Pakistan Refinery Ltd. (PRL) and National Refinery Ltd. (NRL), have started work on expansion of their respective capacities to accommodate the processing of additional domestic crude oil supplies.

The NRL's domestic crude oil capacity is expected to increase by an additional 2,000 b/d upon completion of its energy conservation program. The NRL expects to increase its capacity under its revamp and expansion project by about 3,000 to 4,000 b/d, which will represent an increase of about 30 percent. By mid 1993, the combined refining capacity of the PLR and NRL for processing of domestic crude oil will reach 32,000 b/d.

In view of persisting inadequate domestic refining capacity in Pakistan, the government has permitted foreign oil companies to export the domestic crude oil production that cannot be processed at the refineries in Karachi. The government recognizes the profitability of the foreign oil companies producing operations; by providing adequate incentive for export, there will be a continuous flow of investment in the exploration, development, and production of oil in the country. The absence of this had been hampering the production expansion activities of Union Texas (Pakistan), the major producer in Sindh.

Government will continue to permit foreign companies to export surplus production of crude oil until the commissioning and operations begin of the planned new refinery at Golachari, Sindh, with a 30,000 bd capacity of refining domestic crude oil. This refinery is expected to be on line by mid 1994, and OGDC's crude oil production in Sindh will also be fed by this refinery.

The government continues to make all arrangements for refining of domestic crude oil and its consumption within the country. Such arrangements are considered necessary to maximize domestic consumption of indigenous petroleum resources. Moreover, this will reduce the trade deficit as the share of oil and product imports is about 30 percent of the total imports.

Expansion of the refining capacity of the existing refineries by an additional 48,700 b/d will be achieved by 1994. Three new refineries with total capacity of 200,000 b/d are being planned at Golachari (30,000 b/d), Multan (30,000 b/d), and Port Qasim (120,000 b/d). The planned refining capacity will reach 400,000 b/d by 1994-95.

Other refinery related activities

There are at least two other schemes in the process of being implemented that merit a discussion here. These are the Pak-Arab Refinery Company (PARCO) and the National Petroleum Ltd. (NPL). PARCO was created in 1973 by an agreement between the governments of Pakistan and Abu Dhabi with the objective of constructing an oil refinery of two million tpy capacity in or near Multan along with an 865 km pipeline to transport the crude oil from Karachi to this refinery. Construction of the refinery in the upcountry

would be closer to the demand center and provide an alternative to refineries located near Karachi. Accordingly, a public limited company was established and a project worth US$180 million approved in 1976. The construction of the pipeline began afterwards, but the economics of refinery became questionable as the Attok refinery expanded.

Subsequently, the governments of Pakistan and Abu Dhabi agreed to divide the project into two components — refinery and the pipeline — and to proceed at that stage with the implementation of the pipeline. The construction of the pipeline was completed in 1981 with a substantial cost over-run. The pipeline has been designed for an initial capacity of three million tpy, which can deliver two million tpy of crude oil and one million tpy of products. The capacity can be expanded to 4.5 million tpy if necessary.

Currently about 2.5 million tpy of products are being moved through the pipeline system from its Korangi installation at Karachi to the upcountry installation at Gujarat. The products are then pumped from Gujarat installation to the nearby oil marketing companies terminal at Mahmood Kot, from where the supplies are transported by road and rail to various upcountry depots and customers in the provinces of Punjab and NWFP. PARCO has a product storage capacity of about 25,000 mmt at Keamari, 53,000 mmt at Korangi, and 88,000 mmt at Gujarat.

PARCO has received government approval to extend the pipeline from Gujarat to Lahore. The refined petroleum products will be pumped along a route parallel to the Sui Northern Gas Pipeline to Faisalabad and from there to Lahore. The total length of the pipeline will be about 410 km. PARCO has also updated plans for implementation of the refinery component, which would increase the utilization of the pipeline and reduce the road/rail transportation of some products.

The NPL scheme has been reviewed and discussed within the government since 1983 when the NPL was established as a company under the management and administrative control of PERAC. The objective of this company is to construct and operate a hydrocracker refinery in Karachi to convert about 1.35 million tpy of lower value residue oil available from PRL and NRL into higher value petroleum products such as LPG, kerosene, jet fuel, diesel and fuel oil.

Trade and marketing

The import of crude in 1990-91 was 3.5 million tonnes per year with supplies from Saudi Arabia, Iran, Abu Dhabi, and Oman. In addition, Pakistan imported about 5.1 million tonnes of petroleum products in 1990-91 from Abu Dhabi and Singapore. The major imported products are middle distillates: diesel and kerosene.

Marketing and distribution of petroleum products have changed considerably over the years. Since 1947, the marketing and distribution of petroleum has been undertaken by three oil companies: Burmah Shell, Esso, and Caltex. In the 1960s, the government encouraged local parties to participate in petroleum trading. As a result, Pakistan National Oil Ltd (PNOL) and Dawood Petroleum Ltd (DPL) started marketing operations in 1964 and 1969 respectively. In 1969 Burmah Shell converted into a Pakistani company with 51 percent local private shareholding and the balance of 24.5 percent held by the Shell Petroleum Company and Burmah Oil Company. The company became Pakistan Burmah Shell (PBS).

In 1974, the government nationalized the domestic oil companies and took over the management of the two Pakistani companies, PNOL and DPL. To increase the storage facilities of the petroleum products, the government also incorporated the Pakistan Storage Development Corporation, later the State Oil Company. The government bought the interest of Esso in marketing and transferred the assets and liabilities to the State Oil Company. The two nationalized companies, PNOL and DPL, were then merged into the State Oil Company, which was renamed in 1976 to the Pakistan State Oil Company Ltd. (PSO). The PSO is now the largest marketing company for petroleum products in Pakistan.

Distribution of petroleum products is undertaken by road, railways, and pipelines. The PARCO pipeline transfers 2.5 million tpy of middle distillates from Karachi to a mid-country storage terminal at Mahmood Kot for further distribution to upcountry locations by road and railways. The road transport out of Keamari is undertaken by a public sector carrier, National Logistics Cell, and a private fleet of tankers.

The railway system also plays a significant role in moving petroleum products from Keamari and Mahmood Kot. Any deterioration in the performance of rail facilities

Table 4.2: **Production and import of oil and petroleum products**

	July-March 1990	July-March 1991	% increase
Domestic production, b/d	55,752	65,599	18
		73,950	
		Sept-Dec 1991	
Crude oil imports, b/d	71,161	85,072	18
Crude oil costs (million US$)	308	504	64
Petroleum products imports (b/d)	104,306	85,421	18
Product cost (million US$)	583	825	42

Source: Economic Survey 1990-91

Table 4.3: **Refineries production, 1983-89, thousand tonnes**

Refinery	1983-84	1984-85	1985-86	1986-87	1987-88	1988-89	Average AGR*
ARL	97	652	968	991	1094	1101	22.65
ARL	2122	2289	2228	2331	2398	2239	1.08
National	2311	2345	2348	2352	2401	2327	0.13
Total	4831	5286	5544	5674	5892	5667	3.24
% AGR*		9.42	4.88	2.36	3.84	-3.82	

* AGR annual growth rate
Source: Energy Yearbook 1989-90

directly affects the availability of petroleum products. The available tankwagon fleet with the railways is about 3,700, out of which 2,000 tankwagons are owned by the marketing companies for their own use.

OUTLOOK

Pakistan is experiencing a rapid growth in its energy demand and even higher growth in demand for petroleum products in the 1990s. The new petroleum policy allows Pakistan to seek foreign investment and joint ventures as well as technology in all activities of the oil industry.

Table 4.4 **Planned refineries and expansion, barrels per day**

Refinery	Imported crude capacity	Domestic crude capacity	Total
Bin Qasim refinery	120,000	-	120,000
Golchari, Sindh	-	30,000	30,000
Multan refinery	-	30,000	30,000
Total	120,000	60,000	200,000
Expansion of NRL, PRL and ARL	-	-	48,700
Total	120,000	60,000	248,700

Source: Ministry of Production 1991

The bottlenecks in the petroleum supply system include insufficient and fluctuating domestic supply of crude oil and inadequate and unsuitable refining capacity. Capital constraints in the oil industry make it difficult for Pakistan to expand its oil industry.

Domestic supply of 65,000 b/d crude oil provides only 25 percent of the total petroleum consumption, and the refining capacity is approximately 60 percent of the total product demand. The domestic crude production is expected to reach 76,000 b/d in 1991-92; beyond 2000, self-sufficiency will decline to 10 percent unless new discoveries enhance the low 156 million barrels (mmb) proven reserves. With the rapid growth in demand, these ratios will deteriorate unless substantial expansions are planned and carried out in the near future. In addition to expanding the refinery capacity, the refinery configuration needs significant upgrading to match the demand mix.

While the total petroleum demand is expected to increase at a rate of six percent per year during the 1990s, the product mix will remain stable. This would mean a continuous shortage of light and middle distillate products. The government aims to double the crude oil production capacity to about 80,000 b/d by the mid 1990s and sustaining it at that level during the second half of the 1990s.

The strategy for increasing the refining capacity between 1991 and 2010 by an additional 100,000 b/d per year will cater to the increased demand; about 50,000 b/d per year in the form of secondary refining for cracking up of fuel oil will be also needed.

In addition, there is a need to increase the storage and handling facilities for petroleum products. Expansion of gas processing capacity to meet the increased demand by an additional 2,000 MMcf/d is required. Transmission and distribution networks in the urban areas will need to be extended by an additional 100,000 km by the year 2000.

Government plans also call for installation of additional refining capacity of five million tpy and cracking facilities of two million tpy by 1997. Provided that these plans are implemented as scheduled, domestic production of oil will supply 29 percent of the total oil demand in 1995, but the ratio will decline to 22 percent by the end of the century. Also, with the timely implementation of refining and cracking facilities the country will be able to refine 76 percent of the petroleum demand in 2000 with a product mix which would match the anticipated mix of demand much better than it does at the present time.

Five

THE NATURAL GAS INDUSTRY

INTRODUCTION

Pakistan is endowed with major natural gas resources in the southern and central parts of the country. While current estimates put recoverable reserves of gas in known fields at about 20 trillion cubic feet (Tcf), some of the fields have gas of very low quality, so that total reserves are equivalent to about 15 Tcf.

Since sizeable gas fields were discovered in the early 1950s, development of resources took place concurrently. As of December 1991, there are 20 gas fields producing about 1500 million cubic feet per day (MMcf/d) of natural gas (Table 5.1), and gas production is expected to peak at 2,100 MMcf/d in 1992-93.

Pakistan possesses a large network of gas transmission network serving major part of Punjab, Sindh and parts of Baluchistan and NWFP. About 80 percent of gas is produced by the private sector, and transmission and marketing is through the private sector.

GAS DEMAND AND SUPPLY

Consumption of natural gas increased at an average rate of 8.5 percent during 1973-88. The rate of growth was about 9.5 percent during the 1970s and 7.5 percent during the 1980s. The decline in the rate of growth is related to the limitations on the supply side due to the producer pricing policy, which was inadequate to provide sufficient incentive to gas producers to invest in exploration and development of resources, and the limited capacity of gas transmission network. The insufficiency of supply has created a gas shortage, which has persisted during the 1980s and early 1990s. To alleviate the gas shortages, the government has adopted certain measures to give appropriate pricing

Table 5.1: **Gas supply in the Seventh Five Year Plan**

Production	1987-88	1988-89	1989-90	1990-91	1991-92	1992-93
Total	1200	1400	1500	1735	1901	1995
Sui gas equivalent	1071	1284	1391	1604	1692	1776

Source: Planning Commission, Seventh Five Year Plan 1988-93 and Perspective Plan 1988-2003; Economic Survey 1990-91

Table 5.2: **Gas consumption by sector, 1989-90**

Sector	% of total consumption
Power generation	38.14
Industry	19.48
Fertilizer	24.49
Cement	1.00
Domestic household	13.57
Commercial	2.52
Total	100.00

Source: Economic Survey 1990-91

signals to the consumers by charging them a price closer to the cost of gas supply and to allocate the limited supplies to consumers, which receive the highest netback value from the gas.

The total consumption of natural gas was 12,490 million cubic meters in 1989-90 (1,500 MMcf/d), about 38.1 percent of which was consumed in the power sector, 24.5 percent in the fertilizer sector, 19 percent in the industrial sector, 13.6 percent in the residential sector, and 2.5 percent in the commercial sector (Table 5.2).

In comparison with the pattern of consumption in the early 1970s, the most significant shift took place in the residential sector and the cement industry (Table 5.3). The share of the residential sector increased from two percent in 1973 to 13 percent in 1990-91. On the other hand, the share of the cement sector declined from 16 percent in 1973 to about one percent in 1990-91. The shares of other sectors have remained relatively stable.

Table 5.3: **Gas demand by sector, 1985-86 to 1990-91, million cubic feet per year**

	Cement	Fertilizer	Power	Industry
1985-86	7,286	99,788	103,252	74,852
1986-87	5,496	103,131	118,098	75,305
1987-88	5,262	102,853	142,750	78,741
1988-89	5,255	104,394	142,064	81,421
1989-89	7,988	108,582	169,089	86,368
1990-91*	8,000	115,000	180,000	90,000

* Estimates by author
Source: Economic Survey 1990-91

Based on the foreseeable supply constraints, the government forecasts a growth rate of 3.5 percent per year in total gas consumption during the 1990s. As a result, the total gas consumption is expected to increase from 1,735 MMcf/d in 1990-91 to about 2,095 MMcf/d by 1992-93. However, the peak demand is forecast to increase from 2,000 MMcf/d in 1990-91 to 4,628 MMcf/d in 2005. This growth pattern represents the government's policy of allocating the gas to various users rather than the actual demand by consumers. Since the gas available will remain less than the demand, allocation will take place according to the following criteria:

- the growth of gas use in the residential sector will be limited to 25,000 new customers per year, for whom the gas will replace part of their consumption of kerosene;
- there will be no gas supply for any future cement plants;
- gas supply to the fertilizer industry will be limited to the feedstock needs and 50 percent of energy requirements; and
- for the power sector the gas supply will be limited to the replacement for diesel oil and furnace oil.

Within these constraints, the household sector will experience the highest growth of 6.5 percent per year; it would consume about 20 percent of the total gas production by 2005. The consumption of gas by the industrial sector, including fertilizer and steel, would continue to absorb the major share of gas, accounting for about 50 percent, while the power sector will use about 29 percent of the total gas use.

On the supply side, the government has adopted a producer pricing policy to encourage the exploration and development of gas; the gas production will peak to 2,095 MMcf/d in 1992-93, the final year of the Seventh Plan. The gas supply is expected to increase due to acceleration of the analysis and development of known gas fields and expansion in the capacities of the transmission and distribution systems.

The expected average additional increase in production from each field will comprise about 150 MMcf/d from Pirkoh, 180 MMcf/d from Sui, 70 MMcf/d from Loti, 100 MMcf/d from Badin Block, and about 480 MMcf/d from the associated gas fields. With these expansions, Sui will remain the largest field while its production will increase from 850 MMcf/d in 1988 to 935 MMcf/d in 1993. The Mari field will remain the second largest field, and its output will increase from its current level of 300 MMcf/d in 1991 to 400 MMcf/d in 1995. The Pirkoh field will yield about 250 MMcf/d in 1993 compared with 100 MMcf/d in 1988. Other fields are small new fields which did not make significant contribution to the gas supply before 1987.

Although the short-term potential for expanding local supplies to meet increasing demand is rather good, the long-term supply of gas is not likely to be sustained based on the estimated resources in the country. Thus, the government has finalized plans to import gas through a pipeline from its neighboring country, Iran. For LNG, sources of supply would be from Qatar.

LPG AND CNG SUPPLY AND CONSUMPTION

The forecast for LPG in the Seventh Five Year Plan (1988-93) is set out in Table 5.4. The domestic production has a large shortfall compared to the demand. This subsector will increase its capacity with the imported LPG from the Gulf States during the 1990s.

The demand for CNG has been rising since its introduction in early the 1990s. There are two pilot CNG stations, one in Islamabad and the other in Karachi.
A Canadian company, BC Gas Co., Vancouver, is setting up in 1991 a joint venture in Pakistan to make and distribute CNG through an expanded network. The government wants to expand the network as public response so far has been favorable.

Table 5.4: **LPG supply and consumption forecast, Seventh Five Year Plan**

Production, tonnes	1987-88	1988-89	1989-90	1990-91	1991-92	1992-93
Domestic production	117,895	117,895	148,920	148,920	168,995	189,070
Estimated consumption	120,000	120,000	150,000	150,000	170,000	190,000

Source: Planning Commission, Seventh Five Year Plan 1988-93 and Perspective Plan 1988-2003; Economic Survey 1990-91

The LNG import chain involves liquefaction, facilities in the host country, LNG tankers, and gasification facilities at the receiving terminal in Karachi. The liquefaction and transportation would be quite costly and would result in a delivered price of between US$2.50 and $3 per mmBtu. Although it involves a long pipeline, the piped gas is expected to cost less than the LNG option. The pipeline will constructed from the Kangan field in Iran to Karachi via Makran Coastal belt. The government has signed an agreement with Iran about the pipeline in 1991; by 1995 the gas pipe line supplies of 500 MMcf/d will be reaching Karachi, with expansion to 1,000 MMcf/d by 2000.

GAS TRANSMISSION NETWORK

Pakistan has two principal gas transmission systems, the southern and the northern systems. The southern system runs south from the Sui field to serve both sides of the Indus river valley and the major cities of Karachi and Hyderabad. It is managed by an amalgamation of two companies: Sui Gas Transmission Company (SGTC), which is responsible for gas transmission from Sui gas fields to the south, and the Southern Gas Company (SGC).

The northern system serves the regions of Multan, Faisalabad, Lahore, Gujranwala, Islamabad, and Peshawar. It is managed by SNGPL, which was established in 1963, and is owned 90 percent by the government, seven percent by the Burmah Oil Company and three percent by public shares. In addition to the two major gas transmission systems, there are three smaller systems consisting of the Quetta pipeline to

transport gas from Mari field to three fertilizer plants, a pipeline owned by the WAPDA to transport the Sui gas to the Guddu power station, and a gas transmission line being installed by the WAPDA to transmit gas from Mari, Kandkot, and Uch fields for eventual use in power generating units at Guddu, Uch, and Kot Addu.

To accommodate the expanding gas supply, the government is implementing a development plan to increase the capacities of the transmission and distribution systems. The SNGPL transmission facilities associated with Loti, Pirkoh, and Sui fields will be expanded to 650 MMcf/d. The new transmission lines will be laid to connect the Adhi and Dakhni fields, and the capacity of the Kandkot-Guddu pipeline would be increased to augment supplies from Kandkot. The link to the SGTC Indus Right Bank transmission line will be expanded, while the transmission link-up of the Badin Block fields and construction of pipeline to Jamshoro with a capacity of 100 MMcf/d will be completed by 1995.

PRICING

The government's policy for rapid development of gas resources has led to various adjustments in pricing both at the production and consumption levels. In 1981, the government introduced a formula which would set the producer price of gas at a level sufficient to yield 12 percent rate of return on investment. This policy was intended to stimulate the private sector to undertake more aggressive exploration and development activities.

However, the private sector did not respond because the rate of return was substantially less than that which private oil companies expect to make in similar situations in other countries and the negotiation process was viewed as too long. In 1985, the government decided to improve the terms by introducing a new pricing formula which links the producer price of gas to two-thirds the border price of fuel oil, less a negotiated discount based on the geological conditions of each particular field.

With the new pricing formula, the private sector has shown substantial interest and signed contracts for fifteen new concessions. The new pricing formula was initially approved for the new gas fields. The government has now decided to expand its

application to the already discovered fields, provided that producers are willing to renegotiate their entire contracts. Further, the government is considering a pricing formula based on full parity with the international price of fuel oil for new offshore gas fields that are expected to cost substantially more than previous developments.

Government gas pricing policy for consumption has gone through various stages during the last decade. Prior to 1981, the government set the price of natural gas at a very low level to encourage the use of gas both for new uses as well as a replacement fuel for petroleum products and reduce the import costs of energy, which had become a significant burden on the country's economy.

This resulted in an inefficient use of gas and lack of economic incentive to explore for new gas fields. Since 1981, the consumer prices of natural gas have been adjusted five times. As a result, the average price of gas was increased by about 240 percent during the 1980s. The average price in 1991 is almost at 95 percent of the equivalent international price of fuel oil.

However, the structure of the gas price is still somewhat distorted as certain consumers pay substantially less than the economic price of gas. Presently, about 10 percent of the households have access to natural gas. They pay a price which is about 25 percent of the equivalent price of kerosene or fuel wood, both of which are considered as substitutes for gas and which the remaining 90 percent of the population use.

The average price of gas sold to the power sector is about 60 percent of the price of fuel oil, and to the fertilizer sector about 30 percent. The rest of the industry pay full parity or, in some cases, a price higher than fuel oil price. Thus the price structure remains distorted so that the power sector and residential consumers pay less, and the commercial and industrial consumers more, than the economically efficient price.

Since the 1988-91 structural adjustment agreement with the World Bank and International Monetary Fund, the government has been reviewing gas pricing policy at length. The first issue is whether to link gas prices to the international price or the domestic prices of its substitute fuel. If the government links the price to the international prices of substitute fuels, as normally required by these international

organizations, the gas price will be subject to sharp variations, which would make consumer planning a complicated task.

On the other hand, linking the price to the domestic prices of the substitute fuels would introduce the distortions of petroleum prices to the gas prices. While these questions remain substantially unanswered, the government took a step in 1989 to increase the price of gas to households by about 40 percent, which made the average price charged to the residential sector about 70 percent of the international price of fuel oil.

In addition, the government has instructed the Water and Power Development Authority (WAPDA) to gradually increase the price it pays for natural gas received for power generation. At the same time, there is a serious concern that with the higher price paid for the gas the return to gas producers will be much higher than justified. Thus, a mechanism needs to be introduced through which the government can absorb part of the gas revenue as public rent for an exhaustible resource.

An additional complication in setting gas prices is the presence of significant daily and seasonal patterns in gas demand. With the current patterns, the gas supply cannot meet the demand during the peak seasons. As a result, the industrial sector is supplied with only nine months of its annual requirements. For the remaining three months, the sector has to use a substitute fuel, mostly imported fuel oil.

Theoretically, the gas pricing policy will become an instrument to reduce part of the peak load and thereby match the consumption pattern. The adoption of a time-of-day tariff will not only reduce the demand during the peak hours but would result in greater revenues which may be channeled to exploration and development. This issue has been left for future consideration when the government designs a comprehensive gas pricing policy.

OUTLOOK

Pakistan is a major user of gas and has a well developed gas industry. Despite a significant shift from oil to natural gas, the industry has not expanded due to lack of market incentives to develop and procure additional gas resources. This trend will

change with better incentives where the market acts as arbiter of supply and demand as announced by the government in its new petroleum policy in November 1991.

The gas industry in Pakistan had a 6.7 percent share in 1987-88 in value added large-scale manufacturing and 6.8 percent in 1990-91. The present constraint on the growth of the gas industry is due to lack of discoveries of new gas fields as the current rates of production have already approached rated reservoir capacity of the gas extraction.

Natural gas demand has grown substantially in the past decade and, with demand exceeding supply, the country faces shortages, particularly during the winter months. To cope with this situation, the government is pursuing various policies to increase the domestic supply of gas. It is also investigating several measures to manage the gas demand and, to the extent possible, curtail the demand, particularly during the peak periods.

However, the fact remains that the gas supplies in the late 1990s are not likely to meet the market demand for the gas. Therefore, the growth rate in gas consumption, estimated at 3.4 percent per year for 1990-2005, is a controlled growth which would take place under the government policy of restricting further access to the gas grid.

Six

THE POWER SECTOR

INTRODUCTION

Pakistan has a very low use of electricity compared to other countries in Asia. Only 40 percent of Pakistan's 114 million people have access to electricity. The government plans to provide electricity to 47 percent of the population by 1992-93.

The power sector in Pakistan is dominated by the state in all aspects: construction, operation and maintenance of generation facilities, and transmission and distribution of electricity supply and its marketing.

The federal Ministry of Water and Power (MWP) is the regulatory body which oversees the functioning of the power sector all over Pakistan. Coordination between the federal and provincial ministries for the power sector is provided by the energy wing of the MWP, which acts as a secretariat for the National Energy Policy Committee (NEPC) and Energy Review Group (ERG). The Ministry of Water and Power regulates the tariff structure, investment plans, and financing of the power sector.

The supply of electricity throughout Pakistan is the responsibility of two public sector enterprises: the Water and Power Development Authority (WAPDA) and the Karachi Electric Supply Corporation Limited (KESC). These organizations are responsible for the generation, transmission, and distribution of electricity in their respective service areas.

WATER AND POWER DEVELOPMENT AUTHORITY (WAPDA)

WAPDA was established in 1958 by an ordinance, which was amended in 1959 to allow transfer of the electricity department to it. WAPDA's charter includes investigation, planning, and execution of projects in generation, transmission, and distribution of power in Pakistan. There are eight area electricity boards under WAPDA's power wing, with representatives from the public and provincial governments.

The annual development budget of the WAPDA was Rs15.84 billion (US$725 million) in 1989-90. Its generation was 31.83 billion kilowatt hours (kWh) in 1989-90, of which 24 billion kWh were sold; the system losses were 22 percent of the total generation.

KARACHI ELECTRIC SUPPLY COMPANY (KESC)

KESC is a public company, which was originally established as a private company in 1913. Since 1951 the major shareholders have been the government and government controlled institutions. KESC serves the greater Karachi area and operates thermal power plants supplemented by power purchases from the Karachi Nuclear Power Plant (KNUPP).

GENERATION CAPACITY

In June 1991, total installed generation capacity was 8,508 MW; an increase of 11 percent over the 1989-90 capacity of 7,654 MW. In addition, a 125 MW nuclear power plant is operated by the Pakistan Atomic Energy Commission and a 380 MW of captive power plant by other non-utility enterprises. WAPDA's generation capacity increased by 10 percent from the 1989-90 capacity of 6,409 MW to 7,053 MW in 1990-91 (Table 6.1 and 6.2). WAPDA's generation capacity consists of 54 percent thermal and 46 percent from hydroelectric power. Total capacity is to increase during the Seventh Plan period by an additional 6,558 MW (Table 6.3).

The maximum potential output of the existing hydroelectric stations amounts to about 3,100 MW when all the reservoirs are full. This potential drops to about 1,000 MW during dry seasons and has to be offset by thermal generation. The shortfall between demand and system availability was about 1,500 MW in January 1991 and about 1,200 MW in June 1991, and this shortfall is expected to continue into the mid 1990s.

KESC's generation capacity increased by 19 percent in 1989-90 to 1,318 MW in 1990-91 (Tables 6.1). The oil-fired installed capacity of KESC was about 1,528 MW, in December 1991. Oil supplied 95 percent of the energy input to generation while the remaining five percent was supplied by the Karachi Nuclear Power Plant.

Table 6.1: **Electricity installed capacity, megawatts**

Year July-March	WAPDA	KESC	Nuclear	Total
1989-88	6,409	1,108	137	7,654
1990-91	7,053	1,318	137	8,508
% increase	10	19	-	11.2

Source: WAPDA 1991; KESC Annual Report

Table 6.2 **Electricity generation by source (WAPDA)**

Year July-March	Hydroelectric power billion kWh	% of total	Thermal billion kWh	% of total	Total
1987-88	16.68	61	10.76	39	27.45
1988-89	16.97	59	11.92	41	28.89
1989-90	16.92	54	14.50	46	31.47
1990-91	13.90	54	11.66	46	25.56

Source: WAPDA Annual Report 1980-81 through 1989-90; KESC Annual Report 1980-81 through 1989-90

Table 6.3: **Seventh Plan additional generation capacity by 1992-93, megawatts**

	Hydroelectric power	Fuel oil	Gas fueled	Total
Additional capacity	2,168	3,790	600	6,558
WAPDA	2,168	2,460	600	5,228
Private sector	-	1,330	-	1,330

Source: Planning Commission, Seventh Five Year Plan 1988-93 and Perspective Plan 1988-2003

Table 6.4: Length of transmission lines (WAPDA system)

Voltage	Route length (km) March 1990	March 1991
500 KV	1,614	1,932
220 KV	1,744	1,758
132 KV	11,064	11,216
66 KV	7,963	8,087
Total	22,385	22,993

Source: WAPDA 1991

TRANSMISSION

By March 1991, the total length of transmission lines in the WAPDA utility system was 22,993 km compared with 22,385 km in March 1990. The voltage type and route length is given in Table 6.4.

CONSUMPTION AND DEMAND

The number of consumers has been increasing at a fast pace due to rapid urbanization and the extension of electricity supply to rural areas. The number of consumers has grown at an annual rate of 11 percent, from 0.31 million in 1960 to 7.15 million in February 1991. The Seventh Plan is to provide electrification to another 10,336 villages by 1992-93, bringing the proportion of electrified villages up to 55 percent compared to 34 percent in 1987-88. At least half of all the new connections in the period are to be provided in rural areas.

The target for new consumers for 1990-91 is 559,000, and the number of consumers is expected to increase to 7.5 million by June 1991. The growth from 1988-89 through March 1991 is given in Table 6.5.

Electricity sales have grown at an average annual rate of 12 percent during the 1980s and early 1990s. The industrial sector has remained the dominant consumer of electricity, although its share in total electricity use declined from 38 percent in 1980 to 34 percent by 1991. The residential sector's use of electricity rose from 19 percent in 1980 to 32 percent by 1991 (Tables 6.5 and 6.6).

Table 6.5: **Power consumers by sector (WAPDA system), megawatts**

Year	Domestic and commercial	Industrial	Agriculture	Total
1988-89	6,122,256	153,042	143,869	6,419,167
1989-90	6,562,325	158,800	149,554	6,870,679
1990 - Feb '91	6,848,239	161,584	151,888	7,161,711

Source: WAPDA 1991

Table 6.6: **Electricity consumption by sector, percent of total sale**

	1988-89	1989-90	1990-91 July-March
Domestic household	31.57	31.71	31.74
Agricultural	19.82	20.75	21.43
Industrial	34.47	34.65	34.20
Commercial	4.86	4.58	4.32
Bulk supply and public lighting	9.12	8.15	8.18
Traction	0.16	0.16	0.13

Source: Economic Survey 1990-91

Table 6.7: **WAPDA power system**

Year	Projected demand in MW
1990-91	6,560
1991-92	7,312
1992-93	8,029
1993-94	8,784
1994-95	9,609
1995-96	10,513
1996-97	11,501
1997-98	12,582
1998-99	13,652
1999-2000	14,812

Source: WAPDA 1989-90

Electricity consumption is forecast to grow by seven percent a year to the end of the century. Residential consumption is expected to experience the highest growth rate at an annual rate of nine percent, while agricultural consumption growth is projected at five percent a year.

The demand for electricity has been going up at an annual rate of 15 percent due to overall growth in the various sectors of economy during the 1980s and the early 1990s. During 1986-90, electricity consumption grew at 11.89 percent annually as compared to the GDP growth rate of 5.72 percent, with a resulting elasticity ratio of 2.08:1.

Increases in residential demand together with high irrigation water pumping loads and rural electrification have contributed to high electricity demand. The demand is projected to increase from 6560 MW in 1990-91 to 14,812 MW in 2000 at an annual growth rate of 15 percent. The total growth is estimated to increase by 8,252 MW within a decade. The peak demand up to 2000 as estimated by WAPDA is shown in Table 6.7.

LOAD SHEDDING

Power shortages and unreliability have become a chronic problem in the power sector in Pakistan. Shortfall in power generation in the past led to extensive load shedding during December to March, but in recent years it has become an occurrence of long duration. WAPDA's generation capacity additions have not kept pace with demand since the 1980s. The maximum shortfall in 1989-90 during the peak hours varied from 990 MW to 1,500 MW and the system load has declined from 66 percent in 1975-76 to 56.5 percent in 1990-91.

The impact of power interruptions and load shedding in the industrial sector have been estimated (WAPDA Study 1987) to be an 8.2 percent reduction in value added output. This reduction is equivalent to a decline of approximately US$350 million. This study further estimated that the direct costs to the economy should be multiplied by 1.34 to account for indirect effects. The resulting total represents a 1.8 percent reduction of GDP. Additionally, a loss of 4.2 percent in the output of manufactured exports totalling US$75-100 million has been attributed to load shedding and power interruptions.

Industrial electricity users have resorted to substantial self-generation to mitigate losses from unreliability. The study estimates that total cost per kWh ranges from a low of US$0.14/kWh to a high of $0.74/kWh. In comparison, WAPDA's system-wide average, long-run marginal cost of supply is estimated to be US$0.076/kWh. Thus, the economic cost of grid-supply by the WAPDA is substantially lower than the self-generation incurred by the industry. The extent of this divergence provides some indication of the resource costs to the economy.

The government attempts to avoid actual power cuts, but this is often at the expense of considerable voltage reduction. Installation of new power generation capacity takes the largest share of annual development plan, accounting for 25 percent of the total in 1990-91, compared to 28.3 percent in 1989.

RURAL ELECTRIFICATION

In 1958 only about 600 villages had access to electricity from the national grid. Since 1960, WAPDA has been undertaking annual programs for rural electrification, and by 1991 it provided electricity to 40 percent of the 45,000 villages and 35 percent of the 80,000 settlements in the country (Table 6.8). Much of this increase is attributable to the priority accorded by the government to rural electrification.

The objectives of the program are not only to electrify villages but also to encourage farmers to install additional tube wells for irrigation pumping, to supply power to agricultural-based industries, to create employment opportunities for the rural population, and to encourage the establishment of small and medium sized industries to stem the flow of the rural population to urban areas. In response to government policy, WAPDA accelerated the program of village connection from about 400 a year during the 1970s to 1,800 a year in the 1980s.

The rate of progress is below the targets which were set in the Sixth and Seventh Plan. There are several reasons for the difference between the targets and the actual performance. First, while the rate of rural electrification was impressive, it was not planned within the framework of a consistent and economic master plan. Therefore,

Table 6.8: **Rural electrification by source**

	WAPDA	Other/KESC private	Total	Cumulative	% of total
1987-88	1,865	394	2,295	16,525	33.7
1988-89	1,518	200	1,718	18,243	37.3
1989-90	2,042	200	2,242	20,485	41.8
1990-91	2,042	200	2,242	22,727	46.4
1991-92	1,867	200	2,067	24,794	50.6
1992-93	1,867	200	2,067	26,861	54.8

Source: Planning Commission, Seventh Five Year Plan 1988-93 and Perspective Plan 1988-2003

targets were not realistic nor measured by the economic costs and benefits of rural electrification.

Targets in the Fifth and Sixth Five Year Plan for rural electrification were overly ambitious relative to the availability of resources and as a result there were substantial delays in project implementation. Particularly in the Punjab, rural electrification and irrigation pumping were complementary activities which needed considerable coordination for efficient use of investments. The coordination has not been done satisfactorily in the past. The government has recognized these shortcomings and is in the process of approving a master plan for rural electrification.

ELECTRICITY PRICING

Prior to 1988, electricity tariffs by the two utilities were set independently, each reflecting the cost and financial requirements of their own systems. In 1988, the government unified the two tariffs as one of the initial steps to integrate the two systems and to coordinate their future investments and operations.

The level of electricity tariff is based on financial considerations, which are normally drawn up in consultation with international lending institutions. The average level of tariffs was adjusted annually during the last five years, increasing by a total of about 50 percent. The average tariff was about one rupee per kWh in 1991, which is

about 80 percent of the long-run marginal cost of electricity supply. It is expected that the government will increase the price of electricity by about 40 percent during 1991-1995 in order to make the integrated power system financially viable.

The structure of electricity prices is considered economically inefficient, which creates an inefficient pattern of power consumption. First, there is a cross-subsidy between industrial consumers and residential and agricultural users of power. While the cost of power supply to residential consumers, particularly those located in remote rural areas, is higher, the government pursues a policy of charging a lower price to these consumers due to social considerations. Second, the present pricing structure does not provide an incentive for peak consumers to shift their consumption to the off peak hours, which would enable substantial savings in capital expenditure on new generating capacity. As a first step to improve the tariff structure, the government decided in 1988 to include a fuel adjustment clause in the electricity prices paid by large residential users and to increase the average tariff by residential and agricultural consumers by 21 percent. Furthermore, the government is currently studying the feasibility of implementing a peak-load pricing policy for large industrial consumers.

OUTLOOK

Growing electricity demand and urgency of power resources development is the major issue considering the high annual growth rate of seven percent assumed by the government. Power demand has grown at an average annual rate of 12 percent during the 1980s and the early 1990s. The growth is expected to be more moderate in the future but will continue at a rate of 12 percent per year during the 1990s.

Options include totally opening up the electricity generation and transmission to the private sector, accelerating the development of power generation resources, putting long-delayed nuclear power generation on schedule, strengthening electricity sharing efforts on the supply side, and encouraging efficient use of electricity on demand.

To meet the growth in demand, the government is implementing an aggressive plan to expand the power generating capacity and to consolidate the power sector activities. The expanded capacity by 1992-93 will add up to 6,558 MW to 1987-88

capacity with a mix of hydroelectric power, thermal, and gas turbine generation. Four projects on energy production were signed by government in 1989-90. These include a 1,425 MW thermal power plant near Hab, Baluchistan; a 937 MW nuclear power plant at Chasma with France; a 937 MW nuclear plant with China; and a 1,000 MW Ghazi-Ghariala hydroelectric power project on the River Indus, downstream of Tarbela Dam.

The Hab power plant

The Hab River plant, an oil fired power station, has become internationally well known due to its implementation scheme with private sector funding. This project is the first power plant in the developing world that is being implemented by the private sector with a very complex financial arrangement termed build-own-operate (BOO). The World Bank has mobilized international funds for the financing of the capital cost.

The Hub Co., a consortium led by Japan's Mitsui Company, has won the Hab River's 1,300 MW oil fueled power plant in Baluchistan. Under the BOO, the consortium both builds and operates the utility, selling the output to the national grid run by the WAPDA at Rs1.036 per kWh. The Hub Co. will manage the plant for 17 years, then it will be sold to the government. Xenel Industries of Saudi along with British Electricity International, K & M Engineering (USA), Campenon Bernard (France) and Ansaldo (Italy) are other partners in the project.

The Hub plant will increase the country's generation capacity by 18 percent. The cost is about US$880 million, of which US$600 funding is being provided by a World Bank loan. Work on four 323 MW units is scheduled to start in early 1992 and will be completed by 1995. This project will boost industrial activities in Baluchistan, the least developed of the provinces in Pakistan.

Coal and hydroelectric power projects

There is a feasibility study for a coal-fired power generating complex. The major issues involved are the selection of the appropriate site and the extent to which domestic coal can be used.

In addition, the government is hoping to develop about 8,700 MW of hydro capacity during the next 20 years. The major sites considered for development are the Basha site, with an estimated capacity of 2,400 MW, and the Kalabagh site, with an estimated capacity of 3,000 MW. There are certain institutional and environmental constraints associated with each scheme, making their immediate implementation unlikely. Therefore, efforts are being concentrated on smaller hydroelectric projects such as Chasma (240 MW), Taunsa (110 MW), and Jinnah (110 MW).

Additional generation capacity

The Seventh Five Year Plan has targets for an expansion of the generating capacity by 6,558 MW by 1992-93 (Table 6.3). The mix envisaged for the additional capacity will be mostly oil, gas, and coal fuelled generation, as well as hydroelectric power generation.

Pakistan's planned power projects have attracted substantial international attention due to a variety of reasons. For example, the Chashma nuclear plant (900 MW), which was initially planned for commissioning in 1991, has been held up by international concern over the direction of nuclear program in Pakistan.

With an eventual capacity of 2,500 MW, the Hab River project has been the center of attention in international discussions about the role of the private sector in power generation in developing countries. After more than three years of preparatory work and negotiations among various parties, the project is now officially approved. Financing the project has become very complicated with various multilateral and bilateral financiers. A private sector development fund has been established that will provide up to 30 percent of the total capital cost to any qualified private sector entity intending to invest in the power sector. The Hab River project is the first project to be implemented in this manner.

Hydroelectricity is perceived as a major source of future power generation. The present plan calls for development of about 8,700 MW of new hydro capacity by 2010. Postponement in the implementation of hydroelectric projects will clearly result in the addition of further thermal plants to the development program of the power sector.

Projects currently under implementation or serious consideration are a 2,500 MW oil-fired power station to be constructed and operated by the private sector and a 4,600 MW coal-fired power generation complex. The latter proposal is to a large extent due to the postponement of hydropower projects and limitations in gas supply.

Seven

THE FERTILIZER INDUSTRY

INTRODUCTION

The development of the fertilizer industry has been an outcome of the development of natural gas resources of Pakistan. After the power sector, the fertilizer industry is the largest consumer of natural gas in Pakistan. At the same time, it is the driving force for the agricultural sector, which remains the mainstay of Pakistan's economy, accounting for about one-third of the gross domestic product (GDP), more than 50 percent of total employment, and about 60 percent of total exports. Modern agriculture in Pakistan is heavily dependent on chemical fertilizers, insecticides, pesticides, micro-nutrients, and soil treatment chemicals. The fertilizer industry in Pakistan gives a reasonable indication of the country's overall economic development and the growth potential of its indigenous resources.

Pakistan's fertilizer industry is still in the initial stages of its development. This is evident from the limited range of chemicals products manufactured by the fertilizer industry, which include urea, ammonium nitrate, nitrophosphate, and superphosphate. Pakistan is a net importer of fertilizers, and the import of fertilizers showed a rise of 15 percent in 1990-91.

The fertilizer (chemical) industry share in value added large-scale manufacturing was 6.7 percent in 1987-88 and 6.8 percent in 1990-91. The present constraint on the growth of the fertilizer industry is that the current rates of production have already approached capacity.

THE GAS REQUIREMENT OF THE FERTILIZER INDUSTRY

Currently, all the feedstock and energy requirements of the fertilizer sector are provided by natural gas at a substantially subsidized price. The total consumption of gas in the fertilizer sector was 1.08 billion cubic feet (Bcf) in 1989-90. The projections for future

gas demand indicate that the gas consumption by the fertilizer industry would grow to 1.35 Bcf by 1992-93.

The supply of natural gas is less than the actual growth of the demand by the industry. However, due to the limitations on gas supply, the government has adopted a policy of providing only 50 percent of the energy related component of the industry as well as 100 percent of the feedstock requirements. With this constraint, the gas use of the fertilizer industry is expected to grow at 3.5 percent per year, which would result in an increase in gas use from 315 million cubic feet per day (MMcf/d) in 1988 to 375 MMcf/d by 1995 and 450 MMcf/d in 2000.

CONSUMPTION AND PRODUCTION CAPACITY

The government gives high priority to increasing agricultural production in its economic development effort. Due to the limited scope for expanding the area under farming, more intensive farming practices based on fertilizers and other related inputs are of critical importance for boosting farm output. The consumption of fertilizers is seasonal in Pakistan; about 60 percent of fertilizer is used in the Rabi (fall) season and 40 percent is used in the Kharif (spring) season.

During the 1980s, fertilizer consumption increased at an average annual rate of about 10 percent, reaching nearly 2.04 million nutrient tonnes in 1990-91. There has been an average subsidy of 40 percent on domestic fertilizer since the 1960s, and the subsidy on phosphate and potassium fertilizer is being withdrawn.

There are ten fertilizer units in Pakistan as of 1991, seven public sector and three private sector, with a total installed capacity of 1,195,000 nutrient tonnes. The public producers have a capacity of 651,000 nutrient tonnes, and the private producers have a capacity of 544,000 nutrient tonnes.

The National Fertilizer Corporation (NFC), which operates five fertilizer units in different public locations, accounts for about 50 percent of the nitrogen capacity and all of the phosphorus capacity. The total potash production capacity in the country currently depends entirely on imports for meeting potash requirements, which are comparatively low (42,600 tonnes in 1991).

The capacity for nitrogen and phosphorus is uniformly high in all local fertilizer plants primarily because of trained personnel, satisfactory compensation levels, and a sound performance evaluation and monitoring system for the public sector. The average capacity in the fertilizer industry in 1987 (based on design capacity) was 103 percent for nitrogen and 106 percent for phosphorous. However, the local production of nitrogen and phosphorous is not adequate to meet all the country's needs.

The domestic production covered 84 percent of the requirements of nitrogen compared to 23 percent of phosphorous in 1987. During the last two decades, nitrogen production increased from 50,500 tonnes to about 1.12 million tonnes, while phosphorous production increased from about 700 tonnes to 93,300 tonnes. In spite of increased local production, the country continues to depend on imports; in 1989-90, Pakistan imported 1,127,000 tonnes of fertilizers at a cost of Rs4.4 billion.

Consumption of all fertilizers grew at an average annual rate of 14.6 percent during 1966-67 to 1986-87. Nitrogen continues to be the predominant fertilizer nutrient used, accounting at present for about 75 percent of the total, with phosphorous and potash accounting for 23 percent and 12 percent respectively. The growth of fertilizer consumption is expected to continue in the future with the government's plans for increased agricultural production.

Furthermore, consumption of fertilizer per hectare of arable land in Pakistan (73.7 kg of nutrients/ha) is significantly lower than in some other developing countries (for example, 94.6 kg/ha in Indonesia and 167.4 kg/ha in China). The government has projected fertilizer demand to grow at an average annual rate of five percent during the Seventh Five Year Plan (1988-1993) compared to eight percent during the Sixth Plan. However, the actual demand is growing at an annual rate of 10 percent in Punjab.

RECENT DEVELOPMENTS

The government of Pakistan privatized the fertilizer industry in May 1991. Liberalization policies and reforms in the fertilizer industry are geared to increasing the capacity of the industry to meet the growing demand of the agriculture sector. A fiscal

incentive package designed to encourage the development of industry in rural areas allows a three to five year tax holiday, depending upon the location of plant.

The supply of natural gas has been assured at existing prices for the purpose of feedstock for 10 years from the date of operation of a plant. The expansion of existing plants will be treated as new investment and is entitled to the same concessions. The fertilizer industry will be allowed to import phosphate rock and sulfur free of duties or surcharges.

In the unlikely event of the imposition of price control, the ex-factory price for fertilizers will be fixed so that a minimum after tax return of 20 percent on equity at 90 percent capacity is assured.

The government has been encouraging investment on rehabilitation of the existing plants to conserve energy, reduce costs, and maximize capacity, while promoting capacity expansion based on local inputs. As a result, the fertilizer industry has become internationally competitive, particularly in the nitrogen fertilizer field.

Low production is partly caused by operational difficulties, decline in working hours and the switching from electric power to gas in case of power failure and load shedding. In order to overcome these difficulties and boost production, the government has allowed a number of concessions to the fertilizer industry, including duty-free import of plant and machinery and assured supply of natural gas.

Eight

SUMMARY OUTLOOK FOR ENERGY IN PAKISTAN

INTRODUCTION

Per capita consumption of energy in Pakistan has gone up 10 times since its independence in 1947 and the annual growth rate of energy consumption was estimated at 10 percent during the early 1990s. As detailed throughout the paper, the dilemma facing Pakistan in the 1990s is a continuing much faster rate of growth in aggregate energy demand compared to the growth in energy supplies.

Despite present austerity measures, total primary energy requirements are 10 percent higher in 1990-91 compared to 1989-90. Scarce energy resources coupled with limited financial resources, stalled projects, slow pace of execution, and mismanagement have all contributed to energy supply shortages. Chronic power shortages, load shedding, and paucity of fuel products are frequent occurrences in many parts of the country.

Pakistan's ambitious target of seven percent annual economic growth in the 1990s calls for massive investment to increase energy supplies. The government envisages a shift away from labor intensive industries, such as textiles, footwear, carpets, and garments, toward capital intensive and technology intensive industries.

The future growth of the Pakistani economy means there will be a steady growth in energy demand, primarily for petroleum products in the transport and agriculture sectors, and high power demand in the industrial and domestic sectors. Such a trend emphasizes the continued importance of energy and the need to strengthen infrastructure, utilities, transmission, pipelines, and the physical capital structure.

In 1988 the Planning Commission estimated an average growth rate of 6.5 percent in energy consumption over the Perspective Plan period (1987-88 to 2002-03). The total end-use energy consumption is forecast to reach 68.5 million tonnes of oil equivalent (mtoe) in 2002-03 compared to 28.2 mtoe in 1987-88. Commercial energy consumption will more than triple to 54.1 mtoe in 2002-03 compared to 17 mtoe in 1987-88.

The Sharif government's ambitions for GDP and the high population growth will mean much higher energy demand in the 1990s than the projections made by the Planning Commission in 1988. Together with the rapid increases in electricity and petroleum product consumption, the structure of energy demand and supply is likely to undergo changes with the shift to a more energy intensive lifestyle.

PRIVATIZATION AND LIBERALIZATION

Privatization is being contemplated in the energy sector with the denationalization and disinvestment of public sector monopolies in gas and petroleum products and coal subsectors. However, policy reforms and deregulation in the power sector are lacking. The utilities monopoly of WAPDA still exists and KESC, which is a stock market listed company, has not been separated from WAPDA since its incorporation under it in 1984.

Several major policy reforms in energy have been recently incorporated, including the following:

- induction of the private sector into thermal power generation using imported fuel oil and coal as well as domestic low quality gas;
- adjustment of consumer and producer prices for oil and gas to accelerate exploration for new fields and the development of existing and newly discovered oil and gas fields;
- discontinuation in 1991-92 of government budgetary fiscal support for the state-owned Oil and Gas Development Corporation (OGDC) for exploration, development, production, and operational activities; the OGDC has been financing its annual plan in 1991-92 from its own resources and loans from the World Bank and the Asian Development Bank (US$55 million);
- opening of new oil and gas concession blocks for bidding by the private and public sector with competing on equal terms and reasonable and fair procedures for the award of contracts;
- privatization of the gas distribution companies, namely the Sui Southern Gas Company and Sui Northern Gas Company, with a total worth of US$40 million; and
- deregulation of prices of lubricants and other petroleum products.

Pakistan's recent investment-oriented petroleum policy is designed to enhance exploration of oil and gas, by providing maximum financial incentives and removing certain bottle-necks in the petroleum sector. This is the first comprehensive policy aiming to make the country self-sufficient in oil and natural gas production. The policy contains numerous measures that open new avenues for private investment from domestic and international sources. The new measures, which do not require the approval of the National Assembly, cover contract terms, taxes on inputs, pricing of outputs, and administrative procedure.

Past policy that stipulated that the government would finance five percent of the cost of exploring oil and gas in exchange for a 50 percent share of production arising from discovery has been retrenched. Companies will negotiate terms with the government on a case-by-case basis. Interest in oil and gas exploration in Pakistan picked up in 1990-91: the government granted about 23 concessions compared to four in 1989-90.

The new petroleum policy promotes exploration, optimal extraction, and conservation and environmental protection. New laws are being prepared to ensure product quality and to reduce pollution by means such as the reduction of lead in gasoline. The government also intends to promote the use of compressed natural gas (CNG) as a transportation fuel to replace diesel and gasoline.

Under the new petroleum policy, gas producers have been guaranteed market outlets in Pakistan for up to four years from the date of a commercial discovery. The policy also promises to link the domestic price of liquified petroleum gas (LPG) to the international prices. At the moment, LPG is priced at a fixed rate of Rs5 (US$0.20) per million cubic feet; under the new policy, it will be sold at 66 percent of the price for fuel oil.

The new petroleum policy has freed oil refining from controls, though prices for products will remained fixed until June 1991. Official permission will not be required for the setting up of new refineries. Refineries will be allowed to set up their own marketing companies or will be free to sell their products to whatever company they choose. Refineries may buy crude from either local or foreign markets, with foreign

exchange provided by the government. In addition, lubrication products have been freed from price controls, and there is to be a pricing formula for refineries based on parity with prices for imports.

Marketing companies for petroleum products – Pakistan State Oil, Caltex, and Pakistan Burmah Shell – have been asked by the government to prepare an implementation plan and schedule for the deregulation of lubricant prices in accordance with the new petroleum policy.

The new petroleum policy is expected to assist in delaying oil reserves depletion; however, with the projected petroleum demand growth, imports will play a more critical role. Reliable access to oil and gas supplies abroad would have to be sought through joint ventures with oil-rich neighboring countries in West Asia and the Gulf.

COLLABORATION AND JOINT VENTURES

The Pakistan government has been actively pursuing collaborations and joint ventures in energy projects with donor countries and neighboring countries. Significant cooperation has been forthcoming from China and Iran.

China has been involved with technical assistance in power projects based on coal and nuclear power generation. Plans are being finalized for construction of a 300 MW nuclear power plant with Chinese pressurized nuclear reactor technology. China is also involved with thermal generation of 300 MW at Jamshoro, Sindh, from the Lakhra coal deposits.

China has extended its assistance by transfer of petroleum technology to Pakistan for the development of small oil fields, laying down of gas and oil transmission pipelines, and auxiliary oil field operations and services.

Iran supplied crude oil at concessional terms in 1991. Pakistan and Iran have formalized plans to construct a oil pipeline from Iran's eastern oil fields to Port Qasim, near Karachi, and for other joint venture projects in exploration gas and oil transmission pipelines and auxiliary oil field services.

Pakistan is planning a joint venture refinery with the Iranian National Oil Company (NIOC) at Bin Qasim, near Karachi, which will be based on Iranian crude and process 80,000-120,000 b/d of oil.

Pakistan has also signed a memorandum of understanding with Turkmenistan for supply of natural gas to Pakistan's northern areas. Turkmenistan is the largest producer of natural gas in Central Asia.

In October 1991, Kuwait Petroleum Company (KPC) began sending petroleum products to Pakistan at concessional rates after a lapse of 13 months. For the past few years, the KPC had been meeting over 90 percent of Pakistan's demand for petroleum products. With the reconstruction of Kuwait's two biggest refineries, Kuwait is eager to meet Pakistan's demand for products on a long-term basis.

THE FUTURE

By 2003, Pakistan will be using four times more oil and petroleum products than at present. Even if the domestic crude production increases from the present level of 65,000 to 175,000 b/d in 2003, there will still be a very large gap between oil demand and domestic production. Pakistan needs to secure sufficient domestic and external resources for additional refining capacity and to expand power generation. Investment of US$25 billion is required for meeting the energy needs of Pakistan during the 1990s.

While there is much interest in the Pakistan energy market by oil-rich countries, considerable competition exists for energy capital, making it necessary for Pakistan to offer incentives and stability for overseas investors. To meet its energy needs, Pakistan will face pressure during the 1990s in external trade and payments, reflected in volatile exchange rates and its huge external debt.

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4/10/92