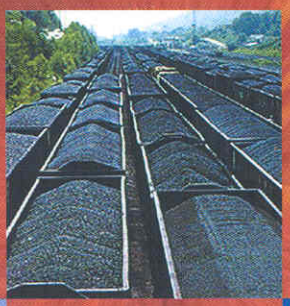
Pakistan Coal Power Generation Potential

June 2004



Private Power & Infrastructure Board


بسم الله الرحمن الرحيم

FOREWORD

God has blessed Pakistan with immense coal resources of more than 185.5 billion tonnes, and if half of these resources are exploited properly it would be sufficient for generating 100,000 MW of electricity for 30 years. It is unfortunate that, so far, only a 150 MW power plant based on indigenous coal has been set up, and that too in the public sector.

In order to exploit Pakistan's coal resources for power generation, enormous investments are required for the development of coal mines and related infrastructure to ensure a sustainable and reliable coal supply for power generating plants. Past experience indicates that the main obstacle in establishing power plants based on domestic coal is its availability and long term reliable supply to the plants.

In view of the limitations and financial constraints of the public sector, the Government of Pakistan announced a private power policy titled "Policy for Power Generation Projects 2002" (the Power Policy 2002) which focuses on the use of indigenous resources, especially coal, for power generation. The Power Policy 2002 is designed to attract international investment and facilitate tapping of the domestic capital market to raise local financing for the development of indigenous coal-based power plants in the country. The objective of the Government is to facilitate investors in developing modern coal mines and coal power plant projects in Pakistan.

This report provides information about the coal resources of Pakistan, coal power policy and needed requirements for the development of integrated projects of coal mine and coal power plants in Pakistan, availing of various incentives provided in the Power Policy 2002.

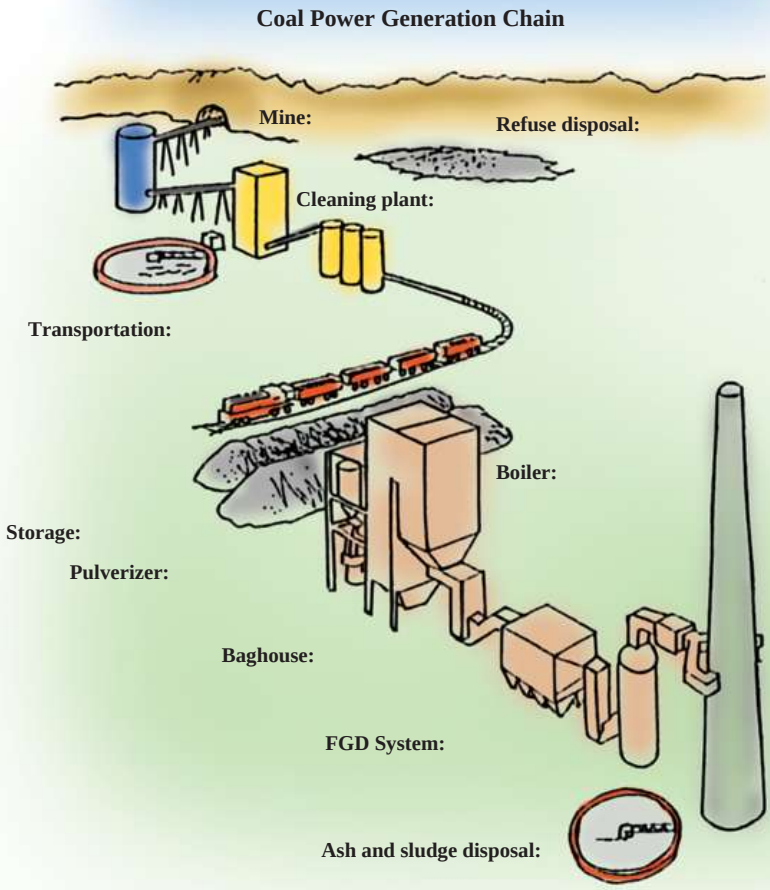
Pakistan today offers a secure, politically stable investment environment which is moving towards deregulation and an open competitive market economy. Prospective investors are invited to come forward and invest in coal mine development and coal power projects in Pakistan. The Government of Pakistan assures them its fullest possible support in implementation of their projects.

LIAQUAT ALI JATOI
Federal Minister for Water & Power

September 2004

PAKISTAN

Coal Power
Generation Potential



PRIVATE POWER & INFRASTRUCTURE BOARD

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ABBREVIATIONS

AEB	Area Electricity Board
AJK	Azad Jammu and Kashmir
BDA	Balochistan Development Authority
Btu/lb	British thermal unit per pound
BOO	Build, Own and Operate
BOOT	Build, Own, Operate and Transfer
CBR	Central Board of Revenue
CCOI	Cabinet Committee on Investment
CFB	Circulating Fluidized Bed
CPP	Capacity Purchase Price
CSA	Coal Supply Agreement
DIMD	Directorate of Industries & Mineral Development
EPA	Environmental Protection Agency
EPP	Energy Purchase Price
FATA	Federal Administrative Tribal Area
FBC	Fluidized Bed Combustion
FC	Financial Closing
FDI	Foreign Direct Investment
FRC	Fuel Research Centre
FSA	Fuel Supply Agreement
GENCOs	Generation Companies
GOP	Government of Pakistan
GSP	Geological Survey of Pakistan
IA	Implementation Agreement
ICB	International Competitive Bidding
IGCC	Integrated Gasification of Combined Cycle
IM	Inspectorate of Mines
IPP	Independent Power Producers
JICA	Japan International Cooperative Agency
KESC	Karachi Electric Supply Company
kWh	Kilo Watt Hour
LCDC	Lakhra Coal Development Company
LOI	Letter of Interest
LOS	Letter of Support
mg/Nm3	Microgram per cubic meter
mg/L	Microgram per liter
ML	Million Liters
MT	Million Tonnes
M/O	Ministry Of
MOU	Memorandum of Understanding
MW	Mega Watt
NA	Northern Area
NECL	Northern Electric Company Limited
NEQS	National Environmental Quality Standards
NEPRA	National Electric Power Regulatory Authority
NOx	Nitrogen Oxides
NTDC	National Transmission and Dispatch Company
NWFP	North West Frontier Province
ODA	British Overseas Development Agency
OPF	Overseas Pakistani's Foundation
PCSIR	Pakistan Council of Scientific and Industrial Research
P & D	Planning and Development
PEPA	Pakistan Environmental Protection Agency
PG	Performance Guarantee
PMDC	Pakistan Mineral Development Corporation
PPA	Power Purchase Agreement
PPC	Private Power Cell
PPIB	Private Power and Infrastructure Board
ppm	Part per million
PUNJMIN	Punjab Mineral Development Corporation
RFP	Request for Proposal
Rs	Pakistan Rupee
SAZDA	Sindh Arid Zone Development Authority
SFBD	Steam Fluidized Bed Drying
SCA	Sindh Coal Authority
SO2	Sulfur Dioxide
SOx	Sulfur Oxides
Sq. Km.	Square Kilometer
TDP	Total Dispersed Particles
USA	United States of America
USAID	United States Agency for International Development
USGS	United States Geological Survey
US$	United States Dollar
WAPDA	Water and Power Development Authority
WPI	Wholesale Price Index
WPIDC	West Pakistan Industrial Development Corporation
WPPO	WAPDA Private Power Organization

INTRODUCTION

Electricity plays a key role in the national growth and economical development of any country. Presently, in Pakistan, only about half the population has access to electricity. However, increasing urbanization and industrialization in the country provide a great opportunity for expansion of the power sector.

Pakistan is a coal-rich country, but, unfortunately, coal has not been developed for power generation for more than three decades due to lack of infrastructure, insufficient financing and absence of modern coal mining technical expertise. The Government has now determined to facilitate private investors to promote investment in coal development and coal power generation. Unavailability of reliable coal is the main obstacle to significant progress in coal power generation. The Federal Government and Provincial Governments, however, are continuously trying to facilitate private investors in developing and promoting indigenous coal for power generation. Coal is a cheap indigenous energy resource and, after the discovery of 175.5 billion tonnes of coal in Thar area of Sindh, Pakistan's coal power potential has increased manifold. It is anticipated that, if properly exploited, Pakistan's coal resources may generate more than 100,000 MW of electricity for the next 30 years.

There are vast resources of coal in all four of Pakistan's provinces and in Azad Jammu & Kashmir. Map 1 shows locations and names of major coalfields and coal occurrences of Pakistan. According to rough estimates, the total coal resources of Pakistan are more than 185 billion tonnes. Coal reserves, together with heating values (as on received basis), of all the four Provinces and Azad Kashmir are given here below.

Province	Resources in Million Tonnes	Heating Value (Btu/lb)
Sindh	184,623	5,219 -13,555
Balochistan	217	9,637 -15,499
Punjab	235	9,472 -15,801
NWFP	91	9,386 -14,217
AJK	9	7,336 -12,338
Total	**185,175**	

Source: Geological Survey of Pakistan / Pakistan Energy Year Book 2003

In view of the unsatisfactory performance of public sector utilities, unavailability of sufficient budget in the public sector, the need to make electricity tariff free from subsidies and to keep it market oriented, the GOP has decided to mobilize the private sector to improve efficiency, reduce the financial burden and keep the power tariff within affordable limits.

The demand/supply projection indicates that power shortages will appear from the year 2006, and will increase to 5, 500 MW in the year 2010 if no measures are taken to bring in new capacity. In order to address these shortages, the GOP announced Power Policy 2002 which provided a set of incentives to attract the much needed investment in power generation. The key points of the new policy are International Competitive Bidding (ICB) and an emphasis on setting up power projects based on indigenous fuel resources such as coal, hydel power and renewable energies. Through the announcement of the Power Policy 2002, the GOP has opened up new avenues for private entrepreneurs to invest in Pakistan's coal sector. The objectives are of two-fold, i.e. development of indigenous coal and utilization for electricity generation at the least cost. In order to develop indigenous coal resources for electricity generation, the GOP has decided to exploit the vast coal deposits of Pakistan aggressively. According to the Power Policy 2002, indigenous coal-based private power proposals will be for integrated coal mining and power plant projects.

In order to fulfill the new policy objectives, PPIB has recently advertised a 450 MW coal-fired project at Lakhra in Sindh. In addition to this, the Government of Sindh has signed MOUs for (i) a 600 MW Thar coal power project by Shenhua Group of China and (ii) a 1200 MW project at Thar by Australian firms using the new technology of 'Underground Coal Gasification'.

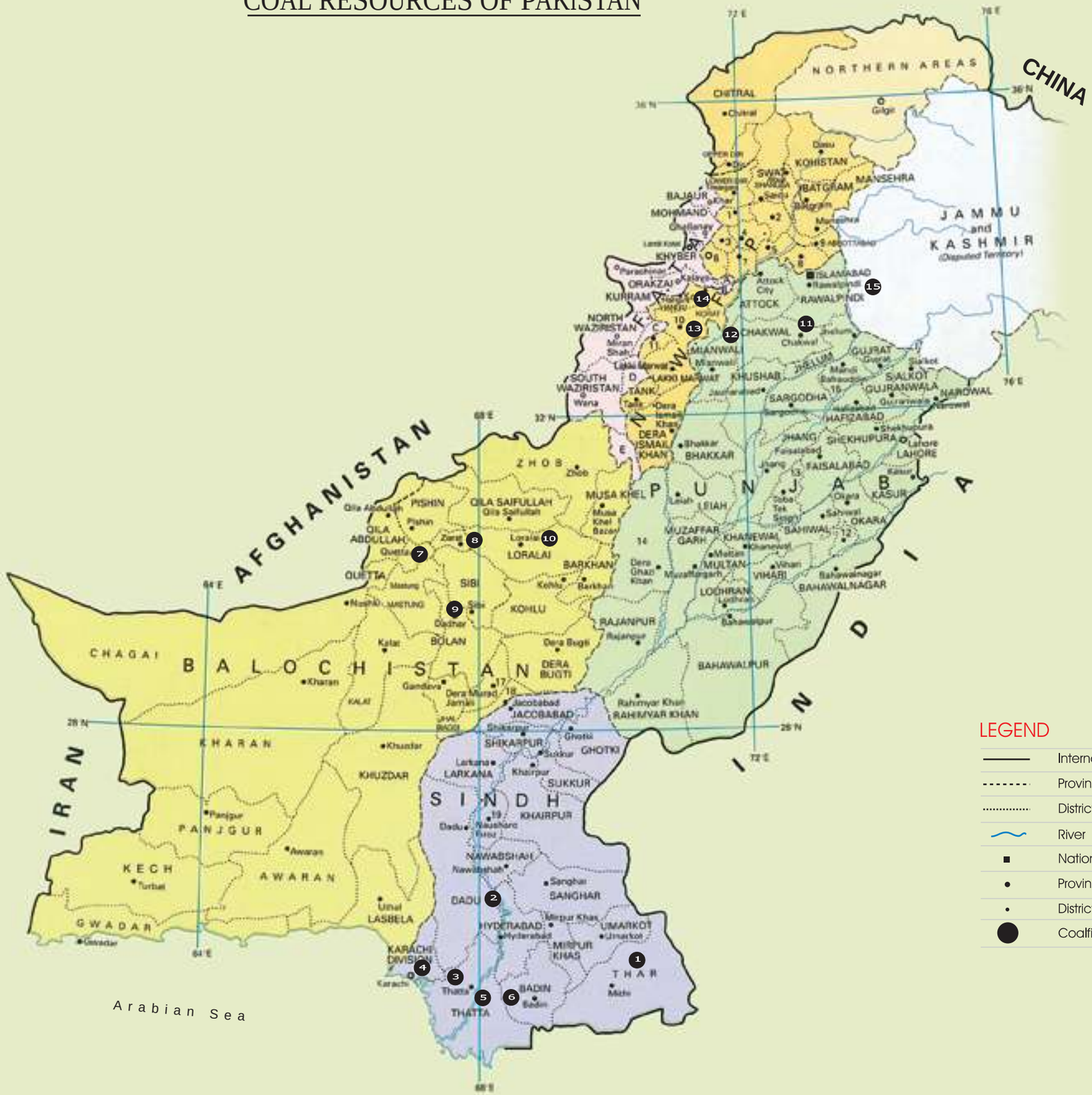
PPIB has been working to attract and facilitate foreign direct investment in Pakistan's power sector. Prospective investors are facilitated and encouraged by PPIB to come up with proposals focusing on maximum utilization of indigenous resources. Pakistan's domestic power market is large, with a population of 140 Million, of which only 40% has access to electricity.

Zafar Ali Khan
Managing Director
Private Power & Infrastructure Board

COAL RESOURCES OF PAKISTAN

Sr#	Location	Coal (Million Tonnes)
	SINDH	
1	Thar	1 75,506
2	Lakhra	1,328
3	Sondra-Jherruck	5,523
4	Meting-Jhimpir	473
5	Indus East	1,777
6	Badin	16
		Total: 184,623
	BALOCHISTAN	
7	Sor-Range/Degari	50
8	Khost/sharigh/Hanai/ziarat	88
9	Mach	23
10	Duki	56
		Total: 217
	PUNJAB	
11	Salt-Range	213
12	Makarwal	22
		Total: 235
	NWFP	
13	Cherat	9
14	Hungu	82
		Total: 91
	AJK	
15	Kotli	9

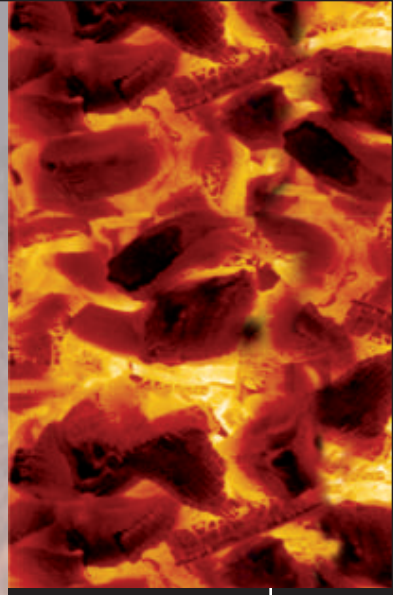
Grand Total: 185,175



LEGEND

- International boundary
- Provincial boundary
- District boundary
- River
- National Capital
- Provincial Headquarter
- District Headquarter
- Coalfield

Map-1: Map showing location of coalfields of Pakistan



Coal Resources Of Pakistan

Chapter 1

1.1 Coal Resources

The presence of coal deposits in Pakistan was known before independence, but its economic value was highlighted in 1980 when large reserves of coal were discovered in the Lakhra and Sonda areas of Sindh Province. The discovery of another huge coal deposit of 175.5 billion tonnes in an area of 10,000 sq. km in Tharparkar District of Sindh has provided a quantum increase in the coal resources of Pakistan. After this discovery, Pakistan is now the 6th richest nation of the world in respect of coal resources. Pakistan did not appear even on the list of coal-rich countries before the discovery of Thar Coal. Coal resources available to Pakistan exist in all four provinces and in AJK. The total coal reserves are estimated at 185.5 billion tonnes, details whereof are in Table 1.

Table 1: PAKISTAN COAL RESOURCES (As on June 2003)

PROVINCE	COAL RESOURCES	HEATING VALUE
Coal Field	**Million Tonnes**	**Btu/lb**
SINDH		
Thar	175,506	6,244 – 11,045
Lakhra	1,328	5,503 – 9,158
Sonda-Jherruck	5,523	5,219 – 13,555
Meting- Jhimpir	473	5,219 – 8,612
Indus East	1,777	7,782 – 8,660
Badin	16	11,415 – 11,521
Sub-Total:-	**184,623**	
BALOCHISTAN		
Sor-Range/Degari	50	11,245 – 13,900
Khost-Sharigh-Harnai-Ziarat	88	9,637 – 15,499
Mach	23	11,110 – 12,937
Duki	56	10,131 – 14,357
Sub-Total:-	**217**	

PUNJAB

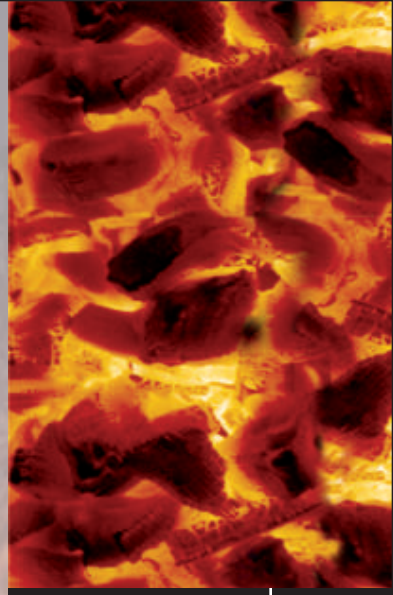
Salt-Range	213	9,472 – 15,801
Makarwal	22	10,688 – 14,029
Sub-Total:-	**235**	

NWFP

Hangu	82	10,500 – 14,149
Cherat	9	9,386 – 14,217
Sub-Total:	**91**	

AZAD KASHMIR

Kotli	9	7,336 – 12,338
Grand Total:-	**185,175**	



Sindh Coal Resources

Chapter 2

The Province of Sindh is located in the south of Pakistan. Coal was discovered in Sindh in 1853 when Baloch nomads reportedly struck a coal seam 2.43 meters thick at a depth of 125 meters by sinking a well for water at Lakhra, a village on the western bank of the River Indus in district Dadu. Burmah Oil Company in 1948, and Pak Hunt International in 1953, recorded the presence of coal at Lakhra in holes drilled in search of oil. The Habibullah Mines Ltd. started commercial mining of coal in Lakhra in 1959. Sonda coal was discovered in 1980 and Thar coal in 1992 by GSP.

The total coal resources of Sindh have been estimated to 184.6 billion tonnes whereas the coal deposits of Thar alone are estimated at 175.5 billion tonnes, which can ideally be utilized for power generation. In addition to Thar, the other coalfields of Sindh are at Lakhra, Sonda, Jherruck and Indus East (Map 2). The Lakhra coalfield is fully developed, and contains mineable coal reserves of 146 million tonnes. Sindh coal is classified as 'Lignite' with calorific value ranging from 5,219 to 13,555 Btu/lb. Thar coal has low sulfur and low ash content but high moisture, whereas Lakhra coal contains high sulfur. The feasibility study conducted by John T. Boyd & Co. of USA has confirmed mineability and suitability of Lakhra coal for power generation. The feasibility study of Thar coal is yet to be completed to confirm its mineability and suitability for large scale power generation. The Sonda coalfield, including Indus East, is the second largest coalfield of Sindh. The feasibility study of Sonda coal for power generation is yet to be initiated.

2.1 Thar Coal

The Thar coalfield is located in the south-eastern part of Sindh. The first indication of the presence of coal beneath the sands of the Thar Desert was reported while drilling water wells by the British Overseas Development Agency (ODA) in coordination with the Sindh Arid Zone Development Authority (SAZDA), in 1991. The Thar coalfield, with a resource potential of 175.5 million tonnes of coal, covers an area of 9000 sq. km. in the Tharparkar Desert. The mineable coal reserves are estimated to be 1,620 million tonnes. The coal-bearing area is covered by stable sand dunes. In order to establish the coal resources in the selected four blocks (Map 3), a total of 167 holes were drilled at one kilometer spacing. Coal resources of the four blocks are estimated at 9,629 million tonnes, as shown below.

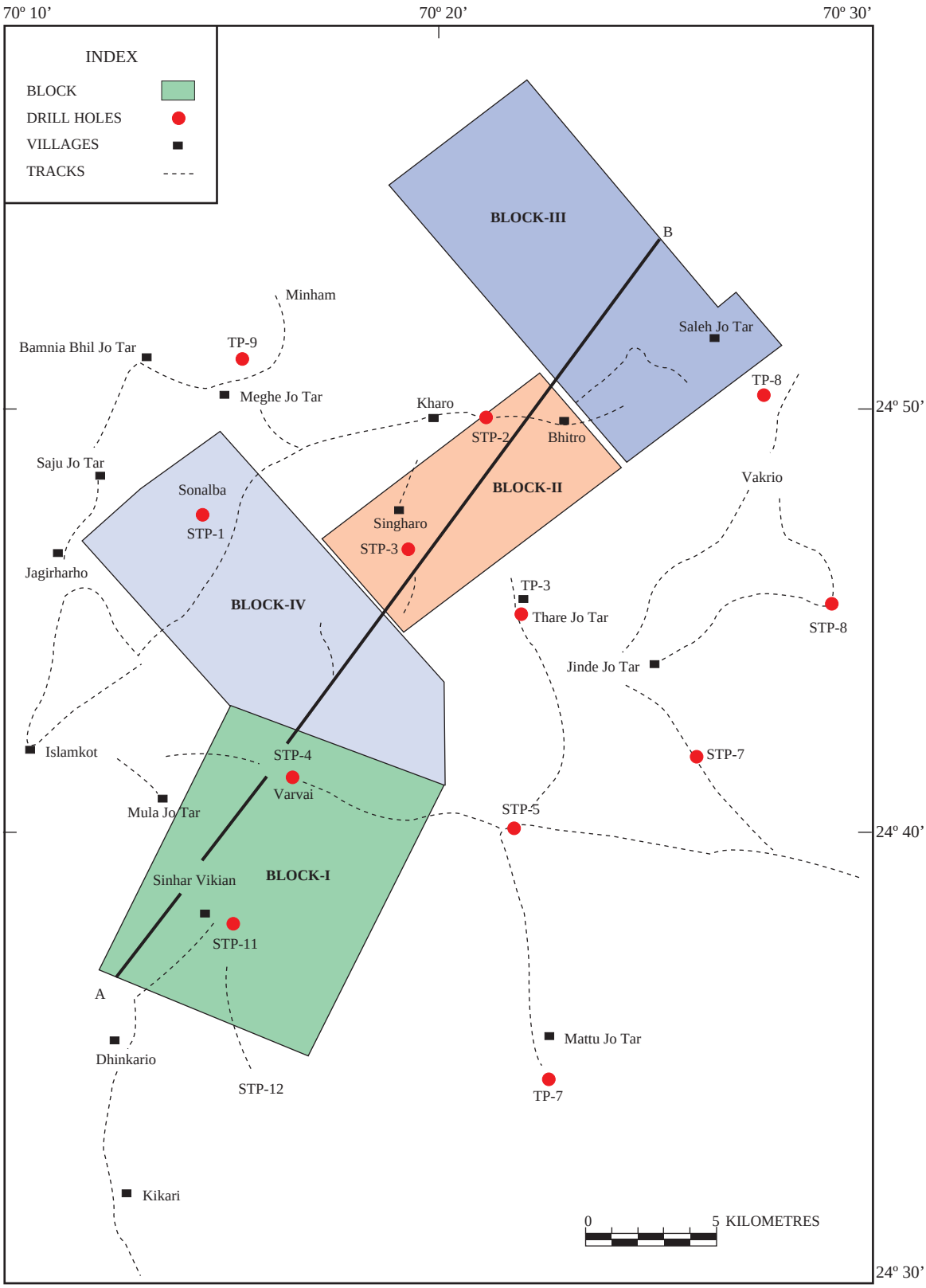
IDENTIFIED COAL POTENTIAL IN SINDH

S.No.	Location	Coal (Million Tonnes)
1	Thar	175,506
2	Lakhra	1,328
3	Sonda-Jherruch	5,523
4	Meting-Jhimpir	473
5	Indus East	1,777
6	Badin	16
	Total	184,623

LEGEND

- City/Town
- River
- Road
- District Boundary
- Coalfields

Map-2: Map showing location of coalfields of Sindh



Source: Survey of Pakistan

Map-3: Map Showing Blocks of Thar Coalfield

Coal Reserves in Million tonnes in the Four Blocks of Thar Coalfield

Blocks	Measured	Indicated	Inferred	Total
Block I	620	1,918	1,028	3,566
Block II	640	944	-	1,584
Block III	413	1,337	258	2,008
Block IV	684	1,711	76	2,471
Total:	2357	5,910	1,362	9,629

The number of coal seams varies from hole to hole, and a maximum of 20 seams have been logged in some of the drill holes. The thickness of coal seams varies from 0.2 to 22.8 meters, whereas the cumulative coal thickness in one of the drill holes is 36 meters. Clay-stone and loose sand beds form the roof as well as the floor rock of coal seams. The thickness of overburden varies from 112 to 203 meters. Thar coal reserves and chemical analysis of the coal samples are at Table 2.

Table 2: THAR COAL QUALITY & RESERVES

Moisture (%)	29.60 – 55.50
Ash content (%)	02.90 – 11.50
Volatile Matter (%)	23.10 – 36.60
Fixed Carbon (%)	14.20 – 34.00
Sulfur (%)	00.40 – 02.90
Heating Value (Btu/lb)	
As received	6,244 – 11,045
Dry Basis	10,723 - 11,353

The quality of coal is Lignite-B to Lignite-A

Coal Reserves (Million Tonnes)	
Measured	2,700
Indicated	9,395
Inferred	50,706
Hypothetical	112,705
Total	175,506

2.2 Lakhra Coal

After the first discovery of coal in 1853, as aforesaid, many geological investigations have been conducted in the Lakhra area by national and international organizations. Interests in large-scale exploration of coal for power generation began to develop in the early 1960s when GSP and USGS performed a systematic geological investigation of the area. WPIDC's tests found Lakhra coal unsuited for hard coke production, but suitable for power generation. In 1996, WPIDC engaged a Polish firm to undertake a mining and power generation feasibility study on Lakhra coal. In 1978, JICA carried out additional technical, financial and economical feasibility studies. In 1981, JICA reported positive results and concluded that a 300 MW plant was technically feasible, but estimated the coal production cost to be very high. Then GOP asked USAID to review all studies on Lakhra and make recommendations on the technical and economical feasibility of a coal-fired power station. USAID completed its Lakhra feasibility study by 1986 and confirmed JICA's appraisal, but proposed changes in design of the plant lowering the estimated cost. The USAID feasibility study concluded that a Lakhra coal mine, supplying coal for a 2 x 250 MW units power plant, was technically sound and socially and environmentally feasible.

The Lakhra coalfield is connected by road through the Indus Highway and a rail track is also available near Khanot, which is also located on the Indus Highway. The Lakhra coalfield is at a distance of 50 km. from Hyderabad and 175 km. from Karachi. Significant coal beds are Dhanwari, Lailian and Kath. The Lailian seam, persistent through out the area, is 3 meters thick. However, the overall average thickness of the Lakhra coal seam is 1.5 meter. The over burden of the first mineable coal seam ranges from 50 to 150 meters.

The Lakhra coal field is doubly plunging anticline, known as the Lakhra Anticline. Its axis runs in a north-easterly

direction. The folding is gentle and the strata dips at 7 degrees. A group of faults parallel to the anticline axis and dipping 70 to 80 degrees, with a small down-throw, exist in the coalfield area. The total coal resources of Lakhra are estimated at 1,328 million tonnes, of which 146 million tonnes is considered mineable. The coal reserves and chemical analysis of coal samples (dry basis) are at Table 3.

Table 3: LAKHRA COAL QUALITY & RESERVES

Moisture (%)	09.70 – 38.10
Ash (%)	04.30 – 49.00
Volatile Matter (%)	18.30 – 38.60
Fixed Carbon (%)	09.80 – 38.20
Sulfur (%)	01.20 – 14.80
Calorific Value (Btu/lb)	5,503 – 9,158

The quality of the coal is Lignite-A

Coal Reserves (Million Tonnes)	
Measured	244
Indicated	629
Inferred	455
Total	1,328

2.3 Sonda-Jherruk Coal (including Indus East and Meting-Jhimpir)

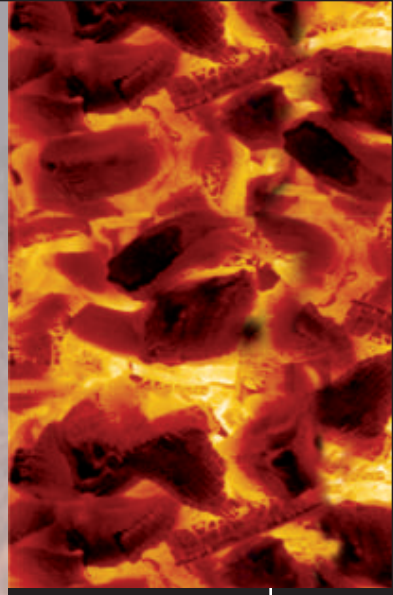
The Sond-Jherruk Coalfield includes Indus East, and was discovered by GSP/USGS in 1981. During 1989 to 1986, GSP drilled 80 holes in the area, which covers an area of 1500 sq. km. The drilling data indicates that the coal bed is about 6.2 meters thick and the over burden is about 120 meters at the first mineable seam. The total coal reserves are estimated to be 7,773 million tonnes, of which 147 million tonnes is considered as mineable. The feasibility study of Sonda coal is yet to be initiated. The coal reserves and chemical analysis of coal samples are at Table 4.

Table 4: SONDA-JHERRUCK COAL QUALITY & RESERVES

Moisture (%)	09.00 – 48.00
Ash (%)	02.70 – 52.00
Volatile Matter (%)	16.10 – 44.20
Fixed Carbon (%)	08.90 – 58.80
Sulfur (%)	00.20 – 15.00
Calorific Value (Btu/lb)	5,219 – 13,555

The quality of the coal is Lignite-A

Coal Reserves (Million Tonnes)	
Measured	245
Indicated	1,611
Inferred	5,917
Total	7,773



Balochistan Coal Resources

Chapter 3

There are number of coalfields in Balochistan. However, the major coalfields are Sor-Range/Degari, Khost/Sharigh/Harnai/Ziarat, Mach and Duki (Map 4). The total coal reserves are about 217 million tonnes, of which 32 million tonnes are considered mineable. The thickness of coal seams ranges from 0.3 to 2.3 meters. Balochistan coal is classified as sub-bituminous to bituminous and the heating value ranges from 9,637 to 15,499 Btu/lb. It has low ash and high sulfur coal, and is considered suitable for power generation. Small power plants up to 25 MW can be set up in each coalfield.

3.1 Sor-Range and Degari Coal

The Sor-Range and Degari coalfields are located about 12 km south of Quetta city, and extend south-east for a distance of 26 km, covering an area of about 50 sq. km. The northern half of the field is known as Sor-Range, and the southern as Degari. Quetta is the nearest railhead for the Sor-Range mines and Spezand for the Degari mines. This is one of the largest coal-producing fields of Balochistan. The coalfield is approachable by a metalled road which encircles the entire coalfield joining the Quetta-Sibi highway near Spezand. The coal-bearing area is a doubly plunging symmetrical syncline. The coal seams generally dip at angles of 45 to 50 degrees. The coalfield lies in an arid to semi-arid region with extreme temperature changes. It experiences heavy snowfall and rain during winter, but little rain during summer. The thickness of the coal-bed ranges from 0.3 m to 1.3 m. The total coal reserves are estimated at 50 million tonnes. The coal is sub-bituminous in quality and is considered suitable for power generation. Small power plants up to 25 MW can be setup in each Sor-Range and Degari coalfield. The coal reserves and coal quality analysis is at Table 5

IDENTIFIED COAL POTENTIAL IN BALOCHISTAN

S.No.	Location	Coal (Million Tonnes)
1	Sor-range/Degari	50
2	Khost/Sharigh/Harnai/Ziarat	88
3	Mach	23
4	Duki	56
	Total	217

LEGEND

City/Town	●
River	≈
Road	∿
District Boundary	—
Coalfields	●

Map-4: Map showing location of coalfields of Balochistan

Table 5: Sor-Range and Degari Coal Quality and Reserves

Moisture (%)	03.90 – 18.90
Ash (%)	04.90 – 17.20
Volatile Matter (%)	20.70 – 37.50
Fixed Carbon (%)	41.00 – 50.80
Sulfur (%)	00.60 – 05.50
Calorific value (Btu/lb)	11,245 – 13,900

The quality of the coal is Sub-bituminous

Coal Reserves (Million Tonnes)	
Measured	15
Indicated	16
Inferred	19
Total	50

3.2 Khost, Sharigh and Harnai Coal

Khost, Sharigh and Harnai coalfields cover an area of 200 sq. km in the Sibi the District of Balochistan. It is located at a distance of 160 km to the East and North-East of Quetta. The Sibi-Khost extension of Pakistan Railway runs along the coalfields. The coalfields are also connected by an unmetalled road. The coal is of Bituminous to Sub-bituminous quality. Coal beds are generally thin, ranging from 0.3 meter to 2.3 meters in thickness and dipping at 60 degrees. The coal is considered suitable for power generation. Small power plants up to 50 MW can be set up, based on coal produced from these three small coalfields. The coal reserves and coal quality analysis is at Table 6.

Table 6: Khost, Sharigh, and Harnai Coal Quality and Reserves

Moisture (%)	01.70 – 11.20
Ash (%)	09.30 – 34.00
Volatile Matter (%)	09.30 – 45.30
Fixed Carbon (%)	25.50 – 43.80
Sulfur (%)	03.50 – 09.55
Calorific value (Btu/lb)	9,637 – 15,499

The quality of the coal is Sub-bituminous

Coal Reserves (Million Tonnes)	
Measured	13
Indicated	00
Inferred	63
Total	76

3.3 Mach Coal

The Mach coalfield covers an area of 45 sq. around Mach town in the Bolan Pass, on both sides of the railway line that connects Quetta with Karachi. Several coal seams are present, ranging in thickness from 0.3 m to 1.5 m, but only three beds with an average thickness of 0.75 m are commercially workable. The quality of coal is Sub-bituminous. The coal is subject to spontaneous combustion, and is suitable for power generation. The coal reserves are estimated to be 23 million tonnes. Small power plants up to 25 MW can be set up, based on this coal. The coal reserves and coal quality analysis is at Table 7.

Table 7: Mach Coal Quality and Reserves

Moisture (%)	07.10 – 12.00
Ash (%)	09.60 – 20.30
Volatile Matter (%)	34.20 – 43.00
Fixed Carbon (%)	32.40 – 41.50
Sulfur (%)	03.20 – 07.40
Calorific value (Btu/lb)	11,110 – 12,937

The quality of the coal is Sub-bituminous

Coal Reserves (Million Tonnes)	
Measured	09
Indicated	14
Inferred	00
Total	23

3.4 Duki Coal

The Duki coalfield is located in the Loralai District of Balochistan, about 320 km east of Quetta, and is connected by a metalled road. It covers an area of 300 sq. km and is characterized by a moderately dipping syncline. The

workable seam has a thickness of 0.5 m and is high volatile bituminous coal. The total reserves of Duki coalfield are estimated at about 13 million tonnes. The coal reserves and quality analysis is at Table 8.

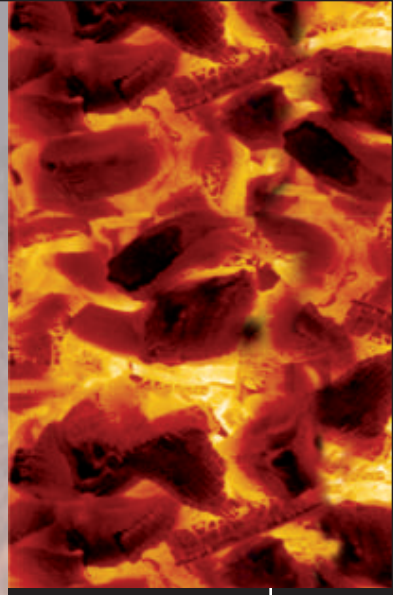
Table 8: Duki Coal Quality and Reserves

Moisture (%)	03.50 – 11.50
Ash (%)	05.00 – 38.00
Volatile Matter (%)	32.00 – 50.00
Fixed Carbon (%)	28.00 – 42.00
Sulfur (%)	04.00 – 06.00
Calorific value (Btu/lb)	10,131 – 14,164

The quality of the coal is Sub-bituminous

Coal Reserves (Million Tonnes)	
Measured	14
Indicated	11
Inferred	25
Total	50

Coal Quality



Punjab Coal Resources

Chapter 4

The main coalfields of Punjab are in the Salt-Range and at Makarwal (Map 5). The total coal resources are estimated at 235 million tonnes, of which 33 million tonnes are mineable. Punjab coal is classified as Sub-bituminous, and the heating value ranges from 9,472 to 15,801 Btu/lb. It has low ash and high sulfur, and is considered suitable for power generation.

4.1 Salt-Range Coal

The Salt-Range coalfield covers an area of about 260 sq. km between Khushab, Dandot and Khewra in the Sargodha and Jhelum Districts of Punjab. The total reserves of the Salt-Range coal are approximately 213 million tonnes, of which 30 million tonnes are mineable. There are more than two coal seams present in the Salt-Range but, in most cases, only one is mineable which varies in thickness from 0.3 m to 1.5 m with an average thickness of 0.75 m. Small power plants of up to 80 MW can be set up, based on Salt-Range coal. The coal quality is Sub-bituminous and is suitable for power generation. The coal reserves and analysis of coal samples is at Table 9.

Table 9: SALT-RANGE COAL QUALITY & RESERVES

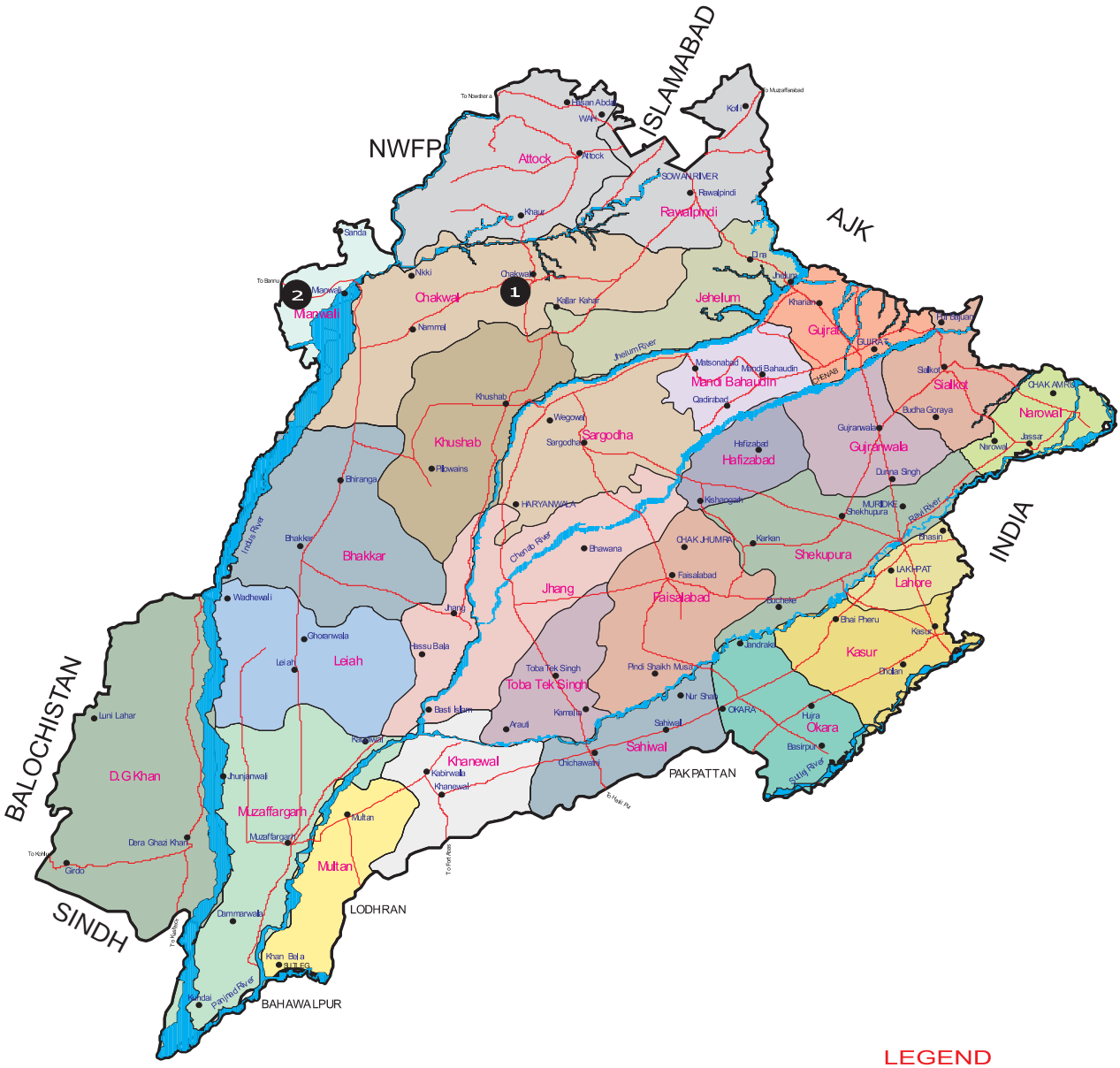
Coal Quality	
Moisture (%)	03.20 – 10.80
Ash (%)	12.30 – 44.20
Volatile Matter (%)	21.50 – 38.80
Fixed carbon (%)	25.70 – 44.80
Sulfur (%)	02.60 – 10.70
Calorific Value (Btu/lb)	9,472 – 15,801

The quality of the coal is Sub-bituminous

	Coal Reserves (Million Tonnes)
Measured	50
Indicated	16
Inferred	147
Total	213

IDENTIFIED COAL POTENTIAL IN PUNJAB

S.No.	Location	Coal (Million Tonnes)
1	Salt-Range	213
2	Makarwal	22
	Total	235



Map-5: Map showing location of coalfields of Punjab

4.2 Makarwal Coal

The Makarwal coalfield is located in the Mianwali District of Punjab. It covers an area of about 75 km, situated near Makarwal town and 13 km west of Kalabagh. The Makarwal coalfield is connected with the Mari Indus-Bannu narrow gauge railway line. The coal occurs in the steeply dipping Hangu Formation and the thickness of its bed ranges from 0.5 to 2.0 m. The coal resources have been reported to about 22 million tonnes and its quality is reported to be Sub-bituminous. The coal reserves and analysis of coal samples is at Table 10.

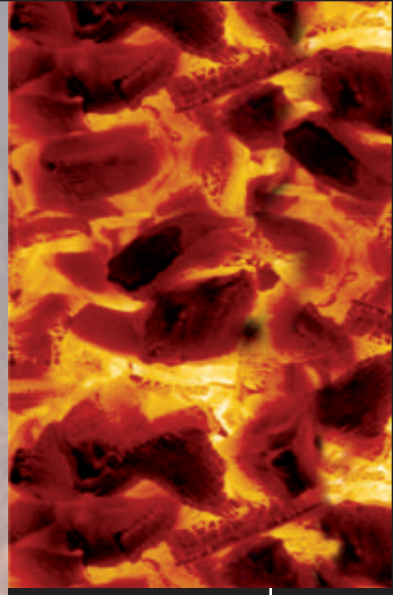
Table 10: MAKARWAL COAL QUALITY & RESERVES

Coal Reserves (Million Tonnes)	
Measured	5
Indicated	8
Inferred	9
Total	22

Coal Quality

Moisture (%)	02.80 – 06.00
Ash (%)	06.40 – 30.80
Volatile Matter (%)	31.50 – 48.10
Fixed carbon (%)	34.90 – 44.90
Sulfur (%)	02.80 – 06.30
Calorific Value (Btu/lb)	10, 688 – 14,029

The quality of the coal is Sub-bituminous



NWFP Coal Resources

Chapter 5

The coalfields of NWFP are not yet fully explored. Its coal deposits are located in two areas, namely Hangu and Cherat (Map 6). The coal resources of Hangu and Cherat are estimated to be 91 million tonnes. The coal is classified as Sub-bituminous and its heating value ranges from 9,386 to 14,217 Btu/lb. It has low sulfur and low ash. The coal beds in Hangu area are up to 3.5 m thick whereas the coal beds in Cherat area are generally less than one meter in thickness. The coal reserves and analysis of coal samples is at Table 11.

Table 11: NWFP COAL QUALITY & RESERVES

Coal Quality	
Moisture (%)	00.10 – 07.10
Ash (%)	05.30 – 43.30
Volatile Matter (%)	14.00 – 33.40
Fixed Carbon (%)	21.80 – 76.90
Sulfur (%)	01.10 – 09.50
Calorific Value (Btu/lb)	9,386 – 14,217

The quality of the coal is Sub-bituminous

	Coal Reserves (Million Tonnes)
Measured	2
Indicated	5
Inferred	84
Total	91

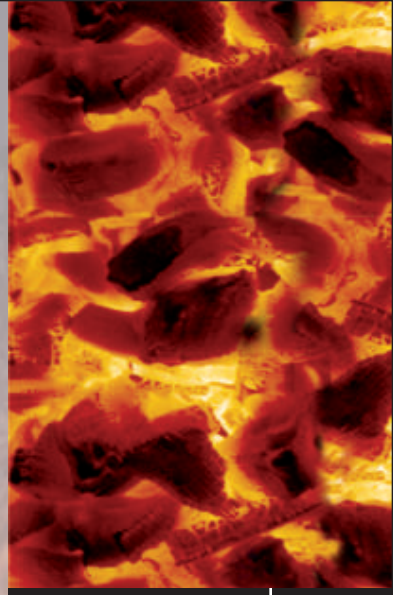
IDENTIFIED COAL POTENTIAL IN NWFP

S.No.	Location	Coal (Million Tonnes)
1	Cherat	9
2	Hungu	82
	Total	91

LEGEND

- City/Town
- River
- Road
- District Boundary
- Coalfields

Map-6: Map showing location of coalfields of NWFP



Azad Jammu & Kashmir Coal Resources

Chapter 6

The AJK coalfield is located near Kotli about 80 km south-east of Islamabad (Map 7). One or two coal beds occur in the steeply dipping Patala Formation. The coal beds have an average thickness of 0.6 m. The total coal resources of AJK are estimated at 0.06 million tonnes. The coal is classified as Sub-bituminous and the heating value ranges from 7,336 to 12,338 Btu/lb. The coal reserves and analysis of coal samples is at Table 12.

Table 12: Azad Jammu & Kashmir Coal Quality and Reserves

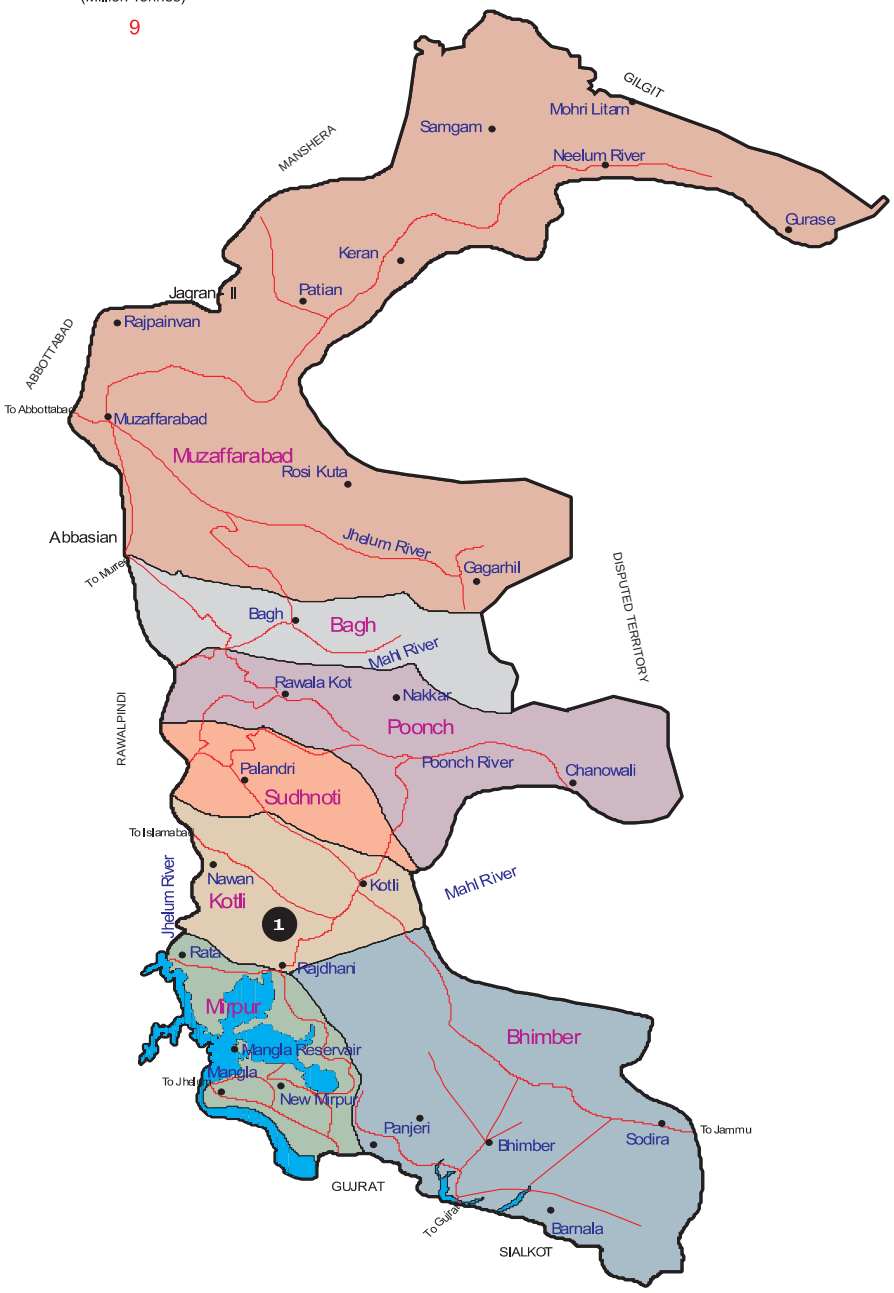
Coal Quality	
Moisture (%)	00.20 – 06.00
Ash (%)	03.30 – 50.00
Volatile Matter (%)	05.10 – 32.00
Fixed Carbon (%)	26.30 – 69.50
Sulfur (%)	00.30 – 04.80
Calorific Value (Btu/lb)	7,336 – 12,338

The quality of the coal is Sub-bituminous

	Coal Reserves (Million Tonnes)
Measured	1
Indicated	1
Inferred	7
Total	9

IDENTIFIED COAL POTENTIAL IN AJK

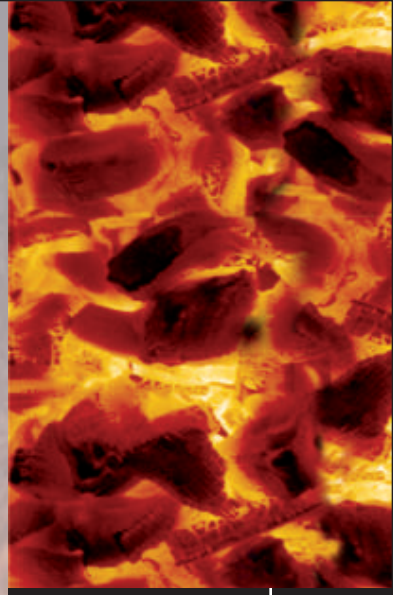
S.No.	Location	Coal (Million Tonnes)
1	Kotli	9



LEGEND

- City/Town
- River
- Road
- District Boundary
- Coalfields

Map-7: Map showing location of coalfields of AJK



Utilization Of Pakistan's Lignite Coal

Chapter 7

7.1 Power Generation

While considering the development of power stations based on lignite coal, it is important to take into consideration the following factors:

a) The power station must be located at the mine site, because the low energy and high moisture content of lignite coal do not justify the transportation cost.

b) Transmission and power line losses require the load centre to be in reasonable proximity to the power station (200 km) and, consequently, relatively close to the mine.

c) Lignite coal has certain characteristics which require special consideration when selecting the type of equipment for mining and power generation, e.g. high moisture content will reduce the efficiency of power generation and add to the cost of capital for the equipment required to burn the coal. On the other hand, boiler efficiency and the coal feed rate increases as the moisture content of the coal increases. Similarly, the ash content of lignite may contain mineral matter bound with the organic material, and these elements, especially sodium, can cause severe slugging and fouling problems in conventional boiler.

Despite these problems, lignite coal is used extensively for power generation throughout the world. In many areas, there is abundance of lignite reserves, as in Pakistan. Pakistan's enormous deposits of lignite need to be developed, because it is relatively cheap to mine and suitable for power generation. Open-cut mines using Bucket Wheel Excavators are able to recover lignite from the thick coal beds located in the Thar coalfield. This type of mining is very common in Germany, Greece, Spain, Australia and India.

The Thar lignite of Sindh has 50% moisture. SFBD technology, now commercially developed, however, removes moisture from coal by direct evaporation in a steam heated exchanger, and produces dry coal with very little moisture. Another technology for power generation from lignite coal is Circulating Fluidized Bed (CFB) which is also very effective. In CFB technology, coal mixed with limestone is burned in a fluidized bed. The sulfur in the coal is absorbed by the calcium carbonate, and the emission is free from sulfur dioxide. Pakistan has large very deposits of limestone

in all its provinces. The Integrated Gasification and Combined Cycle (IGCC), which increases the efficiency and reduces the emission level of the power generation plant, is a recent advanced technology applicable to high moisture lignite coal for power generation.

7.2 Use of Coal as an Industrial Fuel

The importance of coal as an industrial fuel and its role in a wide range of industrial applications are well known in the industry. It is a cheaper fuel than others. In some industrial applications, such as brick kilns and glass tanks, the high emission of the coal flame is a distinct advantage. In brick kilns, for example, it has been found that one tonne of coal will do the same work as one tonne of oil. Coal is used as boiler fuel for the supply of steam to process plant in the paper, chemical, and food processing industries. It is used for direct firing in the manufacture of cement, bricks, pipes, glass tanks, and metal smelting.

7.3 Brick Kilns

Presently, coal is commonly used for making bricks and roofing tiles, as it is an ideal fuel for kilns, especially for heavy clay products. In Pakistan, about 50% of coal production is used in the brick kiln industry. Therefore, a large market for indigenous coal is available in Pakistan for interested private investors.

7.4 Cement

In many countries, coal is used as fuel in the cement industry. Previously, coal was not used as fuel in cement plants in Pakistan, but now the cement industry has started using indigenous coal. The GOP is now conducting a feasibility study to convert gas-based and oil-based cement plants to run on indigenous coal. It is expected that, in future more and more cement plants will use indigenous coal as fuel. This constitutes another market for indigenous coal for private investors.

7.5 Coal Briquettes

Yet another industrial use of coal is in the form of smokeless coal briquettes which can be used as domestic fuel, and would have special applicability in reducing deforestation in the Northern Areas of Pakistan. Pakistan's Fuel Research Center has developed smokeless coal briquette of good quality in its pilot plant at Karachi.

7.6 Coal Gasification

Electricity generation is severely affected by rapidly escalating gas and oil prices in Pakistan. IGCC power plants have the potential of being economically competitive by using gas produced from indigenous coal. Furthermore, catalytic coal gasification is developed as a more efficient and less costly process to produce gas from coal. Methanol or synthetic gas can be produced from Thar coal at the coalfield and can easily be transported by pipeline throughout the demand centers.

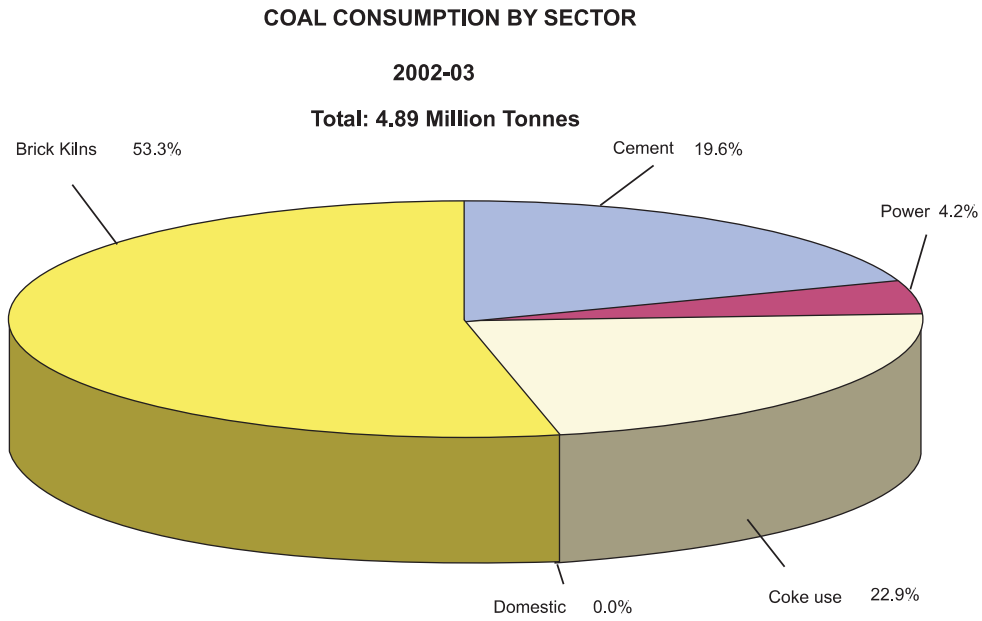
7.7 Underground Coal Gasification

A technology is also available for *insitu* conversion of coal into gas, which can be used for power generation or for conversion into higher value products such as diesel fuel, methanol, and ammonia. Underground coal gasification can be applied to both horizontal and inclined coal beds. Coal not recoverable by conventional mining methods, can be accessed for *insitu* coal gasification. Private investors can use this new technology where coal beds are thin and steeply dipping, and not economical for mining by conventional mining methods.

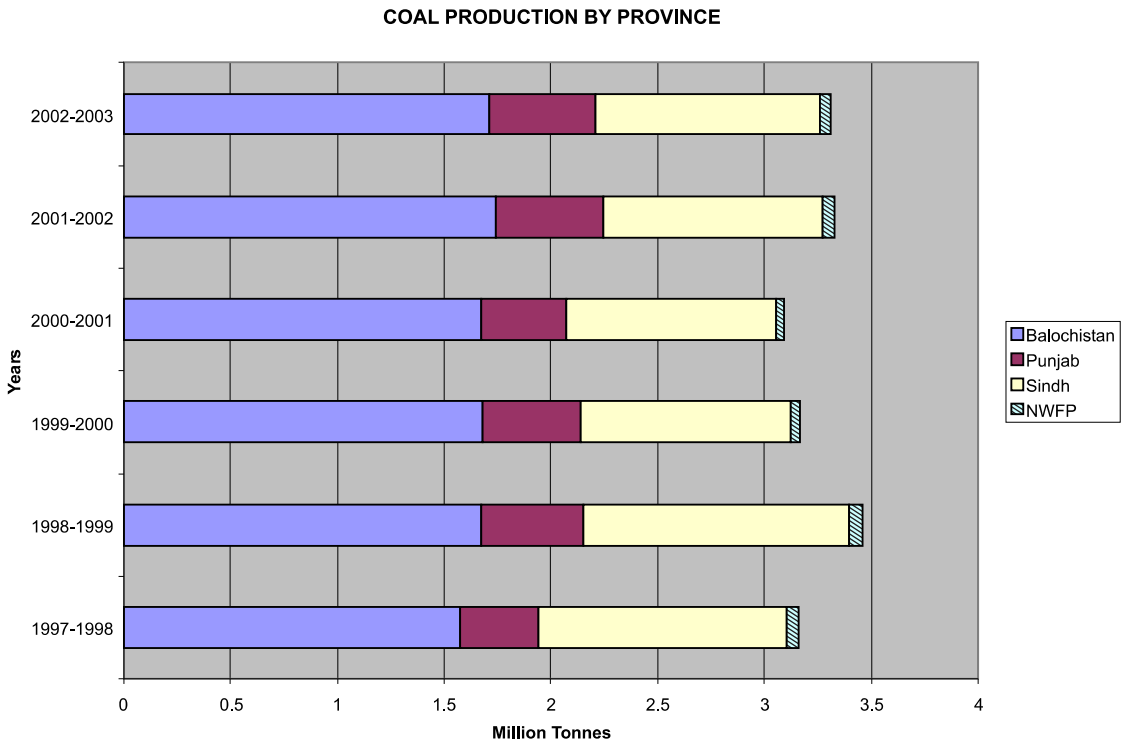
7.8 Coal Consumption in Pakistan (2002 – 03)

Sector	Consumption (Million Tonnes)
Brick Kiln Industry	2.61
Domestic & Coke-making	1.12
Cement	0.96
Power Generation	0.20
Total	4.89

7.9 Coal Consumption by Sector

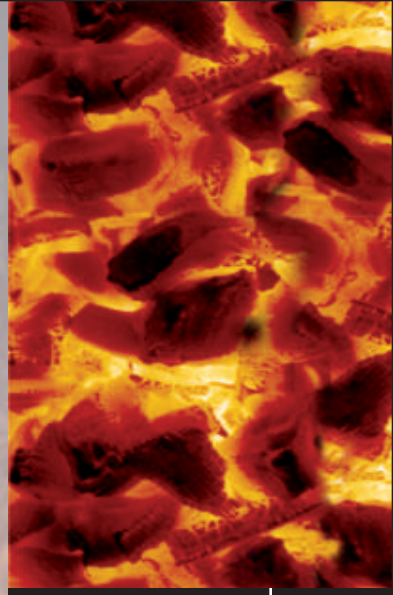


7.10 Coal Production by Province



7.11 Coal Pricing (2002 – 03)

Fuel	Selling Price (At Pit Head)	Price/Million Btu
Sindh Coal	Rs 600 / Tonne	Rs 32.02
Balochistan Coal	Rs 1800 / Tonne	Rs 96.05
Punjab Coal	Rs 1500 / Tonne	Rs 80.04
NWFP Coal	Rs 1400 / Tonne	Rs 74.7i
AJK Coal	Rs 1200 / Tonne	Rs 64.03
Furnace Oil (At Refinery)	Rs 11,835 / Tonne	Rs 290.13
Natural Gas (At Well Head)	Rs 185 / Million cu. fit.	Rs 188.78



Availability Of Infrastructure

Chapter 8

8.1 Coal Mining

Coalfields are generally located in remote and mountainous areas where the basic amenities of life such as roads, railways, telephone lines and cooling water required for mining and setting up coal power plants are either minimal or absent. Similarly, in Pakistan, the vast majority of coalfields are located in undeveloped areas where no significant infrastructure is available. Massive investments for development, of infrastructure, therefore, are needed for mine and power plant development, especially in Thar, which is a semi-desert area. Basic necessities of life, such as drinking water, roads and electricity, are not available in Thar. Infrastructure amenities such as supply of electricity, workers housing, roads for movement of men, materials and heavy equipment, reliable telecommunication, potable water supplies and quick transport system including small airport etc., are necessary for any mining activities. In case of setting up new power stations, the construction of a transmission line to connect such power stations to the National Grid will also be needed. Such infrastructure costs will have to be expended to a large extent before any generation of electricity can occur.

Considering the magnitude of the Thar coal resource and its potential as a long-term source of fuel, together with the considerable industrial benefits, the infrastructure requirement should be evaluated in the long-term perspective and not in the immediate context of the first mining operation and associated power plant. Thar has potential for major development comprising multiple mining/power facilities extending over several decades. Infrastructure requirements for Thar include road access, supply of water, electricity, and telecommunication, an airstrip for light aircraft, transportation alternatives for handling and delivery of lignite to mine-mouth power plants, and a transmission line to the Main Grid. Adequate infrastructure is similarly unavailable in other coalfields of Pakistan, for mining coal and setting up power plants.

The absence of sufficient manufacturing capabilities of mining and power plant equipment and machinery is one of the main impediments to the rapid development of coal mining in Pakistan, and requires to be addressed through massive private investment. The infrastructure requirement in major coalfields of Pakistan is briefly described herebelow.

8.2 Sindh Coal Fields (Thar, Lakhra and Sonda)

- All-weather access roads/highways to coalfields and mines
- Water supply line both for drinking and mine use
- Cooling water for power plant use
- Power supply lines
- Means of coal transportation: heavy trucks, conveyors, and railway
- Coal loading and un-loading facilities
- Coal stock yard and reclaiming equipment
- Coal dust suppression equipment
- Telecommunication facilities
- Mining and power plant machinery, equipment and materials
- Coal washing plant
- Environmental monitoring station
- Housing, health care and educational facilities
- Airstrip for light aircraft
- Transmission lines to connect to the main grid

8.3 Balochistan Coal Fields (Sor-Range, Degari and Sharigh)

- All-weather access roads to mines
- Water and power supply lines to mines
- Means of coal transportation: trucks, conveyors and aerial ropeway
- Coal stock yards
- Coal loading and un-loading facilities
- Telecommunication facilities
- Mining equipment and machinery
- Coal washing plant
- Housing, health care and educational facilities
- Transmission lines to connect to the main grid

8.4 Punjab Coal Fields (Salt-Range and Makarwal)

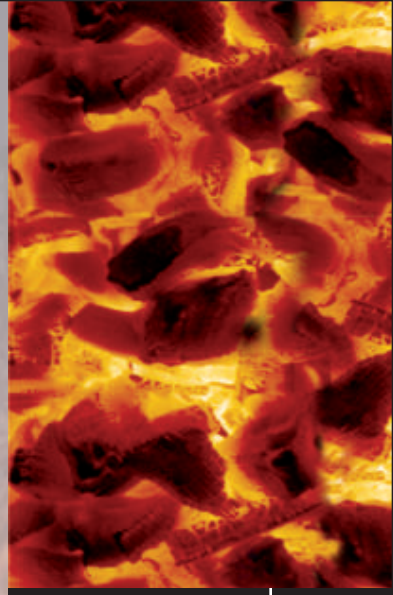
- All-weather access roads to mines
- Water and power supply lines to mines
- Means of coal transportation: trucks, conveyors and aerial ropeway
- Coal loading and un-loading facilities
- Telecommunication facilities
- Mining equipment and machinery
- Housing, health care and educational facilities
- Transmission lines to connect to the main grid

8.5 NWFP Coal Fields (Hangu & Cherat)

- Water and power supply lines
- Means of coal transportation: trucks, conveyors etc.
- Coal loading and un-loading facilities
- Telecommunication facilities
- All weather access roads
- Mine rescue and training centre
- Mining equipment and machinery
- Housing, health care and educational facilities
- Transmission lines to connect to the main grid

8.6 Azad Jammu & Kashmir Coal Field (Kotli)

- Water and power supply lines
- Means of coal transportation: trucks, conveyors etc.
- Coal loading and un-loading facilities
- Telecommunication facilities
- All weather access roads
- Mine rescue and training centre
- Mining equipment and machinery
- Housing, health care and educational facilities
- Transmission lines to connect to the main grid



Institutional Set-up For Coal Development & Utilization In Pakistan

Chapter 9

According to the Constitution of Pakistan, “Minerals” constitute a “Provincial subject”. Coal, being a mineral, therefore, falls within the Provincial domain. On the other hand, being an energy resource, it is utilized for power generation. Ownership of coal, leasing of mining rights and receipt of royalties are a prerogative of Provincial Governments. Large-scale coal development for power generation with direct foreign investment is jointly conducted by the Federal and Provincial Governments. Various Federal and Provincial agencies are engaged in exploration, development, production and utilization of coal in Pakistan. The function and responsibilities of these organizations are briefly described here below.

9.1 Federal Agencies

9.1.1 Ministry of Water & Power

The Ministry of Water and Power plays the lead role in the implementation of all policy pertaining to water and power issues in the country. The Ministry of Water and Power has been assigned the following responsibilities:

- Development of water and power resources of the country
- All matters relating to the 1960 Indus Water Treaty and Indus Basin Works
- All matters/functions relating to WAPDA
- Liaison with international engineering organizations in the water and power sectors, such as the International
  Commission on large dams, International Commission on Irrigation & Drainage, and International Commission on Large Power Systems
- Assistance to federal agencies and institutions for promotion of special studies in the water and power sectors
- All matters relating to electricity in Pakistan
- All matters pertaining to KESC and Pakistan Electric Agencies Limited
- Matters relating to National Engineering (Services) Pakistan Ltd.
- Matters relating to the National Tube-well Construction Corporation
- Matters relating to the Indus River System Authority
- All matters pertaining to PPIB

- Matters related to independent power projects (IPPs)
- Monitoring of technical standards and specifications of materials and tools and plants used in water and power engineering and technologies

9.1.2 Private Power & Infrastructure Board (PPIB)

PPIB was created in 1994 as part of the GOP's efforts to introduce major policy reforms, facilitate private investment and structural changes in development of the power sector. PPIB provides a 'one window' facility to investors in the private sector by functioning as a one-stop organization on behalf of all ministries, departments and agencies of the GOP in matters relating to the setting-up of power projects in the private sector. These matters include negotiation of Implement Agreements (IAs), Power Purchase Agreements (PPAs), Fuel Supply Agreements (FSAs), other related agreements, and liaison with the local and international agencies for facilitating and expediting the progress of private sector power projects. In addition, with the prior approval of the GOP, PPIB is also responsible for formulating, reviewing and updating policies and procedures relating to private sector investments in power generation and allied infrastructures.

Pursuant to the 1994 Power Policy, PPIB succeeding in attracting foreign direct investment (FDI) worth US$ 4 billion in three years and helped overcome load-shedding in the country. Presently, sixteen (16) IPPs with a total generating capacity of around 6,000 MW are providing electrical power to the national grid. PPIB maintains very specialized skill covering all aspects of power engineering, legal, financial and negotiation skills.

Through announcement of the 2002 Power Policy, new avenues have been opened up for private entrepreneurs looking for opportunities to invest in Pakistan's private sector. PPIB has received a very encouraging response from the private sector and, until now, private entrepreneurs have submitted thirty- three (33) Expressions of Interest (EOI) for developing power generation projects worth 5,969 MW. A primary goal of the 2002 Power Policy is to harness indigenous natural resources, especially the enormous untapped coal resources recently discovered at Thar in the Province of Sindh. In order to achieve coal power policy objective, PPIB advertised for a coal-fired power project at Lakhra in Sindh. The Government of Sindh has signed MOU's for (i) a 600 MW Thar Coal Power Project with the Shenhua Group of China, and (ii) a 1200 MW project at Thar with Australian firms using "Underground Coal Gasification" technology. These are integrated project involving coal mine development and establishment of a coal power plant for electricity generation.

PPIB facilitates implementation of projects above 50 MW capacity, whereas projects up to 50 MW are implemented through one-window facilities available at the provincial level. PPIB also handles various project-related time-bound activities as specified in the security package agreements. These activities are of analytical nature and relate mainly to obligations to sponsors. In addition, PPIB provides all possible support, e.g. technical, legal and financial inputs to Provincial Governments whenever required. PPIB is also assisting the Government of Sindh in its efforts to develop and utilize Sindh's coal resources for power generation.

The Board governing PPIB has representatives from all four provinces of Pakistan. In order to facilitate coordination between various agencies and in taking timely decisions on various issues while implementing private power projects, a committee under the Secretary, Water and Power, comprising representative of PPIB, WAPDA, KESC, the Planning & Development Division and the concerned provincial authorities has been constituted to oversee the implementation of the 2002 Power Policy.

Contact Address:

Managing Director,

PPIB, M/O Water and Power, Government of Pakistan

50, Nazimuddin Road, F-7/4, Islamabad

Tel: (92-51) 9205421, 9205422, Fax: (92-51) 9217735, 9215723

Website: www.ppib.gov.pk, E-mail: ppib@ppib.gov.pk

9.1.3 Water & Power Development Authority (WAPDA)

WAPDA was established by statute in 1958 and entrusted with a massive agenda which included generation, transmission and distribution of power in the whole of Pakistan excluding Karachi. It owns about 54 percent of the country's total power generation capacity, serves 88 percent of all electricity customers in Pakistan and has the principal power generation, transmission and supply system in the country. It has a customer base of over 10 million.

The privatization of WAPDA is being conducted by corporatized unbundling, which is now underway. The distribution network of WAPDA has been divided into nine electricity supply companies, which are successors of former Area Electricity Boards (AEBs). The AEBs were departments within WAPDA to administer the supply and distribution, construction, expansion, maintenance and operation of the distribution system. The newly incorporated electric supply companies have been structured in line with modern management practices. The thermal power generation facilities of WAPDA have been restructured and incorporated to form three Generation Companies (GENCOs). In addition, a National Transmission & Dispatch Company (NTDC) has been incorporated for the transmission and dispatch functions previously performed by WAPDA. Now, WAPDA has been left with only its hydel generation facilities

Contact Address:
Chairman, WAPDA, WAPDA House, Lahore
Tel: (92-42) 9202225, 9202211 Fax: (92-42) 9202500, 9202454

9.1.4 WAPDA Private Power Organization (WPPO)

WPPO, previously established with WAPDA, is now placed within NTDC to negotiate Power Purchase Agreements (PPAs)), with sponsors of private power projects.

Contact Address:
General Manager, WAPDA Private Power Organization, WAPDA House, Lahore

9.1.5 Karachi Electric Supply Company (KESC)

KESC, established in 1913 addresses the electric power requirements of Karachi and is a composite as a joint stock public limited company utility responsible for generation, transmission and distribution of electricity, and has customer base of 1.5 million predominantly urban consumers.

Contact Address:
Managing Director, KESC, 5th Floor, AIMAI house, Abdullah Haroon Road,
Karachi, Tel: (92-21) 9206295, Fax: (92-21) 920516 E-mail: fakesc@hotmail.com

9.1.6 National Electric Power Regulatory Authority (NEPRA)

In order to promote fair competition in electricity generation and to protect the rights of consumers as well as producers and sellers of electricity, the GOP established NEPRA under the Regulation of Generation, Transmission and distribution of Electric Power Act 1997. The main functions of NEPRA are to grant licenses for generation, transmission of electric power, and prescribe and enforce performance standards for generation, transmission and distribution companies and power plants established in the private sector. NEPRA protects the interests of companies providing electric power services as well as those of the consumers of electricity. NEPRA issues licenses for companies to regulate their operation according to NEPRA rules and regulations.

Contact Address:
Chairman, NEPRA, 2nd Floor, OPF Building, G-5/2, Islamabad
Tel: 9220902, 9207200, and 9207093 Fax: 9210215
E-mail:office@nepra.isb.sdnpk.org Website: www.nepra.org

9.1.7 Board of Investment (BOI)

In order to streamline and coordinate the process of investment and to create an investor-friendly culture in the country, the GOP established the Board of Investment

(BOI) as the central investment promotion and facilitation agency. The BOI is supervised by the Minister for Industries and Production and chaired by the chief executive of the GOP. The main functions of the BOI are to promote investment opportunities in all sectors of the economy and to provide facilitation services to local, foreign and overseas Pakistani investors. The BOI acts as the focal point of contact between investors and all GOP agencies of concerned with investment proposals and responsible for providing incentives and other facilities. In order to address investment-related key issues, the Cabinet Committee on Investment (CCOI) has been formed, headed by the Minister of Finance and Economics, to deal with matters relating to private sector investment. In addition, Provincial Committees on Investment have also been formed, led by the heads of the Provincial Governments to ensure close coordination between the BOI and the provinces. The BOI has been restructured under statute to bring in private sector expertise to perform daily functions of BOI.

Contact Address:
Chairman, Board of Investment
Ataturk Avenue (Old USAID Building),G-5/1, Islamabad
Tel: 9206161, Fax: 9217665

9.1.8 Central Board of Revenue (CBR)

CBR is responsible for an investor-friendly sale and taxation policy in Pakistan so as to facilitate foreign investors in importing plant, machinery and equipment required for the construction and smooth operation of power projects. For this purpose, CBR issues various regulatory orders, from time to time, in order to facilitate investors to avail incentives provided by the GOP.

Contact Address:
Chairman, Central Board 0f Revenue, G-5, Islamabad
Tel: 9201936, 9209723, Fax: 9205308

9.1.9 Ministry of Petroleum & Natural Resources

A mineral development wing has been established in the Ministry of Petroleum and Natural Resources. This organization is responsible for mineral and coal development in Pakistan. The Mineral Wing makes policies for the rapid development of minerals, including coal, in Pakistan. It collects data/information regarding Pakistan's coal/mineral resources, which it provides to prospective investors for development and utilization.

Contact Address:
Director General (Minerals), M/O Petroleum & Natural Resources, 21-E, Huma Plaza, Blue Area, Islamabad, Tel: 9202337

9.1.10 Geological Survey of Pakistan (GSP)

The Geological Survey of Pakistan (GSP) is responsible for preparation of geological, geophysical and geochemical maps, and for making available geo-data required for large-scale coal and mineral exploration mapping. GSP is also responsible for exploratory drilling, sampling, analysis and estimation of reserves for coal/minerals in Pakistan. GSP performs the following functions:

a. Undertakes geological, geophysical, geochemical and tectonic surveys, generates and disseminates basic data on potential prospecting areas as per priorities determined by the Mineral Investment Facilitation Authority (MIFA).

b. Produces 1: 250,000 geological maps and 1: 50,000 maps of the whole country, commencing with priority areas identified by the Provinces.

c. Expedites publication of geological, geophysical and geochemical data and makes available maps thereof.

d. Coal/mineral exploration is a minimal activity of GSP, merely for support to its regional surveys.

e. Helps the Provinces in generating geological data.

Contact Address:
Director General, GSP, Seriab Road, Quetta

9.1.11 Pakistan Mineral Development Corporation (PMDC)

Formed as a private limited company under the Companies Act of 1913, Pakistan Mineral Development Corporation

(PMDC) is owned by the GOP and holds leases in Punjab, Sindh and Balochistan for mining coal. PMDC is responsible for the exploration, development, mining, beneficiation, marketing and utilization of coal in the whole of Pakistan.

Contact Address:
Managing Director, PMDC, 13-H/9, Islamabad
Tel: 9258701-4, Fax: 9258705

9.1.12 Lakhra Coal Development Company (LCDC)

LCDC is responsible for developing the Lakhra coalmines and coal-fired power plants in the public sector of Pakistan. In the first phase, LCDC supplies coal and limestone to FBC technology-based coal power plants set up by WAPDA at Khanot near Lakhra.

Contact Address:
Managing Director, LCDC, PIDC House, Karachi

9.1.13 Energy Wing – Planning & Development Division

The Energy Wing was created in 1988 under the Ministry of Planning & Development, to undertake the technical, financial and economical appraisal of energy resources and power generation projects. The Energy Wing also prepares short and long term energy sector programs including forecasts of the supply and demand of energy resources in the country.

Contact Address:
Energy Chief, Energy Wing, Planning & Development Division
99-West, Shalimar Plaza, Blue Area, Islamabad, Tel 9216310 Fax: 9220724

9.1.14 Fuel Research Centre (FRC)

The Fuel Research Center (FRC) has been established under the Ministry of Science and Technology, to carry out research on discovered and available fuel such as oil, gas and coal, for their efficient use in power generation. FRC is responsible for the analysis of coal and rock samples necessary for mine development and for setting up coal power plant. It also conducts research work for clean coal technologies to be used for electricity generation and effective environmental control.

Contact Address:
Managing Director, Fuel Research Center, University Road, Karachi

9.1.15 Pakistan Council of Science & Industrial Research (PCSIR)

PCSIR has been established in the Ministry of Science and Technology for all types of scientific and industrial research in the country. It is also involved in the research of coal and its various industrial use, including coal power generation and clean coal technologies. PCSIR also analyzes coal and rock samples.

Contact Address:
Chairman, PCSIR, 16, H-9, Islamabad, Tel: 9257284, Fax: 9258167

9.1.16 Pakistan Environmental Protection Agency (PEPA)

Pakistan Environmental Protection Agency (PEPA) has been established at the Federal level, to formulate environmental protection laws and policies for a pollution-free atmosphere in Pakistan. PEPA is also responsible for implementation of environmental protection laws in the country.

Contact Address:
Director General, Pakistan Environmental Protection Agency
44-E, Office Tower, 3rd & 4th Floor, Blue Area, Islamabad
Tel: 9217882, 9205234, Fax: 9206343, 9201074

9.2 Provincial Agencies

According to the Constitution of Pakistan, coal/minerals are a “Provincial subject”. Therefore, development of coal is a responsibility of the Provinces. Hence, at Provincial level, various agencies are working for the development

of coal and its efficient use in the industry. These agencies and their responsibilities are described here below:

9.2.1 Directorate of Industries and Mineral Development (DIMDs)

The Directorate of Industries and Mineral Development (DIMD) has been established in all of Pakistan's provinces and AJK, for the development of coal and minerals. The Provincial DIMDs are responsible for issuing prospecting license for the development of coal and minerals and granting mining leases for the production of coal and minerals in the Provinces.

In Sindh, a separate Directorate of Mineral Development has been created with a view to improve regulatory arrangements for exploration, development and mining of coal/minerals. A separate Mineral Development Ministry has also been created in Sindh, for effective coordination and formulation of policies. As and when required to attract foreign investment, the Mining Concession Rules would be amended without compromising on the constitutional limits and rights of the Province.

9.2.2 Sindh Coal Authority (SCA)

The Sindh Coal Authority (SCA) was established in 1993 to explore, exploit, develop, and utilize the vast indigenous coal resources of Sindh. The main objective of SCA is to attract potential investors to establish integrated projects of coal-mining and coal-fired power plants in Sindh. SCA provides a one-window facility, and preliminary data required for coal mining and coal-fired power plants. SCA acts as a lead agency to perform the following functions:

- Accelerate the pace of activities relating to coal development and is responsible for planning (includes studies, experiments, scientific & technical evaluation), promoting, organizing and undertaking coal-mining projects and implementing programs for exploitation, mining, processing and utilization of coal.
- Prepare and execute schemes and take necessary steps for execution of such schemes.
- Advise the Government of Sindh in all matters connected with conservation, development, working and utilization of coal deposits.
- Publish results of research and development activities of coal resources of the Province, from time to time, for general information.
- Promote joint ventures with foreign investors for development of coal resources of the Province.
- To procure approvals for independent projects of coal-mining and power generation or integrated projects of coal mining and coal-power plants and fiscal concessions etc. from concerned agencies. Such approvals would include MOUs, mining and surface rights and all agreements involved in the implementation of projects/programs.
- Monitor all implementation program and coal mining projects.
- Undertake development of infrastructure service facilities such as roads, water, electricity, gas, skilled and unskilled labour, professional personnel, land development and financial and ancillary facilities directly required to implement coal development schemes.
- Prepare documents incorporating technical, social and environmental aspects of coal-mining and coal-fired power plants.

Contact Address:
Director General, Sindh Coal Authority
F-158/A, Block No. 5, KDA Scheme No. 5, Clifton, Karachi
Tel: (92-21) 9251507, 5833550, Fax: (92-21) 5874708

9.2.3 Inspectorates of Mines (IMs)

Inspectorates of Mines are established in each province of Pakistan and in AJK to formulate mining laws, by-laws, rules and regulations for the safety of mines and mine workers. The Inspectorates of Mines are headed by Chief Inspectors of Mines, and work under provincial Labour and Welfare Directorates.

9.2.4 Mine Rescue Centers

A Mine Rescue Center is established in each province of Pakistan. These Centers are responsible for carrying out rescue operations in case of emergency such as mine-fires, gas explosions, collapsing of mines and sudden in-rush of water inside the mines.

9.2.5 Mine Training Centers

The Mine Training Centers provide training to mine-workers for dealing with rescue work in case of accident and hazards due to mine fires. These Training Centers also train mine-technicians, mine-supervisors and mine-workers for safe operation of the mines.

9.2.6 Provincial Environmental Protection Agencies (EPA)

Provincial Environmental Protection Agencies have also been established in each province and in AJK, to procure implementation of the environmental laws of Pakistan in the industry and in every walk of life. Provincial Environmental Protection Agencies are authorized to establish their own environmental standards.

9.2.7 Punjab Mineral Development Corporation (PUNJMIN)

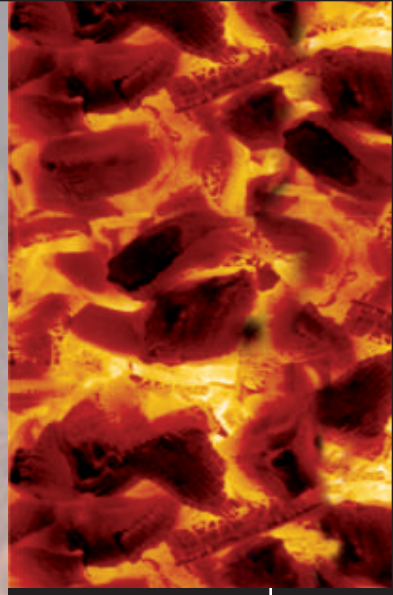
The Province of Punjab is blessed with substantial mineral and coal resources. The Government of Punjab has established the Punjab Mineral Development Corporation (PUNJMIN) by statute in 1975. The functions of PUNJMIN are to draw up schemes for the development, survey, mining, processing and industrial exploitation of coal and minerals. This organization is also responsible for improving infrastructure such as road, water supply, power and other ancillary facilities for the exploitation of coal.

Contact Address:
Managing Director, PUNJMIN, Alfalah Building, The Mall, Lahore

9.2.8 Balochistan Development Authority (BDA)

The Balochistan Government has established The Balochistan Development Authority (BDA) for exploitation of its vast coal and mineral resources, and for the establishment of various industrial units in the Province. The function of the BDA is to set-up industry in the public sector and to facilitate the private sector in industrial exploitation of the vast coal and mineral resources of Balochistan.

Contact Address:
Chairman, Balochistan Development Authority, Quetta.



Existing Coal-fired Power Projects In Pakistan

Chapter 10

10.1 WAPDA 150 MW Lakhra Coal Power Plant

As a result of the Lakhra experience, WAPDA has set-up in 1994, with Chinese Assistance, three units of 50 MW each, power plants based on Lakhra coal using FBC technology near Khanot in the Dadu District of Sindh. While operating the plant, WAPDA faced several problems such as boiler tube leakage, air pollution etc. due to supply of coal below the designed specification. At present, the plant is shut down due to running at de-rated capacity. The plant was consuming about half a million tonnes of lignite coal annually. The coal was supplied from the Lakhra mines of PMDC and LCDC on daily basis. The generation cost of the plant was Rs 2.61 per kWh, including the cost of coal and lime stone. The plant is expected to resume operations after eliminating the problems, failing which, it will be privatized through open tender.

10.2 WAPDA 15 MW Quetta Coal Power Plant

With USAID assistance in 1963, WAPDA set-up a power plant having two units, each of 7.5 MW capacity, at Sheikh Mandah near Quetta using pulverized coal technology. The plant used sub-bituminous coal from the Sore Range mines of Balochistan. The annual coal consumption of the plant was 30,000 tonnes. The plant has completed its life and WAPDA has now closed both the units since they were functioning at de-rated capacity. The plant is now under repair and upgrading to enhance the capacity.

10.3 6 MW Salt- Range Coal Power Project (Under 1994 Power Policy)

PPIB issued a Letter of Support to Northern Electric Company Limited (NECL) for setting up a 6 MW coal-fired power plant based on Salt-Range coal near Chakwal. The IA and PPA were signed with NECL, which achieved Financial Close in November 1996. The Commercial Operation Date for their project is expected in 2004.

10.4 Coal-Based Power Projects (Under the Power Policy 2002)

The GOP and the Sindh Government signed MOUs and invited EOIs through advertisement for the development of indigenous coal and for setting up coal- based power projects for a total

capacity of 2,600 MW. The following power projects based on indigenous coal are under process by PPIB and the Sindh Government.

10.4.1 Thar Coal Mine & 600 MW Power Plant

The Shenhua Group of China has signed an MOU with the Sindh Government to carry out detailed geological investigation and the feasibility study for setting up 2x300 MW coal-fired mine-mouth power plant based on Thar coal. The feasibility study is yet to be completed.

10.4.2 Thar Coal Gasification & 1200 MW Coal Power Plant

An Australian Group has signed an MOU with the Sindh Government to conduct a feasibility study for the development of underground coal gasification and for setting-up a 1200 MW power project based on Thar coal. The feasibility study is yet to be completed.

10.4.3 Lakhra Coal Mine & 450 MW Power Plant

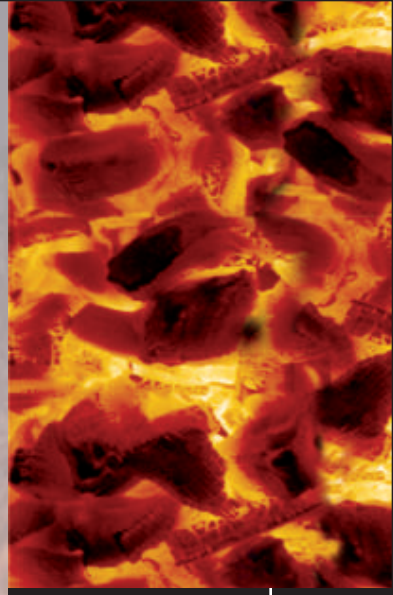
The GOP / PPIB have invited EOIs for the development of a 450 MW integrated project of coal mine and power plant in Lakhra through press advertisement. The pre-qualification of interested firms is now under process.

10.4.4 Sonda-Jherruk Coal Based 200 MW Power Plant

The Dadabhoy Group has shown interest in the development of a 200 MW power plant project based on Sonda-Jherruk coal near Thatta, Sindh, and has requested PPIB for the issuance of an LOI to carryout a feasibility study for the proposed project. Their application is now under process by PPIB.

10.4.5 Ghotki 150 MW Coal Fired Power Plant

M/S Habibullah has shown interest in the development of a coal-based power plant at Ghotki in Sindh, and have requested PPIB to issue an LOI to conduct a feasibility study for the project. Their project proposal is now under process by PPIB.



Policy For Power Generation Projects 2002

Chapter 11

11.1 Power Policy 2002

Since the previous Power Policy of 1998 failed to attract private investors, the GOP felt it necessary to create an environment and craft a new set of incentives which, on the one hand, offer attraction to investors and, on the other, keep consumer-prices within affordable limits. Keeping in view these objectives, the Policy for Power Generation 2002 has been formulated so as to offer maximum incentives and assurance to investors. In the Power Policy 2002, the main emphasis has been on the development of power projects based on indigenous fuel resources, especially coal and renewables.

11.2 Major Policy Features

- Main emphasis has been given on the development of power projects based on indigenous coal.
- Requests for proposals (RFPs) for indigenous coal-fired projects with a capacity above 50 MW, will be for integrated coal-mining and power generation projects.
- The basis for selection of successful bidders will be the minimum levelized tariff, either through ICB for solicited proposals, or through negotiation for proposals on raw sites. Raw sites mean locations whereat feasibility studies have not been initiated so far.
- Variable tariffs over the life of the project will be permitted under terms specified in the RFP.
- The process of selection will involve pre-qualification, issuance of RFP and bidding. The evaluation of bids will be in accordance with bid criteria clearly laid down in the RFP
- It will not be possible to invite competitive bids and receive firm offers without proper feasibility studies for particular site-specific indigenous coal-based power projects. Detailed feasibility studies for such projects will be conducted in the private sector before bids are invited and the LOS issued. Feasibility studies may be conducted in the private sector only on raw site, provided the project on raw site has been accepted and an LOI issued after submission of the required bank guarantee.

- Competitive tariffs will comprise an Energy Purchase Price (EPP) and a Capacity Purchase Price (CPP), with provision for escalation.
- The GOP will guarantee the terms and conditions of executed agreements, i.e. IA, PPA and Coal Supply Agreements (CSAs), including payment terms, are maintained for the duration of the Agreements for projects above 50 MW.
- The coal power generating companies will be allowed to import plant, equipment and machinery not manufactured locally, at concessionary rates. The power companies will also be completely exempted from the payment of income tax and withholding tax on imports.
- In order to promote indigenization, the local engineering industry will be encouraged to form joint ventures with foreign companies to develop integrated projects of coal-mine and coal-fired power plants with a cumulative capacity of at least 2000 MW by the year 2015.

11.3 Prequalification of Bidders

Bids for indigenous coal-based power projects will only be considered from bidders who have been pre-qualified on meeting at least the following conditions:

a) One of the sponsors, who will be designated the "Main Sponsor", must have at least a 20% stake in the equity and, together with other partners, have direct and relevant experience/capability in the successful development or implementation or ownership or operation of coal mine and coal-based power plants of similar magnitude.

b) Demonstrate capability for financing (equity and debt) or arranging finance for coal-power projects and mines of similar size.

c) The Main Sponsor should not own more than 25% of the total generation capacity in Pakistan at the time of bidding.

d) During the Lock-in-Period (i.e. the period from the LOS issuance date until the sixth anniversary of the successful commissioning of the power plant) the Main Sponsor in the application of pre-qualification must have a lead role and sufficient financial strength to hold at least 20% of the equity of the project company. The pre-qualified sponsors must hold 51% of the equity for the same period.

11.4 Requests for Proposal (RFP)

The Request for Proposal (RFP) for an indigenous coal-fired project with capacity above 50 MW will be for an integrated coal mining and/or power generation plant.complex. A typical RFP is likely to specify the followings for each project offered for ICB:

1) Type of project (indigenous coal based)
2) Coal supply details (quality and quantity of coal, proven coal reserves, mineable reserves, availability of reserves for 30 years etc.)
3) Mining details (mine plan, mining method, mining machinery, production schedule, coal transportation details, mine safety, environmental concerns etc)
4) Power plant details (plant foundation, cooling water and make-up water, machinery/equipment, boiler details, coal storage/reclaiming, coal/ash handling, environmental concerns etc.)
5) Net capacity (MW)
6) Reference annual plant factor (%)
7) Transmission arrangements including the point of delivery to the power purchaser
8) Terms of PPA
9) Specific allowances for scheduled maintenance and excused forced outages
10) Cooperation arrangements/agreement with local engineering companies
11) Evaluation criteria
12) Tariff, including: Limitations on "front-end loading", limitations on proportion of capacity charge to overall tariff, reference date(s) for indexation which would be 30 days prior to bid submission dead lines unless

specified otherwise, Fuel price and indexation mechanism(s), if required, matching of debt-related capacity charge stream with loan repayment stream, sum of energy charge and non-debt-related capacity charge to be 'constant' or 'increasing' during the term

The following documents will also be included in the RFP: -

a) Instructions to bidders
b) General provisions for bidders
c) Minimum technical standards
d) Standardized forms for NEPRA's tariff determination
e) Feasibility study of the integrated coal mining and/or power generation complex
f) Coal information data and hydrological data, if available
g) Copies of relevant standard security package agreements and documents (i.e. LOS, IA, PPA, CSA etc.)
h) Environmental laws, rules and regulations, procedure and guidelines of the GOP for both mine and power plant

If necessary, pre-bid conferences will be held to facilitate exchange of information with bidders in a transparent manner, giving equal and adequate opportunity to all prospective bidders. The RFP for an indigenous coal-fired power project with capacity above 50 MW will be for an integrated coal-mining and power generation complex.

11.5 Feasibility Study

The scope of the feasibility study would depend on whether the project is an integrated coal-mine and power generation plant or a stand-alone power generation plant. For integrated-coal-mine and power generation plants, the feasibility study will cover all aspects of coal mining and power generation, including, but not limited to, coal reserves, mineability, risks involved in mining, legal aspects of mining and etc, besides storage/transportation of coal to the power plant, operations of the power plant on coal, necessary details about the power generation plant itself and, above all, the commercial viability of the project. The feasibility study may or may not suggest a 'Coal Supply Agreement (CSA)' in such case. For a stand-alone coal-based power generation plant, the mining section would not be covered in detail. However, availability of a sufficient and reliable coal supply for power generation would be considered, besides other necessary aspects. The feasibility study may require a CSA even if the coal supplier is sister concern of the power generator.

Generally, feasibility study may identify the basic parameters of the project, such as geological condition, optimum net capacity, estimated annual plant factor, transmission line requirement etc. necessary to allow firm bids for development of the identified project. The feasibility study for indigenous coal based power projects will determine the basic mining parameters such as quality, quantity and mineability of coal deposits, hydrogeology and ground water condition, mine design, coal production and coal supply schedule, coal transportation and storage, capital and production cost, environmental aspects etc. Similarly, the study will determine plant site conditions, cooling water requirements and availability, ash disposal, coal stocking and reclaiming, environmental concerns etc. The feasibility study will be carried out in accordance with internationally acceptable standards. The GOP will not guarantee its content or conclusions. The bidders will have the right, at their own cost, to examine, evaluate, and form their own conclusion on, any or all aspects of the feasibility study and carryout any additional studies and investigations to make their own assessment about feasibility and validity of the project.

11.6 Evaluation of Bids

- Bids will be opened on the prescribed date in the presence of bidders representative who choose to attend the bid opening
- The detail evaluation criteria will be provided in the RFP
- The bid with the lowest evaluated levelized tariff will be ranked No. 1

PPIB will reserve the right to reject any or all bids without assigning reason therefor, and will not assume any liabilities or claims for compensation in connection therewith. Once the bid is accepted and tariff approved by PPIB, the successful bidder will be issued an LOS by PPIB against delivery of a Performance Guarantee (PG) in favor of PPIB, in the required amount valid up to three months beyond the Financial Closing date specified in the LOS and upon payment of the cost of the feasibility study to PPIB. Under normal circumstances, no extension in achieving Financial Closing will be granted. However, on the sponsor's request, if the committee under the chairmanship of the Secretary, Water & Power and comprising representatives of PPIB, WAPDA, KESC, P&D Division, the concerned Provincial Department and SCA, is satisfied that delays are due to factors beyond the reasonable control of the sponsors and Financial Closing will be achieved shortly, a one-time extension of up to a maximum period of six months will be given against extending the validity period of the PG and increasing the guarantee amount by 100%.

11.7 Submission of Proposals

Proposals on raw sites for indigenous coal-based power projects with capacity above 50 MW will be submitted to PPIB, and must include the following:

a) Project Name/Identification

b) Project Location

c) Proposed Capacity and Plant Factor

d) Basic Outline of Structure and Plant

e) Mine Plan, indicating mining method, coal reserves, quality of coal, production and coal supply schedule

f) Feasibility Study, indicating specific milestones and completion date

g) Pre-qualification details of the proposed sponsor

h) Previous history of the project/proposal

Proposals on raw sites will be examined by a committee under the Secretary, Ministry of Water & Power, and comprising representatives of PPIB, WAPDA, KESC, the Planning and Development Division, and the concerned Provincial Private Power Cell (PPC), or SCA for coal-power projects in Sindh. Proposals approved by the committee will be further processed by PPIB for issuance of the LOI.

11.8 Letter of Interest (LOI)

The sponsors of approved Projects will be issued their LOIs by PPIB, provided they post in each case, in favor of PPIB, a bank guarantee of the value of US$1,000 per MW for a period not less than six months in excess of the then validity of the LOI. The initial validity of the LOI will be between 12 to 24 months, and will depend on the size of the project. In case the 'Panel of Experts' (POE) is satisfied that the sponsor's progress during conduct of the feasibility study is satisfactory and the feasibility study is likely to be completed shortly, a one time extension may be granted by the committee up to a maximum period of 180 days. Submission of the bank guarantee in the double the original amount and valid beyond six months of the extended LOI period, will be mandatory to qualify for extension in validity of the LOI.

The LOI will require the sponsors to conduct a complete feasibility study monitored by the POE appointed by PPIB. The sponsors will have to meet the standards and milestones stipulated in the LOI. In case the POE confirms that the sponsors have failed to meet the relevant milestones/standards, PPIB will terminate the LOI and encash the bank guarantee. The sponsors will have no claim for compensation against the GOP. In case the POE approves, the sponsors will be allowed within three months, to negotiate the tariff with the power purchaser. If the tariff negotiation is successful, the sponsors will file an application with NEPRA for tariff approval. If NEPRA approves the tariff, PPIB will issue an LOS on the sponsor's depositing the Performance Guarantee (PG) of the value of US$ 5,000 per MW in favor of PPIB, valid up to three months beyond the Financial Closing date specified in the LOS. In case negotiation on tariff fails and the three months negotiation period lapses, the project will be processed as a solicited proposal. The sponsors who have

conducted the feasibility study on raw site will also be allowed to participate in the bid on submitting a bid bond and, if approved by PPIB, will be given a chance to undertake the project at the lowest tariff offered during the bidding process. On their refusal, however, PPIB will appoint an independent auditor, and the successful bidder will reimburse the reasonable and independently audited cost of the feasibility study to the initial sponsors before obtaining the LOS.

11.9 Fee Structure

	US$
Registration	100
Purchase of Pre-qualification Documents	1,000
Purchase of RFP Documents	2,000
Evaluation Fee:	
51-100 MW	20,000
101-400 MW	30,000
401-600 MW	50,000
Above 600 MW	75,000

11.10 Bid Bonds/Letter of Support/Performance Guarantee

- Each bidder will submit a bid bond of US$ 1,000 per MW at the time of submission of bid
- The bid bond of all other bidders will be returned after declaration of the successful bidder
- The successful bidder will be required to post a PG in the sum of US$ 5,000 per MW in favor of PPIB, valid initially for a period of three months in excess of validity of the LOS
- After submission of the PG by the successful bidders, the bid bond will be returned
- The PG will secure the successful bidder's obligation to execute the IA, PPA, SCA and other relevant agreements and achieve Financial Closing (FC) within the specified period
- The LOS will normally be issued for a period of 15-18 months, as specified in the Request for Proposal (RFP), by which date the sponsors / project company must achieve Financial Closing for the project specified in the LOS
- The PG will be in the form of an irrevocable direct pay letter of credit in favor of PPIB issued by an internationally recognized bank acceptable to the GOP. The PG must always remain valid for a period not less than three months in excess of the then-prevailing Financial Closing deadline
- The sponsors will have an option to terminate the LOS and any of the project agreements executed at any time before the required date for Financial Closing, as per terms and conditions of the LOS. The termination option may be exercised by foregoing a portion of the PG equal to the face value of the PG multiplied by the number of months since the issuance of the LOS (rounded to the nearest whole number) divided by the total number of months allowed in the LOS to achieve Financial Closing
- The PG will be encashable on call by PPIB. Neither the sponsors nor the project company shall have any claim against the GOP or any of its components/organization/provinces/institutions on any ground whatsoever
- Until Financial Closing, the LOS will govern the project and supersede all documents and agreements; thereafter the security agreements will supersede the LOS
- If the LOS expires, the IA, PPA, and CSA and all other agreements with any governmental entity, will automatically terminate

11.11 Project Implementation

Successful bidders will submit to PPIB on a format, specified by PPIB, a mutually acceptable implementation schedule with specific milestones for progress monitoring.

PPIB and the power purchaser will require successful bidders to submit periodic progress reports regarding the status of the contractual obligations, Consents, financial and physical progress report and a summary table showing progress towards achievements of such milestones. Delays in achieving Financial Closing due to events beyond control of the sponsor / project company will be accommodated through a day-to-day extension allowed under the IA. Similarly, delays in the Commercial Operation Date (as specified in the PPA) of the Power Complex, will incur liquidated damages as specified in PPA. Equitable compensation against parties concerned, may be specified in the IA/PPA, for not meeting specified milestones under the security agreements.

11.12 Power Tariff

- The development of a coalmine, establishment of coal-fired power plant and transportation facilities to supply reliable coal for the integrated project of power plant and mine, require substantial investment. These expenses are to be accounted for in the power tariff in the form of capacity and energy charges. However, in a stand alone coal based power generation complex, the EPP component of tariff will include the reference fuel price reflecting the coal prices governed by the provincial authorities and reflected in CSA.
- The tariff will be denominated in Pakistan Rupees
- Bidders will be asked to quote their tariff in two parts: (1) Energy Purchase Price (EPP) and (2) Capacity Purchase Price (CPP)
- The RFP may specify the maximum percentage of overall tariff for the capacity component
- The CPP will be expressed in Rs/kW/month and the EPP in Rs/kWh
- The CPP will be paid provided the plant is available for dispatched to standards specified in the PPA. The EPP will be paid upon the amount of kWh of energy dispatched
- In order to ensure sustained interest of the sponsor during the entire life of the project, the sum of the EPP and non-debt related CPP (computed on a kWh basis at the reference plant factor specified in the RFP) will remain constant or increase over time. The debt-related CPP stream may match the loan repayment stream
- The EPP for indigenous coal-based power projects will consist of the fuel component based on price of the supply of coal and variable operation and maintenance charges as stated in the RFP
- Bidders may include separate components in the CPP and the EPP which are subject to adjustment only for variations in the exchange rate between the Pakistan Rupee and US$, between the reference date and the date of payment
- The reference rate for foreign exchange shall be the National Bank of Pakistan TT& OD selling rate of the US$ prevailing thirty (30) days before the required date of bid submission. The specific reference date will be stated in the RFP
- Adjustment of exchange rate fluctuations will be affected quarterly. Exchange rate fluctuation in excess of 5% during any month will be allowed
- Escalation for $ components to cover $ inflation will not be provided. However, bidders may include components in the EPP and CPP, which are escalable for Pakistan Rupee inflation. Such Pakistan Rupee escalation will be effected from the bid submission date by the Pakistan Wholesale Price Index (WPI) for ‘manufacturing’ as notified by the GOP’s Federal Bureau of Statistics (FBS). The reference value of the WPI for ‘manufacturing’ will be the most recent value notified (not less than 30 days before the date of submission of the bid) unless notified otherwise in the RFP, which will specify the actual date for this reference value of WPI for ‘manufacturing’
- Escalation will be effected quarterly

- Sponsors will be required to submit yearly tariff profiles in real terms at the time of bidding

11.13 Delivery Point

The indigenous coal-based power tariff payable under the PPA will be quoted at the point of delivery indicated in the RFP. The delivery point will either be the bus bar of the power plant or specific location on the grid of the power purchaser, depending upon one of the following options specified in the RFP:

a) The Transmission Line up to the power complex will be built, owned, maintained and operated by the power purchaser. In this case, the power tariff will be the bid and paid-for energy and net capacity delivered at the out going bus bar of the power plant.

b) The Transmission Line from the power complex to the grid will be built by the company and transferred to the power purchaser, who will then own and operate the Transmission Line. In such case, the power tariff will be the bid and paid-for energy and net capacity delivered at the out-going bus bar of the power plant. The sponsor will build in the cost of the Transmission Line in the tariff quotation.

c) The Transmission Line from the power complex to the grid will be built by the power purchaser and the sponsors jointly, and then be transferred to the power purchaser, who will the own and operate the Transmission Line. In this case, the power tariff will be the bid and paid for energy and net capacity delivered at the out-going bus bar of the power plant. Details of cost sharing will be specified in the RFP.

d) Any other different arrangement.

11.14 Load Dispatch Center

The load dispatch center shall dispatch plants in accordance with the most economical dispatch criteria (without any bias), which will be on the basis of the lowest energy cost component, transmission line losses, system stability and reliability, and other economic considerations.

11.15 Environment

All requirements of the Pakistan Environment Protection Agency (PEPA) Act 1997, relating to environmental protection impacts and social soundness assessment shall have to be met.

11.16 Incentives for Setting-up Indigenous Coal Based Power Plant

11.16.1 Fiscal Incentives

- Customs duty at the rate of 5% on the Import of plant and equipment not manufactured locally
- No levy of sales tax on plant, machinery and equipment
- Exemption from Income Tax including Turnover Rate Tax and Withholding Tax on import
- Repatriation of equity along with dividends is allowed
- Permission to set-up integrated coal-mining and power projects
- Maximum indigenization as per GOP policies is allowed
- Secured return on investment for dedicated coal resource developed for Power generation
- Investment made in integrated projects of coal-mining and coal power plant to be recovered from Tariff
- Exemption from payment of Zakat on the dividends for Non-Muslims and non-residents

11.16.2 Financial Incentives

- Permission to issue corporate registered bonds
- Permission to issue shares at discounted rate
- Raising of local/foreign finance allowed as per applicable rules

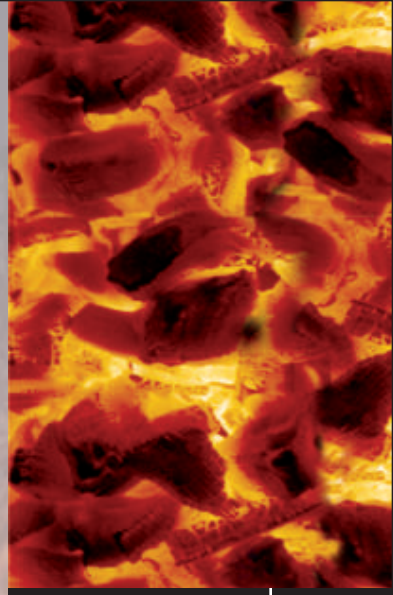
- Permission to foreign banks to underwrite the issue of shares and bonds
- Non-residents are allowed to purchase securities issued by Pakistani companies
- Abolition of the 5% limit on investment of equity

11.16.3 Security

- The GOP will guarantee the contractual obligation of NTDC / KESC and Provincial / AJK Governments
- Protection against political risks
- Protection against changes in taxes and duties regime
- Protection against risk associated with convertibility / remitability of currency

11.16.4 Other Features

- One-window support through PPIB for coal power projects above 50 MW
- One-window support through Private Power Cells and SCA to establish for coal power projects below 50 MW in the Provinces / AJK
- Long-term agreements, such as IA, PPA and FSA/CSA, are available on BOOT and BOO models
- BOOT projects are allowed to be transferred to the Government of Pakistan after concession period
- Solicited proposals with feasibility study processed through ICB
- Unsolicited proposals without feasibility study for raw sites invited through advertisement



Chapter 12

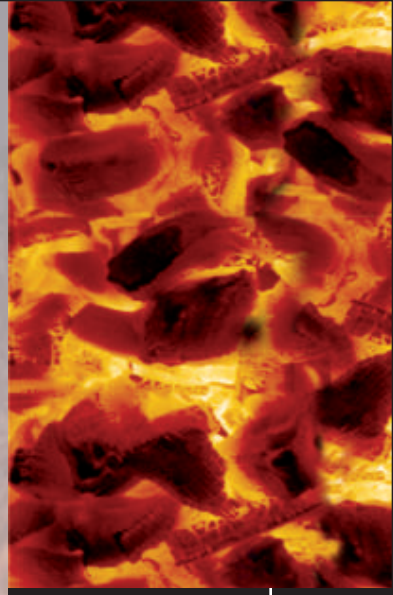
Benefits Of Indigenous Coal Development

It is useful to summarize the reasons for development of indigenous coal in Pakistan. In terms of energy content, Pakistan's coal is its largest fossil energy resources. At present, these coal resources are perhaps a thousand times greater than known natural gas resources in terms of energy content and have the largest potential for continuing future electricity supplies. Although Pakistan has coal resources in all its four provinces, more than 95% are in Sindh. The development of indigenous coal will provide the following benefits.

- Electricity generation at large scale and may be at low cost
- Reduction of foreign exchange imbalance
- Allocation of domestic natural gas for other priority industrial uses, such as petrochemical and fertilizers
- Availability of indigenous coal for making bricks, cement and smokeless coal briquettes for domestic use to prevent deforestation
- Increased employment opportunities
- Self-sufficiency in energy supply
- Generating revenue for economic development and poverty elimination
- Development of underdeveloped areas
- Development of infrastructure set-up in the country
- Manufacturing of indigenous mining and power plant machinery and equipment
- Transfer and adaptation of modern mining technology, gaining mechanized mining experience, availability of trained mining personnel and development of coal-mining industry in Pakistan
- Multiplier effect by creating a number of support industries and providing additional employment for skilled labor

- Reduction in demand for imported fuel which drains the foreign exchange resources of Pakistan
- Security from interruption of energy supplies and protection from international oil price fluctuations
- Production of methanol and synthetic natural gas by coal gasification
- Opportunities for foreign investment and joint venture activity in the country
- Gasification including insitu gasification of coal for power generation
- Extraction of coal-bed methane for power generation and other industrial use
- Production of liquid fuel from coal

The aforementioned benefits indicate the importance of indigenous coal development for Pakistan. These expected benefits and presence of enormous coal resources provide great opportunities for investors to invest in the coal sector as well as in the development of coal-related infrastructure in Pakistan. Prospective investors can now feel secure in investing in any large-scale coal and coal power projects in Pakistan since a sizeable market for coal and attractive incentives are available through the one-window facility provided by PPIB.



Power Generation Potential Of Indigenous Coal Resources

Chapter 13

13.1 Introduction

The bulk of Pakistan's indigenous coal resources lie in Sindh. The largest reserve, 175 billion tonnes of lignite coal, is located in the Thar Desert of Sindh. Thar coal is yet to investigated and developed for mining and power generation. In addition to this, there are lignite coal reserves in Lakhra, Sonda, Indus East and other coalfields of Sindh. The Lakhra coal field is thoroughly investigated and developed. Several public and private mining companies are mining coal from Lakhra. It has been confirmed that Lakhra coal is suitable for power generation. A 150 MW FBC plant is currently being operated by WAPDA on Lakhra coal. The Sonda and other coal-fields of Sindh are yet to be investigated and developed.

In Balochistan and Punjab, coal has been continuously mined since before independence. Good quality Sub-bituminous coal is available in various coalfields of Balochistan and Punjab, which coalfields are considered suitable for power generation. Some small coal reserves are also located in NWFP and AJK, and are being mined on a small scale.

On the basis of available mineable coal reserves, a tentative estimate of power generation potential and quantity of required coal is set forth herebelow:

COAL FIELDS	GENERATION POTENTIAL	CONSUMPTION Million Tonnes/Year

13.2 Sindh

Thar	100,000 MW	536.00
Lakhra	1,000 MW	4.60
Sonda	500 MW	2.30

13.3 Balochistan

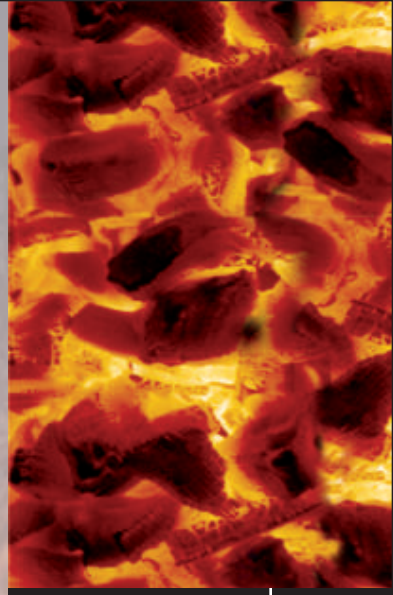
Sor- Range-Degari	50 MW	0.13
Sharigh-Khost	50 MW	0.13
Mach	25 MW	0.06
Duki	25 MW	0.06

13.4 Punjab

Salt-Range	80 MW	0.35
Makarwal	50 MW	0.13

13.5 NWFP

Hangu/Cherat	10 MW	0.03



Coal Fired Power Plant Planning And Design Issues

Chapter 14

14.1 Introduction

Developers of coal fired power stations need to have coal quality data to ensure that the plant is designed and built according to actual coal available to be burnt. Hence, coal as fuel is purchased to satisfy the design specification. Therefore, the planning exercise is essential for achieving a cost-effective, quality power plant. The power plant usually has a designed life of 25 to 30 years. The value of coal to be consumed during the lifetime of a base-load plant will be approximately the original total cost of the station. It is therefore important to select the design coal to ensure low capital and operating cost, and its availability over the entire life of the power plant. Operating and maintenance cost capitalized over the life of the plant amounts to about 30% of coal costs in case of domestic coal. The following planning activities are essential in the early stages of a coal-fired power plant project.

- Confirmation of coal reserves / long-term supplies
- Coal quality
- Coal price
- Coal transport and storage
- Coal combustion
- Furnace ash and fly ash collection/disposal
- Environmental considerations
- Cooling water
- Topography and geology
- Land requirements
- Climate
- Political and legal considerations

14.2 Coal

The coal purchaser ensures that adequate economically extractable coal reserves are available if a long-term contract is desired. The following coal properties are needed

- Proximate analysis
- Ultimate analysis
- Ash analysis
- Mineral matter analysis
- Ash fusion temperature
- Grindability
- Abrasiveness
- Coal size distribution
- Reactivity
- Hardness
- Handleability
- Ash and dust size distribution
- Dust resistivity
- Specific energy
- Delivery cost

14.2.1 Specific Energy

The specific energy is dependent on composition of the coal, indicated by the ultimate analysis, and is adversely affected by the moisture and ash content. The volatile matter is of key interest in determining the coal's reactivity and ignitability. Low volatile coal requires long burnout time and ignition support at certain loads. Coal having less than 18% volatile would requires special boilers using down- shot firing to provide turbulence and longer furnace residence time.

14.2.2 Ash Content

Ash content has an adverse effect on the power plant and its costs. An increase in ash content results in a direct decrease of specific energy. It then requires a greater quantity of coal to be handled by the coal plant, boiler, electrostatic precipitators and ash plant, and results in a larger and costlier plant and increased O& M cost once the plant is in service. Ash is responsible for erosion problems in boiler pressure parts and ducts, resulting in increased O & M cost and loss of availability. The effects of a 1% increase of ash content in coal increases O & M cost and plant costs by US$ 0.2 million per year and capital costs by 4%, whereas it reduces plant availability.

14.2.3 Moisture Content

The total moisture in coal includes the inherent and surface moisture, which directly affects its specific energy and efficiency of the boiler due to loss of latent heat of water with the flue gas. An increase of 1% moisture drops boiler efficiency by 1%. A greater volume of coal is also required, affecting the O & M cost and capital cost of the plant. The dust collecting plant, ash plant and boiler plant are also affected by the increase in moisture of the coal. An increase of 1% of moisture in design coal, increases the capital cost of the power plant by 0.4%.

14.2.4 Sulfur

The sulfur content is also an important factor in coal quality, mainly for corrosion and environmental reasons. Coal with low sulfur content can be used without a desulphurization plant.

14.2.5 Ash Analysis

The composition of ash determines its slagging and fouling effects, its abrasiveness and coating of heating surfaces of the furnace and convection areas of boiler.

14.2.6 Ash Fusion Temperature

Ash fusion temperature provides an important index for evaluation of slagging characteristics of the ash and determining furnace size and heating surfaces

14.3 Water

Thermal power stations using evaporator-cooling systems require 12 to 15 million liters (ML) of water annually per installed MW of capacity. A 2,800 MW power station will therefore require a reliable source of water of up to 40,000 ML per year (110 ML/day), depending on local conditions. Approximately 90% of this is lost by evaporation. This water can be of low quality, such as brackish or sea water. Dry cooling systems avoid this loss, but are most costly to install and will increase coal consumption over the life of the plant by about 2% for mild climates and up to 10% in very hot regions.

14.4 Geotechnical

Geotechnical considerations are of great significance for a proper foundation and civil works design. Failure of civil structures during the life of the plant can have severe implication in terms of ability of the plant to continue service.

14.5 Topography and Climate

The availability of good topographic mapping during planning is essential. It is used to perform early evaluation of dam sites for water supply and ash disposal purposes. The climate data, together with background dust, SOx, noise and other environmental data are necessary. It is also necessary to install fixed monitoring and automatic recording equipment at suitable intervals across the proposed site. Boilers performance is sensitive to ambient temperatures. The design of footings and structure of a large plant must take wind loading into account.

14.6 Environment

It is necessary to conduct a number of site studies for a new coal power station project, to determine the following:

- Existing flora and fauna
- Existence of archaeological remains
- Background noise levels
- Natural water mechanism and water qualities
- Marine life in rivers, lakes or sea, in areas likely to be affected
- Background dust levels and air quality
- Natural water temperatures

14.7 Site Selection

The site for a new coal power station is selected by balancing economics and environmental acceptability. The following factors must be considered:

- Coal characteristics, supply arrangements and on-site storage arrangement
- Cooling water system
- Water supply arrangements
- Topography and availability of land
- Climate
- Proximity to transmission line
- Availability of human resources, service industry, construction materials and infrastructure
- Geotechnical conditions
- Seismic conditions
- Environmental issues

14.8 Coal Handling Plant

Coal may be delivered by train, road, trucks and conveyors. Coal transport, storage, stockpiling and reclaiming can be achieved using a wide range of types and plant configurations. It is however essential to design a simple coal handling plant with the least number of transfers. The design can be based on an extensive use of bulldozers and scrapers to make stockpiles and reclaimation to meet long-term and short-term requirements. Extensive use of bins, hoppers or bunkers with automatic filling and

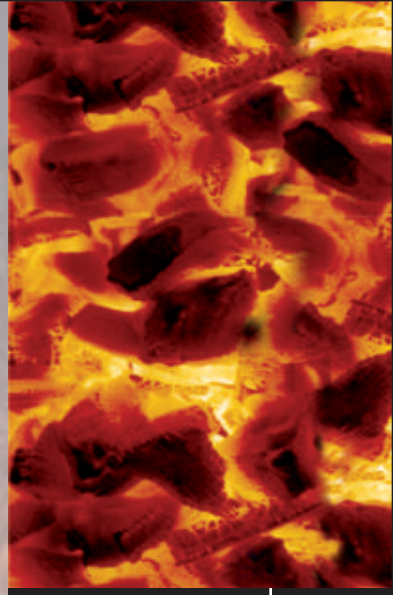
discharge facilities can also be an alternative. The storage capacity should be for a three-month supply of coal at the power plant. At the stock yard, good drainage need to be built, and spontaneous combustion requires provision for compact coal for long-term storage and fire detection equipment.

14.9 Ash Collection Plant

Two types of ash collection are used, i.e. electrostatic precipitators and fabric filters. For high sulfur coal, a wet scrubber can also be used. The selection depends on the ash content, ash perceptibility, gas temperature, sulfur content and allowed dust control limits.

14.10 Ash Disposal

Wet ash disposal systems are being currently used in most power stations, however, dry ash disposal systems are also adopted in various plant. The ash disposal cost is proportional to the ash content. For coal with 20% ash, the disposal cost may amount to US$ 2 per tonne of ash. Reduction of the ash content to 10%, may save 20 cents/tonne of coal handled. Ash can be disposed of in open-cut mines and in disposal ponds. Ash is also commercially used as a road building material as well as in agriculture and land fills. Fly ash for commercial use is transported dry by pipeline or road tanker. Fly ash for waste disposal may be pumped as slurry.



Coal Mine Development Requirements

Chapter 15

The following are the requirements for developing a coal-mine by both under- ground and open-cut mining methods in a new coalfield.

15.1 Preliminaries

- Procurement of prospecting / mining lease area
- Exploration and estimation of coal reserves:- Close space drilling (coring & non-coring) and confirmation of coal reserves for long term supply
- Feasibility Study: Determination of coal mineability, coal quality analysis, ground water conditions and hydrogeology, geotechnical analysis of coal and coal-bearing strata; i.e. over-burden/inter-burden on coal beds, number of coal beds and thickness of each, dip of beds, hardness, quality of coal and its calorific value, cost of coal and its area of utilization, mine design and planning, infrastructure requirement such as roads, power & water supply etc., market and transportation of coal, environmental concern, availability of skilled and unskilled labor, capital and mining cost, availability of funds.

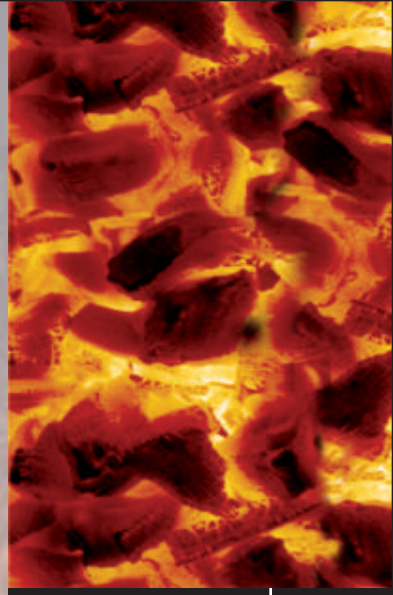
15.2 Development of Underground Mine

- Purchase of land, site development and services
- Drilling and blasting arrangement
- Access to coal deposits (drifts, vertical/inclined shafts, tunnels)
- Development of galleries, cross-cuts, road-ways etc.
- Men, materials and machinery-handling facilities
- Development of coal working faces (log-wall/ short-wall faces)
- Coal handling and transportation facilities (rail track, locomotives, mine cars, conveyors, skips, chutes, haulages etc.)

- Installation of mining machineries (shearer, continuous miner, road headers, roof bolters, shuttle cars, gate conveyors, chain conveyors etc.)
- Roof support arrangements (shield support, hydraulic support, hydraulic jack, steel arches, rock bolters, timber support etc.)
- Electrical equipment (cables, transformer etc.)
- Mine health and safety equipment (gas detectors, self rescuers, breathing apparatus, first-aid etc.)
- Mine water-handling equipment (water pumps, pipes etc.)
- Mine lighting and communication arrangements
- Installation of equipment at surface (compressors and compressed air supply arrangements, work shop, store, battery charging house, power supply, circuit breaker, surface haulages timber yard, mine rescue station, dispensary etc.)
- Coal storage yard
- Coal washing plant
- Coal refuse and tailing disposal area
- Mine office and administration building
- Housing colony for labor and staff

15.3 Development of Open-Pit Mine

- Purchase of land, site development, site services, surface work and temporary housing
- Mine planning and layout:
    1. Number of coal-beds, thickness of each coal-bed, thickness of over-burdens / inter-burdens
    2. Coal/rock ratio, pit size, strip length and depth
    3. Recovery percentage
    4. Life of mine
    5. Capacity of coal production per year
    6. Number and size of equipment
    7. Economy of scale, using large capacity machines
    8. Redundancy and maneuverability of machine
    9. Availability of spares, repair and maintenance facilities
    10. Capital investment
- Mining Equipment and Combination:
    1. Scrapers and Pushing Bulldozers
    2. Front End Loaders and Trucks
    3. Hydraulic Shovels / Back-Hoes and Trucks
    4. Face Shovels and Trucks
    5. Bucket Wheel Excavators
    5. Dragline and Shovels
- Drilling and blasting arrangement
- Magazine house and transportation arrangement for explosives
- Removal of over-burden/inter-burden with Walking Dragline to expose coal beds and deposition of rock materials on the surface in systematic order
- Coal cutting and transportation from pit to storage area using Belt- Conveyors, Front End Loaders and Self-Dumping Trucks
- Compressors and compressed air supply arrangement
- Electricity supply and electrical equipment
- Water Pumps and accessories
- Communication system and lighting arrangement
- Work-shop for repair and maintenance
- Mining machinery and equipment storage yard
- Coal washing plant
- Dispensary
- Housing for labor and staff



Environmental Consideration

Chapter 16

16.1 National Environmental Quality Standards (NEQS)

PEPA has established the following NEQS relating to Industrial Gaseous Emission and Liquid Industrial Effluents.

Parameter	Source of Emission	Standards
Industrial Gaseous Emission		
Smoke	Not to exceed	40%
Particulate matter		
(Based on 10 micron size)	Boilers & Furnaces:	
	(i) Using Oil	300 mg/Nm3
	(ii) Using Coal	500 mg/Nm3
	(iii) Cement Kilns	200 mg/Nm3
	(iv) Blast Furnaces	500 mg/Nm3
Hydrogen Chloride	Any	400 mg/Nm3
Chlorine	Any	150 mg/Nm3
Hydrogen Fluoride	Any	150 mg/Nm3
Hydrogen Sulfide	Any	10 mg/Nm3
Sulfur Oxides	Sulfuric Acid Plants	400 mg/Nm3
Carbon Monoxide	Any	500 mg/Nm3
Lead	Any	50 mg/Nm3
Mercury	Any	10 mg/Nm3
Cadmium	Any	20 mg/Nm3
Arsenic	Any	20 mg/Nm3
Copper	Any	50 mg/Nm3
Antimony	Any	20 mg/Nm3
Zinc	Any	200 mg/Nm3
Oxides of Nitrogen (NOx)	Any source	400 mg/Nm3

Liquid Industrial Effluents

Temperature	40 degree C
pH value	6 – 10 pH
Total suspended solids	150 mg/L
Total dissolved solids	3,500 mg/L
Grease and oil	10 mg/L
Chloride	1,000 mg/L
Fluoride	20 mg/L
Cyanide	2 mg/L
Sulphate	600 mg/L
Sulphide	1.0 mg/L
Ammonia	40 mg/L
Cadmium	0.1 mg/L
Chromium	1.0 mg/L
Copper	1.0 mg/L
Lead	0.5 mg/L
Mercury	0.01 mg/L
Selenium	0.5 mg/L
Nickel	1.0 mg/L
Silver	1.0 mg/L
Total toxic metal	2.0 mg/L
Zinc	5.0 mg/L
Arsenic	1.0 mg/L
Barium	1.5 mg/L
Iron	2.0 mg/L
Manganese	1.5 mg/L
Boron	6.0 mg/L
Chlorine	1.0 mg/L

16.2 Amendment in National Environmental Quality Standards

Power plants using oil or coal as fuel will comply with the NEQS except for emission of Sulfur Dioxide and Nitrogen Oxides, where the following standard will apply.

A. *Sulfur Dioxide (Sulfur Background Levels: Microgram/ cubic meter)*

Background Air Quality (S02 Basis)	**Annual** average	**Max. 24-hour** Interval	**Criterion-1** Max. SO2 Emission (TDP)	**Criterion-2** maximum allowable ground level increment to ambient (mg/m3) 1yr. average
Unpolluted	< 50	< 200	500	50
Moderately Polluted				
Low	50	200	500	50
High	100	400	100	10
Very Polluted	>100	400	100	10

B. Nitrogen Oxide

Ambient air concentrations of nitrogen oxides should not exceed:

Annual Arithmetical Mean:- 100 microgram/cubic meter (0.05 ppm)

Emission levels for stationary source discharges, before mixing with the atmosphere, should be maintained as follows:

For fuel fired steam generators (10 – 9) gram per Joule of heat input

Gaseous fossil fuel	86
Liquid fossil fuel	130
Solid fossil fuel	300
Lignite fossil fuel	260

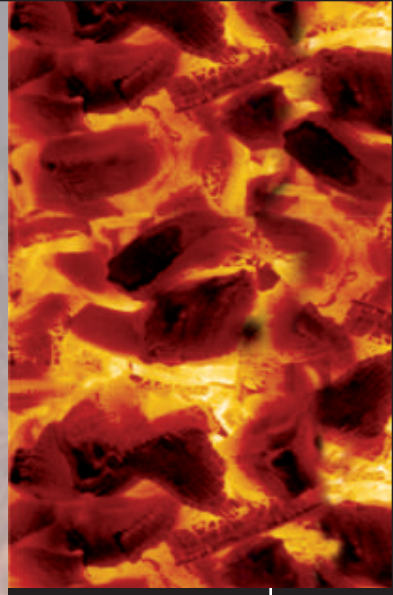
16.3 Environmental Criteria Applicable for Coal-Fired Power Plant

The following criteria are applicable for coal-fired power plants are developed from the World Bank Environmental Guidelines and with coordination between the World Bank Office of Environmental Affairs, USAID, WAPDA and the feasibility contractors.

Parameters	Criteria
	Emissions
Air	Sulfur dioxide: 454 Metric tons/day (500 tons/day/unit) at 85% capacity Factor Particulates: 100 micrograms/cubic meter Nitrogen oxide (NOx): 260 microgram/joule (0.6 lb/Million Btu)
	Ambient Quality
	Sulfur dioxide: 100 microgram/cubic meter annual average and 500 microgram/ cubic meter maximum daily average Particulate: 100 microgram/cubic meter annual geometric mean and 500 microgram/cubic meter maximum daily average Nitrogen dioxide: 100 microgram/cubic meter annual average
Water and Land	No specific limitation, but general restriction on affecting health and welfare
Noise	Noise level (annual average) required for protection of public health and welfare recommended in World Bank Guidelines
Social and Cultural	Secondary growth effects to the general population shall be addressed and impacts to tribal people shall be mitigated
Occupational	World Bank Occupational Health and Safety Guidelines for Power Plants, coal and fuel oil

16.4 Environmental Criteria Applicable to Coal Mines

Parameters	Criteria
Air	Ambient Quality for Particulates: 100 mg/m3 annual geometric mean 500 mg/m3 max. 24 – hour average
Land	Surface mine reclamation shall be performed to return lands to conditions capable of supporting prior uses or uses that are equal to or better than prior land use Develop a sedimentation and erosion control plan Cover waste piles
Water	Runoff and drainage limitations: Total Suspended Solids:- 30 – 100 mg/L Total Iron:- 4 – 7 mg/L pH:- 6 – 9 Soluble Toxicants;- None Apply best practicable commercially available technology to minimize, control, or prevent disturbances to surface or underground water quality and quantity

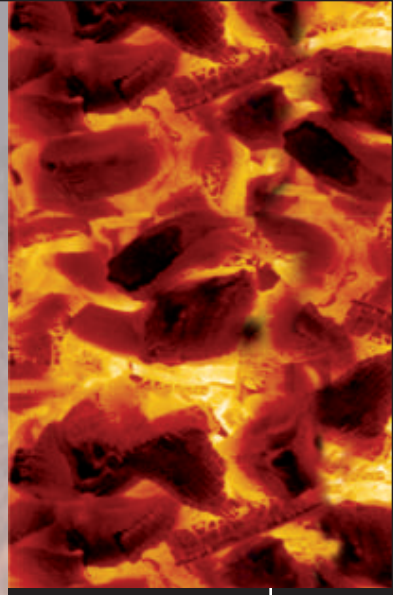


Chapter 17

Why Invest In The Coal Power Sector

Because:

- Pakistan is a coal rich country
- The total coal resource of Pakistan is more than 185 billion tonnes
- Coal deposits are located in all the Provinces of Pakistan and in AJK
- The coal reserves of Pakistan are considered suitable for power generation
- Opportunities are available for utilization of coal in other industries such as cement, bricks kilns, coal gasification and coal briquettes
- Pakistan has a population of about 140 million, and only 40% people have access to electricity, resulting in a large and growing domestic power market
- Government guarantees the performance of the power purchaser
- Government provides protection against political risks and change in law
- Concessionary duties and taxes regime announced by the GOP for the power sector
- One-Window facility provided at Federal level through PPIB, for power projects above 50 MW
- Efficient and cost-effective technical manpower available in coal mining and in the power sector
- Pakistan has successfully attracted four billion dollars from private sector in power generation and world renowned power sector players already operating in Pakistan



How To Set-up A Power Generation Project Based On Indigenous Coal In Pakistan

Chapter 18

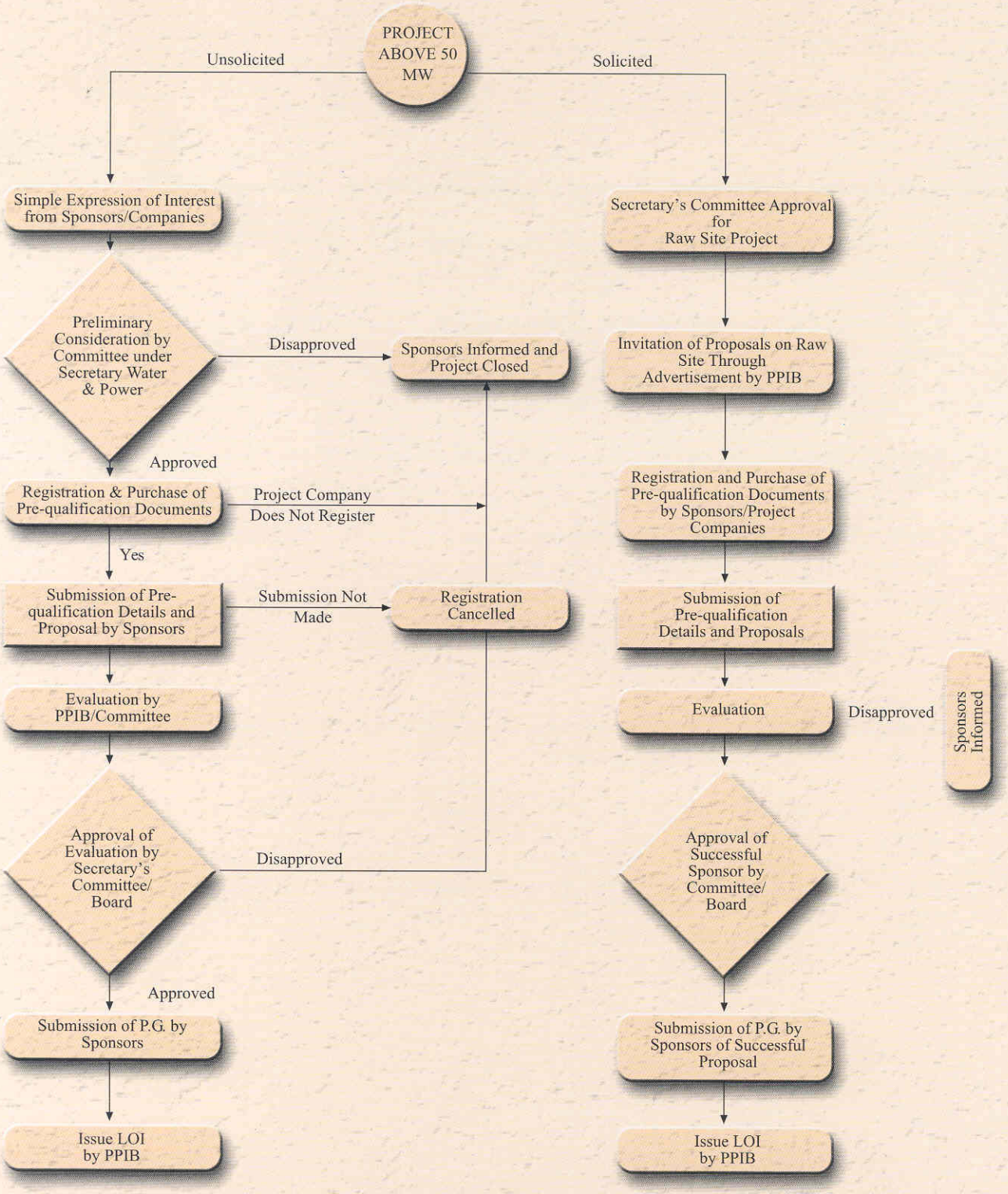
- Contact Provincial Governments/authorities for the development and availability of coal for the proposed power plant
- Apply to concerned Provincial authorities for coal concession or grant of mining lease over a prospective coal bearing area to explore and develop coal independently or in joint venture

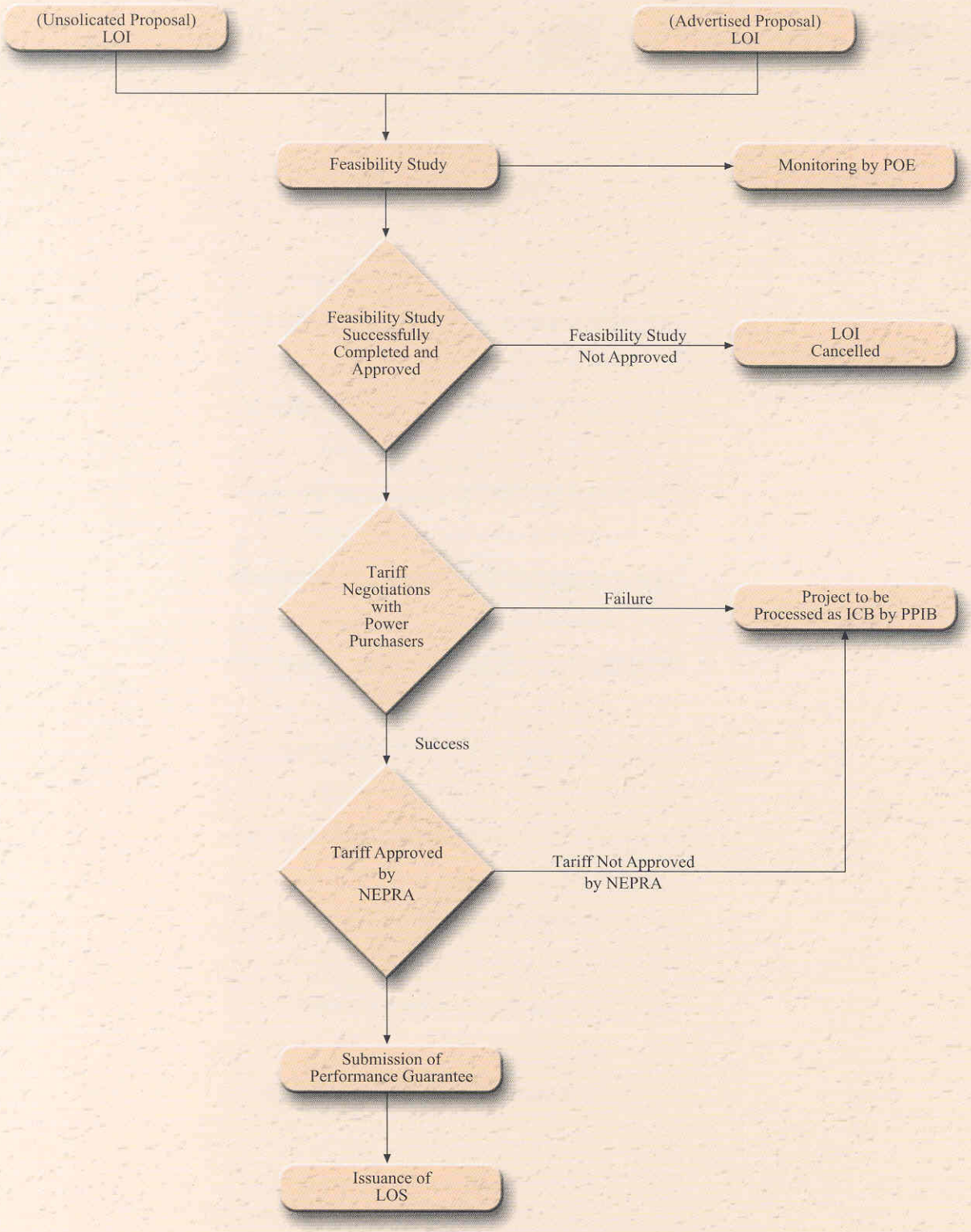
OR

Enter into a long-term Coal Supply Agreement with one or more of the coal producing local firms

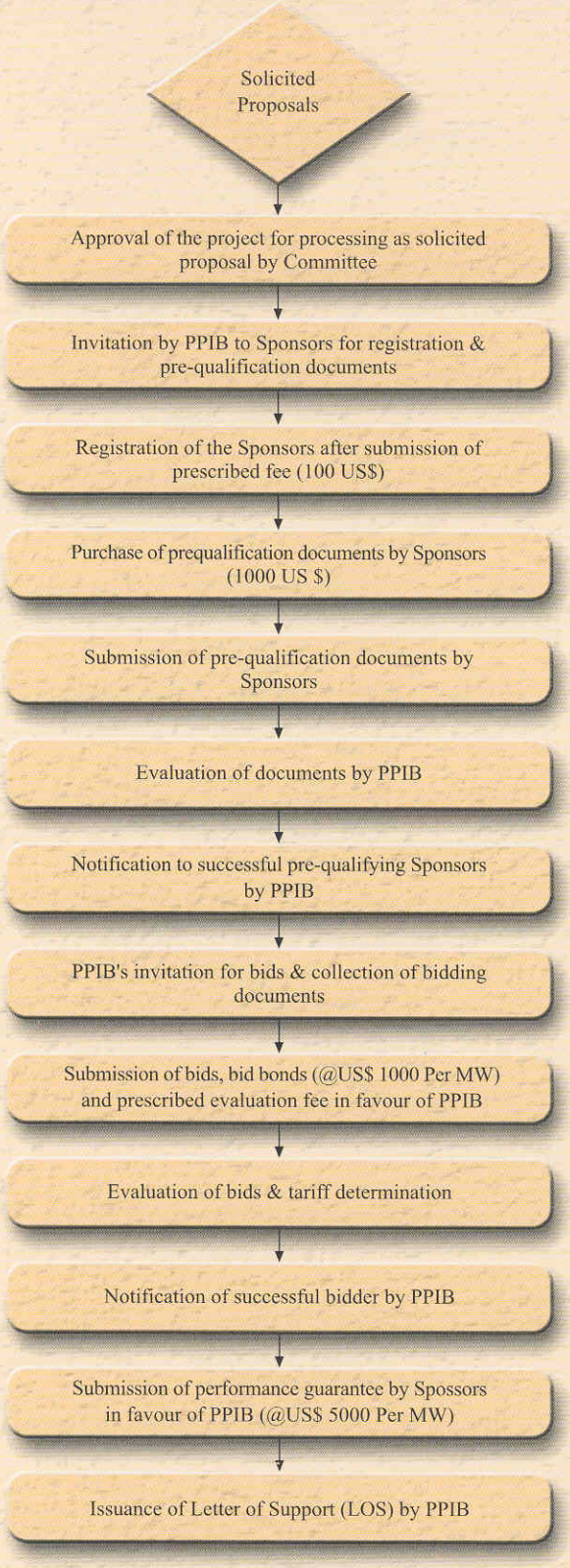
- Contact Provincial Governments for any assistance required in conducting negotiations and finalizing deals with local mining firms, public or private, for production and supply of the required coal
- Work-out agreements/arrangements with the Provincial Governments/authorities on the provision of infrastructure support required for the coal mining project
- Submit the power generation proposal with capacity above 50 MW to PPIB according to the procedure laid down in the Power Policy 2002
- Small power plants of up to 50 MW capacity will be implemented at a one-window facility available at the Provincial level
- Procedure for submitting proposals or bids to PPIB are given below in flow-diagrams in next pages

Graphical Presentation for Processing of Projects above 50 MW for Raw Site




(Unsolicated Proposal)
LOI
(Advertised Proposal)
LOI
Feasibility Study
Monitoring by POE
Feasibility Study
Successfully
Completed and
Approved
Feasibility Study
Not Approved
LOI
Cancelled
Tariff
Negotiations
with
Power
Purchasers
Failure
Project to be
Processed as ICB by PPIB
Success
Tariff Approved
by
NEPRA
Tariff Not Approved
by NEPRA
Submission of
Performance Guarantee
Issuance of
LOS

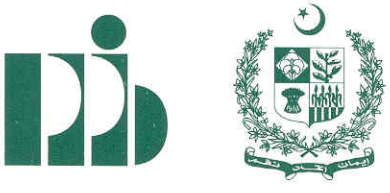
Graphical Presentation for Processing of Solicited proposals



PAKISTAN – THE BASIC FACTS

Official Name	Islamic Republic of Pakistan
Capital	Islamabad
Area	803,940 sq. kilometers
Location	South Asia
Geographic Coordinate	30 00 N, 70 00 E
Climate	Hot & humid summer, dry & cold winter
Population	148.72 millions
Population growth rate	3.1%
Religion	Islam (Muslims 97%)
Languages	English/Urdu
Currency	Rupee (US$ 1 = 58.45: May 31, 2004)
Sea ports	Karachi, Port-Qasim, Gawadar & Pasni
Dry ports	Lahore, Rawalpindi, Sialkot, Faisalabad, Peshawar and Quetta
International airports	Karachi, Lahore, Islamabad, Peshawar and Quetta
Inflation	3.9%
Per capita income	US$ 652
Growth rate of GDP	6.4%
Growth rate of manufacturing	17.1%
Labor force	45.05 million
Labor force in mining & manufacturing	11.25%
Unemployment rate	8.27%
Number of companies incorporated	43,000
Listed companies	700+
Foreign firms	600+
Export	US$ 10 billion
Import	US$ 12 billion
FDI	US$ 629.1 million
Cargo handled at Karachi port	26.7 million tonnes
Cargo handled at Port Qasim	13.2 million tonnes
Roads	257,683 kilometers
Motor vehicle registered	786,907
Railway tracks	7,791 kilometers
Telephones	4.28 million connections
Number of Post Offices	12,234
Number of Telegraph Offices	362
Internet Connection	1.7 million

We Welcome Private Investors To Join Hands With Us To Develop Pakistan's Coal & Power Sector For Mutual Benefit



Private Power and Infrastructure Board
Ministry of Water & Power
Government of Pakistan
50 Nazimuddin Road,
F-7/4, Islamabad, Pakistan
Tel: (92-51) 9205421, 9205422
Fax: (92-51) 9217735, 9215723
Website: www.ppib.gov.pk
Email: ppib@ppib.gov.pk

Private Power and Infrastructure Board
Ministry of Water & Power
Government of Pakistan