CHAPTER 9 CONSIDERATIONS REGARDING ENVIRONMENTAL MATTERS

9-1 Basic Conception of Environmental Matters

In construction of a thermal power station, the environmental matters to be considered are those such as the environment of the construction site and its surrounding area, living conditions, reliability of technology of pollution control equipment, construction cost, etc., which are to be subjected to overall judgment, upon which the most effective and economical pollution control measures should be implemented. In this Project, seen from the present state of the construction site, it is thought an air pollution control measure and a waste water countermeasure will be needed in construction of this power station.

9-2 Air Pollution Control Measure

The factors for air pollution which must be given the utmost consideration in case of a coal-fired thermal power station are dust and soot (SO_x).

9-2-1 Dust Countermeasures

Since the coal to be used at this thermal power station is of relatively low calorific value, in addition to which the content of ash in the coal is high so that there will be a large quantity of ashes produced upon combustion of the coal, there is a necessity to prevent floating dust.

In general, of the ashes produced at a pulverized coal-firing boiler, about 15% is fused and deposited at the clinker hopper, and about 5% is deposited at the economizer hopper and the air preheater hopper as cinder ash of large particle size, but the remaining 80% becomes fly ash of small particle size and is hauled to the flue beyond the air preheater so that it is necessary for this to be collected as much as practicable to prevent diffusion in the atmosphere.

For collection of fly ash, electrostatic precipitators will be installed for the reasons given in Chapter 5, and since the ash of the coal to be used at this thermal power station is of extremely high electrical resistivity, the countermeasures stated in Chapter 5-4-7(8) should be taken.

9-2-2 Soot Countermeasures

The coal to be used for this thermal power station has a sulfur content in fuel of 7.1% which is an extremely high value, and it can be expected that the concentration of sulfur oxides in flue gas will be high. The conditions of the site for construction of this coal-fired thermal power station are that educational facilities such as Sind University are at approximately 5 – 7 km to the south, while approximately 18 km to the southeast there is the City of Hyderabad, and, the wind in wintertime blows mainly from northwest. The diffusion of smoke emitted from the stacks of the power station of 300 MW x 1 unit in the Jamshoro area was calculated, using the Bosanquet and Sutton's Formula.

In the calculations, the effective height of a stack is calculated by the theoretical formula of Bosanquet, and the maximum ground concentration of sulfur oxides and the emergence distance were obtained using the diffusion formula of Sutton. These calculations are widely used throughout the world.

According to the calculation results, in case the wind velocity at the outlet of a stack of the thermal power station is 3 m/sec, a point 29.6 km distant from the point of the discharge has the maximum ground concentration of sulfur oxides, and this value is 0.08 ppm. In case of a wind velocity of 6 m/sec, a point 13.9 km away will be the point indicating the maximum ground concentration, and this value is 0.144 ppm.

The ground concentration of flue gas to be contained in sulfuric oxides has been studied with regerence to the regulations set forth in the U.S. Federal. The ground concentration provided for in the U.S. Federal is 0.03 ppm at a year value and 0.14 ppm at a 24 hours value, respectively.

However, the results of calculations have proved that a 24 hours value of the ground concentration in the above-mentioned localities would be over the regulated value in the U.S. Federal.

Accordingly, it will be essential that a flue gas desulfurization plant be provided in order to reduce the ground concentration of sulfuric oxides to values less than those set forth in the U.S. Federal.

Since the quantities of sulfuric oxides to be reduced are small, design has been made on the flue gas desulfurization plant so that the said plant may have a capacity of treating half of flue gas from economical standpoints.

In case the flue gas desulfurization plant with half capacity should be provided, the maximum ground concentration of sulfuric oxides would be 0.042 ppm at a wind velocity of 3 meters and 0.079 ppm at a wind velocity of 6 meters, respectively. Thus, if such a plant is furnished, the ground concentration of sulfuric oxides will be below a 24 hour value of 0.14 ppm regulated in the U.S. Federal.

Results of Calculations of Effective
Stack Height and Concentration of SO_x

(1) Planning Condition

1)	Capacity	300 MW x 1 unit
2)	Coal Calorific Value (Gross Calorific Value)	4,613 Kcal/kg (Air Dry Base)
3)	Inherent Moisture	9.5%
4)	Ash	23.7%
5)	Sulfur	7.1%
6)	Hydrogen	3.5%
7)	Gross Thermal Efficiency (Generator End)	37%
8)	Wind Velocity	3 m/s and 6m/s (20°C)
9)	Excess Air, O_2	1.31 (O_2 = 5%)
10)	Stack Height	150 m

(2) Effective Stack Height using Bosanquet Theoretical Formula

1) Theoretical Air Quantity

$$A_o = 1.01\frac{H\ell}{1{,}000} + 0.5 \ (Nm^3/kg)$$

where

A_o: Theoretical air quantity (Nm^3/kg)
$H\ell$: Net Calorific value (Kcal/kg)
= Hh − 600 (9h + W)
= 4,367 Kcal/kg
Hh: Gross calorific value (Kcal/kg)
h: Hydrogen content (%)
W: Water content

$$\therefore A_o = 1.01\frac{4{,}367}{1{,}000} + 0.5$$
$$= 4.91 \ (Nm^3/kg)$$

2) Theoretical Combustion Gas Quantity

$$G_o = \frac{0.89\ H\ell}{1{,}000} + 1.65 \ (Nm^3/kg)$$

where

G_o: Theoretical combustion gas quantity (Nm^3/kg)

$$\therefore G_o = \frac{0.89 \times 4{,}367}{1{,}000} + 1.65$$
$$= 5.54$$

3) Actual Combustion Gas Quantity

$$G_W = G_o + (m - 1)A_o \ (Nm^3/kg)$$

where

G_W: Wet gas quantity (Nm^3/kg)
m: Excess air ratio 1.31

$$\therefore G_W = 5.54 + (1.32 - 1) \times 4.91$$
$$= 7.06 \ (Nm^3/kg)$$

$$G_D = G_W - \frac{V}{g}(9h + W)$$

where

V: Vapor volume at standard condition
g: Molecular weight of water
G_D: Dry gas quantity (Nm^3/kg)

$$\therefore G_D = 7.06 - \frac{0.224}{18}(9 \times 3.5 + 9.5)$$

$$= 6.55$$

4) Coal Consumption

$$W_{CD} = \frac{300\ MW \times 860}{4{,}613 \times 0.37}$$

$$= 151.2\ t/h$$

where

W_{CD} : Consumption of air dried coal

$$W_{CW} = W_{CD} \times \frac{Coal\ \%\ (Air\ Dried\ Base)}{Coal\ \%\ (AS\ Received\ Base)}$$

$$= 151.2 \times \frac{90.5}{75} = 182.5\ t/h$$

5) Exhaust Gas Quantity

$$Q_D = 151.2 \times 6.55 \times 10^3$$
$$= 990.36 \times 10^3\ (Nm^3/h)$$

where

Q_D : Dry exhaust quantity (Nm^3/h)

$$Q_W = 182.5 \times 7.06 \times 10^3$$
$$= 1{,}288.5 \times 10^3\ (Nm^3/h)$$

where

Q_W : Wet exhaust quantity (Nm^3/h)

6) Effective Stack Height

a) Exhaust Gas Quantity at Outside Air Temperature of 20°C (m^3/s)

$$Q_{V1} = \frac{1{,}288.5 \times 10^3 \times (273 + 20)}{3{,}600 \times 273}$$

$$= 384.1\ m^3/s$$

where

Q_{V1} : Exhaust gas quantity at outside air temperature of 20°C

Gas discharge velocity from stack $V_g = 30$ m/s
Wind velocity $U = 3$ m/s and 6 m/s

b) Height of Momentum Rise of Discharged Smoke

$$Hm = \frac{4.77}{1 + \frac{0.43U}{V_g}} \times \frac{\sqrt{Q_{V1} V_g}}{U}$$

where

Hm: Height of momentum rise of discharged smoke (m)

In case of U = 3 m/s

$$\therefore Hm = \frac{4.77}{1 + \frac{0.43 \times 3}{30}} \times \frac{\sqrt{384.1 \times 30}}{3}$$

$$= \frac{4.77}{1.043} \times 35.8$$

$$= 163.7 \text{ m}$$

In case of U = 6 m/s

$$\therefore Hm = \frac{4.77}{1 + \frac{0.43 \times 6}{30}} \times \frac{\sqrt{384.1 \times 30}}{6}$$

$$= \frac{4.77}{1.086} \times 17.9$$

$$= 78.6 \text{ m}$$

c) Height of Buoyancy Rise of Discharged Smoke

$$Ht = 6.37 g \frac{Q_{V1} \Delta T}{U^3 T_1} (\log_e J^2 + \frac{2}{J} - 2)$$

$$J = \frac{U^2}{\sqrt{Q_{V1} V_g}} (0.43 \sqrt{\frac{T_1}{g(d\theta/dZ)}} - 0.28 \frac{V_g \ T_1}{g \ \Delta T}) + 1$$

where

ΔT: Difference between exhaust gas temperature and outside air temperature (T_1 = 20°C)

g: Acceleration of gravity 9.81 (m/s²)

$d\theta/dZ$: Temperature gradient of atmosphere 0.0033 (°C/m)

In case of U = 3 m/s

$$J = \frac{3^2}{\sqrt{384.1 \times 30}} (0.43 \sqrt{\frac{273 + 20}{9.81 \times 0.0033}} - 0.28 \frac{30(273 + 20)}{9.81 \times 120} + 1$$

$$= \frac{9 \times 38.8}{107.3} + 1$$

$$= 4.3$$

$$Ht = \frac{6.37 \times 9.81 \times 384.1 \times 120}{3^3 \times 293}(\log_e 4.3^2 + \frac{2}{4.3} - 2)$$

$$= \frac{4,003,582}{7,911}(2.92 + 0.47 - 2)$$

$$= 506.1 \text{ m}$$

In case of U = 6 m/s

$$J = \frac{6^2}{\sqrt{384.1 \times 30}}(0.43\sqrt{\frac{273 + 20}{9.81 \times 0.0033}} - 0.28\frac{30 \times 293}{9.81 \times 120}) + 1$$

$$= \frac{36 \times 38.8}{107.3} + 1$$

$$= 14.0$$

$$Ht = \frac{6.37 \times 9.81 \times 384.1 \times 120}{6^3 \times 293}(\log_e 14.0^2 + \frac{2}{14.0} - 2)$$

$$= \frac{9,850,541}{63,288}(5.28 + 0.14 - 2)$$

$$= 155.6 \text{ m}$$

d) Effective Stack Height

$$He = H_o + 0.65(Hm + Ht)$$

where

He: Effective stack height (m)
H_o: Actual stack height (m)

In case of U = 3 m/s

$$He = 150 + 0.65(163.7 + 506.1)$$
$$= 585.4$$

In case of U = 6 m/s

$$He = 150 + 0.65(78.6 + 155.6)$$
$$= 302.2$$

(3) SO_2 Gas Concentration C_{max} at Maximum Ground Concentration and Emergence Distance X_{max} Using Sutton Formula

$$C_{max} = \frac{2Qs}{\pi e u He^2}(\frac{C_z}{C_y}) \times 10^6 K_1$$

$$X_{max} = (\frac{He}{C_z})^{\frac{2}{2-n}} \times 10^{-3}$$

where

C_{max}: Maximum ground concentration (ppm)
X_{max}: Emergence distance (km)
Qs: Discharge quantity of SO_2 at ambient temperature (m^3/s)
Cz: Sutton's diffusion parameters (Vertical) = 0.07
Cy: Sutton's diffusion parameters (Horizontal) = 0.07
N: Meteorological parameter = 0.25
Kt: Dilution parameter = 0.15 (one hour value)

1) Without Flue Gas Desulfurization Plant

$$Qs = 151.2 \times 7.1/100 \times 22.4/32 \times (273 + 20)/273 \times \frac{1}{3,600} \times 10^3$$

$$= 2.24\ m^3/sec.$$

In case of U = 3 m/s

$$C_{max} = \{2 \times 2.24/\pi e \times 3 \times (585.4)^2\} \times \frac{0.07}{0.07} \times 10^6 \times 0.15$$

$$= 0.08\ ppm$$

$$X_{max} = (585.4/0.07)^{\frac{2}{2-0.25}} \times 10^{-3}$$
$$= 29.6\ km$$

In case of U = 6 m/s

$$C_{max} = \{2 \times 2.24/\pi e \times 6 \times (302.2)^2\} \times \frac{0.07}{0.07} \times 10^6 \times 0.15$$

$$= 0.144\ ppm$$

$$X_{max} = (302.2/0.07)^{\frac{2}{2-0.25}} \times 10^{-3}$$
$$= 13.9\ km$$

2) With the Half Scale of Flue Gas Desulfurization Plant Since the desulfurization efficiency is 90%

$$Qs = (\frac{2.24}{2}) + (\frac{2.24}{2}) \times 0.1$$

$$= 1.23\ m^3/sec$$

In case of U = 3 m/s

$$C_{max} = \{2 \times 1.23/\pi e \times 3 \times (585.4)^2\} \times \frac{0.07}{0.07} \times 10^6 \times 0.15$$

$$= 0.042\ ppm$$

$$X_{max} = (585.4/0.07)^{\frac{2}{2-0.25}} \times 10^{-3}$$
$$= 29.6\ km$$

In case of U = 6 m/s

$$C_{max} = \{2 \times 1.23/\pi e \times 6 \times (302.2)^2\} \times \frac{0.07}{0.07} \times 10^6 \times 0.15$$

$$= 0.079 \text{ ppm}$$

$$X_{max} = (302.2/0.07)^{\frac{2}{2-0.25}} \times 10^{-3}$$

$$= 13.9 \text{ km}$$

9-3 Waste Water Countermeasures

Power station drainage is subjected to oil separation, filtration and neutralization treatments.

9-3-1 Classification of Drainage

Power station drainage are generally classified into four categories described below:

(1) Living Drainage
Waste water from toilet, kitchen and washroom

(2) Equipment Drainage
Boiler blow water, equipment washing water, dimineralizer regeneration water

(3) Oil-containing Drainage
Waste water from oil storage house

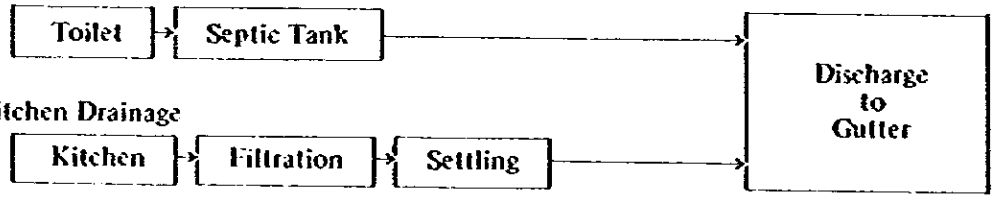
(4) Rainwater Drainage

9-3-2 Lay-out of Treatment of Drainage

Lay-out of treatments of drainage described below:

(1) Living Drainage

1) Toilet Drainage
   a) Central control room
   b) Power house: 1 floor of the power house
   c) Administrative building
   d) Work shop
   e) Coal and ash handling control room
   f) Guard house
   g) etc.

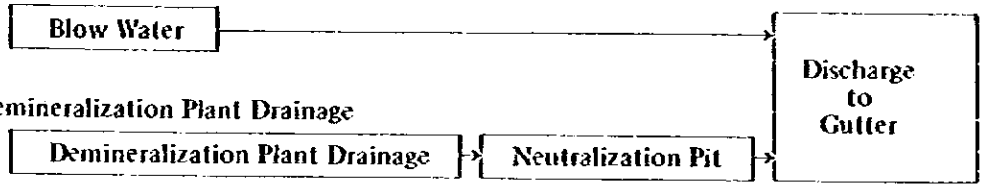


2) Kitchen Drainage

(2) Equipment Drainage

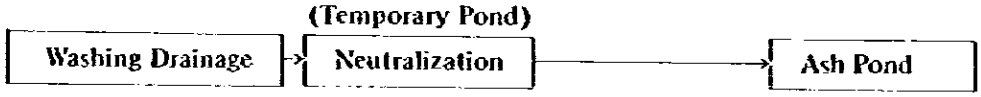
1) Boiler Blow Water

2) Deaerator Blow Water



3) Demineralization Plant Drainage

4) Electrostatic Precipitator, Air Preheater, Stack Washing Drainage, Boiler Chemical Cleaning Drainage



5) Coal Yard Drainage

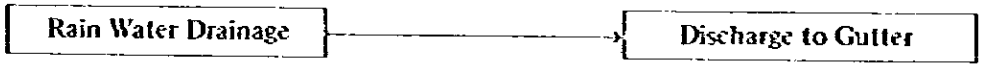
(3) Oil-containing Drainage

1) Oil Storehouse Drainage

2) Bulldozer Garrage Drainage

3) etc.

(4) Rain Water Drainage



ANNEX 1 INFORMATION OF FLUE GAS DESULFURIZATION

(1) History of Sulfur Oxides Emission Regulations

Air pollution is caused by the incursion of such pollutants as oxides of sulfur and nitrogen, particulates, noxious gases, heavy metallic dusts and other materials produced and given off into the atmosphere from factories and similar commercial installations. In addition to these, there are contaminants such as carbon monoxide, NO_X, hydrocarbons, and dust particles given off by automobiles as well as oxidants created secondarily by the above-mentioned pollutants and contaminants.

In Japan, atmospheric pollution was not restricted because it was too late to introduce any anti-pollution measures controlling the emission of these pollutants whereas rapid economic growth effected heavy concentration of industries and population in urban areas.

The electric utility of Japan has expanded proportionally to the economic growth. In particular, the output of thermal power plants has displayed a remarkable increase since the availability of sites for the establishment of hydroelectric plants is now scarce, and the expansion of nuclear power plants has staggered. Consequently, the increase in thermal power generation contributes to the emission of a vast amount of particulates and sulfur oxides to the already polluted atmosphere.

The past trend of controlling the emission of sulfur oxides from thermal power plants in Japan and the measures for pollution control of sulfur oxides are described below.

1) Control of Oxides

The basic Anti-pollution Law enacted in 1969 provided for the environmental standards that are desired to be maintained for the protection of human health and the conservation of life environments and that are a common and practical goal for the various administrative policies which aim at pollution control. The provided standards are shown in Table 1. At the time of its enactment, the Government also established a policy relating to the period and method to attain these environmental standards. The policy was to gradually achieve and maintain these standards according to the degree of air pollution and in compliance with the promulgation of measures. The measures and programs required for the achievement of the standards are given in Table 2.

In 1973, the standards relating to sulfur oxides were revised as seen in Table 1. There was a great difference between the original standards and the revised ones. The latter provided standard values on both a daily basis and an hourly basis while the former standards were based on the average value in a year.

These revised standards are the most stringent in the world. For reference, the environmental standards for various atmospheric contaminants are compared with those of the United States. Federal Standards as shown in Table 3.

Table 1 Comparison of Original and Revised Standards

1969 Standards	1973 Standards
1. Average hourly value in a year should not exceed 0.05 ppm. 2. Number of days in which average hourly value in a day is less than 0.05 ppm should be maintained at more than 70% of the total days of a year. 3. Number of hours during which hourly value is less than 0.1 ppm should be maintained at more than 88% of the total hours of a year. 4. Number of hours during which hourly value is less than 0.2 ppm should be maintained at more than 99% of the total hours of a year.	1. Average hourly value for 24 hours should not exceed 0.04 ppm. 2. Hourly value should not exceed 0.1 ppm.

Table 2 Efforts to Achieve the 1967 Environmental Standards

1. Promotion of measures to reduce sulfur
   a) Stimulation of exploration, exploitation and import of low sulfur crude oil and natural gas
   b) Development and commercial use of desulfurization techniques of heavy oil and flue gas
   c) Encouragement of installation of heavy oil and flue gas desulfurization plants
2. Overall implementation of anti-pollution measures
   a) Planning and implementation of anti-pollution programs
   b) Subsidies to local public entities
   c) Proper use of land
   d) Strengthening of emission control
   e) Consolidation of monitoring system

Table 3 Comparison of Environmental Standards between Japan and U.S.

Contaminant	Japan National	U.S. Federal
Particulates	0.1 mg/m³ (24 hrs.) 0.2 mg/m³ (1 hr.)	0.075 mg/m³ (a year) 0.26 mg/m³ (24 hrs.)
Sulfur dioxide	0.04 ppm (24 hrs.) 0.1 ppm (1 hr.)	0.03 ppm (a year) 0.14 ppm (24 hrs.)
Carbon monoxide	10 ppm (24 hrs.) 20 ppm (8 hrs.)	9 ppm (8 hrs.) 35 ppm (1 hr.)
Nitrogen dioxide	0.02 ppm (24 hrs.)	0.05 ppm (a year)
Oxidants	0.06 ppm (1 hr.)	0.08 ppm (1 hr.)
Hydrocarbon	*	0.24 ppm (3 hrs.)

* guide line: 0.20–0.31 ppm (3 hrs.)

(2) Emission Control

1) Outline of Emission Standards

Emission Standards are provided on the basis of the control of the amount of pollution and/or concentration. In the early stage, the emission control was based on the conception that the amount of sulfur oxides according to the height of a stack should be regulated (K-value regulation) from the viewpoint of the dilution effect by the diffusion of sulfur oxides. Later, the concept of regulating the total amount of sulfur oxides was introduced and incorporated into the emission standards together with the K-value regulation.

These emission standards in Japan are applied to each factory or industrial installation which generates flue gas. Introduction of the total amount regulation is designed to rationally and systematically achieve the environmental standards in an area where the K-value regulation alone is ineffective to the maintenance of environmental standards owing to the heavy concentration of industrial installations. In this system, the permissible total amount of emitted pollutants in the area can be computed by using a pollution forecast simulation technique which incorporates the various characteristics of the locality such as meteorological conditions, conditions of emission sources, etc.

In Japan, regarding the control of sulfur oxides, there are presently two kinds of area which are classified, according to the degree of pollution, into one controlled by K-value regulation and another controlled by a combination of both K-value and total amount regulation.

2) K-value Regulation

The emission standards for sulfur oxides are the values of K established in each area according to the degree of pollution by using the following diffusion formula:

$$q = K \times 10^{-3} He^2$$

where q is the amount of sulfur oxides in Nm^3/h

He is the effective height of the stack in meter

Thus, the smaller the K-value, the more severe the regulation becomes. In order to meet the requirement for K-values which are gradually smaller, construction of higher stacks, use of lower sulfurcontent fuels, or introduction of flue gas desulfurization plant becomes necessary.

Moreover, the K-value regulation has provided the special emission standards which are stricter for new or expanded facilities only in an area where the existing facilities are concentrated and the pollution is already heavy. K-value of such areas are indicated by figures in parentheses in Table 4.

Table 4 Revisions made to the Emission Standards for Sulfur Oxides (K-value)

		1968	1969	1971	1972	1973	1974	1975	1976
Overcrowded Area		20.4	11.7 (5.6)	11.7 (5.6)	7.01	6.42	3.5 (1.17)	3.0	3.0
Other Polluted Areas	I	26.3	12.8	12.8	7.59	7.59	4.67 (1.75)	3.5	3.5
	II	26.2	14.0	14.0	9.34	9.34	6.42	4.67	4.5

Note: Overcrowded areas include Tokyo, Yokohama, Kawasaki, etc., and other polluted areas Chiba, Ichihara, etc. for I and Muroran for II.

3) Total Amount Regulation

In 1974, the total amount regulation was introduced to reasonably and systematically maintain the environmental standards, in an area where the conventional regulation alone proved to be ineffective owing to the heavy concentration of industrial installations. In this system, the permissible total amount of emitted pollutants in a specific area were calculated by using a pollution forecast simulation technique which takes into account such local characteristics as weather, conditions of emission sources, etc.

The number of areas designated as the total amount regulation area has three times increased so far. All are included in the category of the severest and the second severest K-value regulation. The basic formula for computing the total amount standard is:

$$Q = aW^b$$

where Q is the total amount standard in Nm^3/h

W is the fuel consumption in terms of heavy oil in kℓ/h

The Government establishes the values of a and b for each area. Careful consideration is given to factories, etc. to which this control is applied, regarding fuel consumption per hour, for example, more than one kℓ per hour in Yokohama, more than 0.3 kℓ per hour in Kobe, etc.

For new expanded facilities, the following formula is applied:

$$Q = aW^b + ra\,[(W + W_i)^b - W^b]$$

where W_i is the fuel consumption at the facility under construction

r is the value determined by the government for each area (1/3 in Yokohama and 0.3 in Kobe)

(3) Selection of Optimal Process

Firstly, the two processes, namely Limestone/Gypsum Recovery Process and Calcium Base/Throw-Away Process were selected for comparison in order to select the most appropriate process for the Lakhra Coal-fired Thermal Power Station. Both processes have high reliability in operation. There exist many actual records of having employed the Limestone/Gypsum Recovery Process in Japan while the Calcium Base/Throw-Away Process has been commonly adopted in the U.S.A. The two processes are simple, and the operation and repair are easy to be undertaken. Accordingly, it can be said that both processes are and will be suitable for thermal power stations.

The results of economic comparisons of both processes are as shown below:

Item \ Process	Limestone/Gypsum Recovery Process	Calcium Base/ Throw-Away Process
Construction Costs	292 Million Rupees	205 Million Rupees
Cost of F.G.D. Occupied in Power Cost	7.0 Paisas	6.5 Paisas

Although the construction costs of the Limestone/Gypsum Recovery Process seem to be rather costly, the amount of sales of Gypsum as a byproduct can be anticipated. The cost of F.G.D. occupied in power cost is slightly higher in the case of the Limestone/Gypsum Recovery

Process. The above-mentioned comparisons prove that there are almost no difference between both processes. It is recommended that Limestone/Gypsum Recovery Process be employed for effective utilization of limestone and gypsum as such indigenous resources will be properly put into use.

(4) Installation of Desulfurization Equipment to Treat Half of Flue Gas

If reference is made to an environmental code of the U.S.A. (U.S. Federal) related to sulfuric oxide, installation of the following desulfurization equipment to treat one half of flue gas will meet the requirements set forth in the said code.

Category	SO_2 Gas Concentration at Max. Ground Concentration	Emergence Distance
Non FGD	0.144 ppm	13.9 km
Half Scale of FGD	0.079 ppm	13.9 km

(5) Description of Processes

The lime-limestone/gypsum recovery process is to be explained below.

Lime-Limestone/Gypsum Recovery Process

1) Absorption Section

First, the flue gas from the boiler is put into the dust remover where dust is removed by scrubbing the gas. After the dust remover, the flue gas is led into the absorber with 6 banks of spray nozzles, where SO_2 is removed.

Within the absorber, SO_2 in the flue gas reacts with the absorbent to be converted into calcium sulfite and, though in small quantities, calcium sulfate which is produced in the absorber due to the oxidation reaction of calcium sulfite and to the reaction between absorbent and sulfur trioxide in the flue gas. These reactions are:

$$CaCO_3 + SO_2 + 1/2H_2O \longrightarrow CaSO_3\ 1/2H_2O + CO_2 \quad (1)$$

$$CaSO_3\ 1/2H_2O + 1/2O_2 + 3/2H_2O \longrightarrow CaSO_4 \cdot 2H_2O \quad (2)$$

$$CaCO_3 + SO_3 + 2H_2O \longrightarrow CaSO_4 \cdot 2H_2O + CO_2 \quad (3)$$

Droplets entrained in the flue gas are eliminated by their collision against blades of mist eliminator which are washed intermittently by both fresh water and liquor separated in the thickener, which is called the mother liquid (hereinafter referred to as ML), in order to prevent it from clogging and scaling. After clean gas passed through mist eliminator is reheated up to a suitable temperature, it is exhausted from a stack.

2) Gypsum Producing Section

The bleed slurry containing calcium sulfite, calcium sulfate and calcium carbonate is transferred from the absorber to pH controller where pH value of slurry is adjusted with a small quantity of sulfuric acid to keep the best condition for oxidation of calcium sulfite. And then, it is introduced to the oxidizer, where forced-oxidation by air-blowing is carried out to produce gypsum. The chemical reactions are:

$$CaSO_3 \cdot 1/2H_2O + H_2SO_4 + 1/2H_2O \longrightarrow CaSO_4 \cdot 2H_2O + SO_2 \quad (4)$$

$$CaCO_3 + H_2SO_4 + H_2O \longrightarrow CaSO_4 \cdot 2H_2O + CO_2 \quad (5)$$

$$CaSO_3 \cdot 1/2H_2O + SO_2 + 1/2H_2O \longrightarrow Ca(HSO_3)_2 \quad (6)$$

$$Ca(HSO_3)_2 + 1/2O_2 + H_2O \longrightarrow CaSO_4 \cdot 2H_2O + SO_2 \quad (7)$$

Gypsum is produced by dehydration of the concentrated slurry by means of centrifugal separators after the slurry from the oxidizer is concentrated to about 20% at the thickener, and stored in warehouse.

3) Absorbent Section

Absorbent such as $CaCO_3$ which is stored in the silo is mixed with the ML at the pit to prepare about 15% slurry. The amount of absorbent almost equivalent to the mol number of absorbed SO_2 in the flue gas is automatically supplied to absorber after SO_2 concentration, gas volume and density of absorbent slurry are measured.

4) Waste Water Treatment Section

In order to avoid accumulation of impurities and material corrosion caused by chroline, a portion of ML is discharged from the system after the treatment for environmental protection.

Fig. - 1 FLUE GAS DESULFURIZATION, LIME STONE - GYPSUM RECOVERY PROCESS

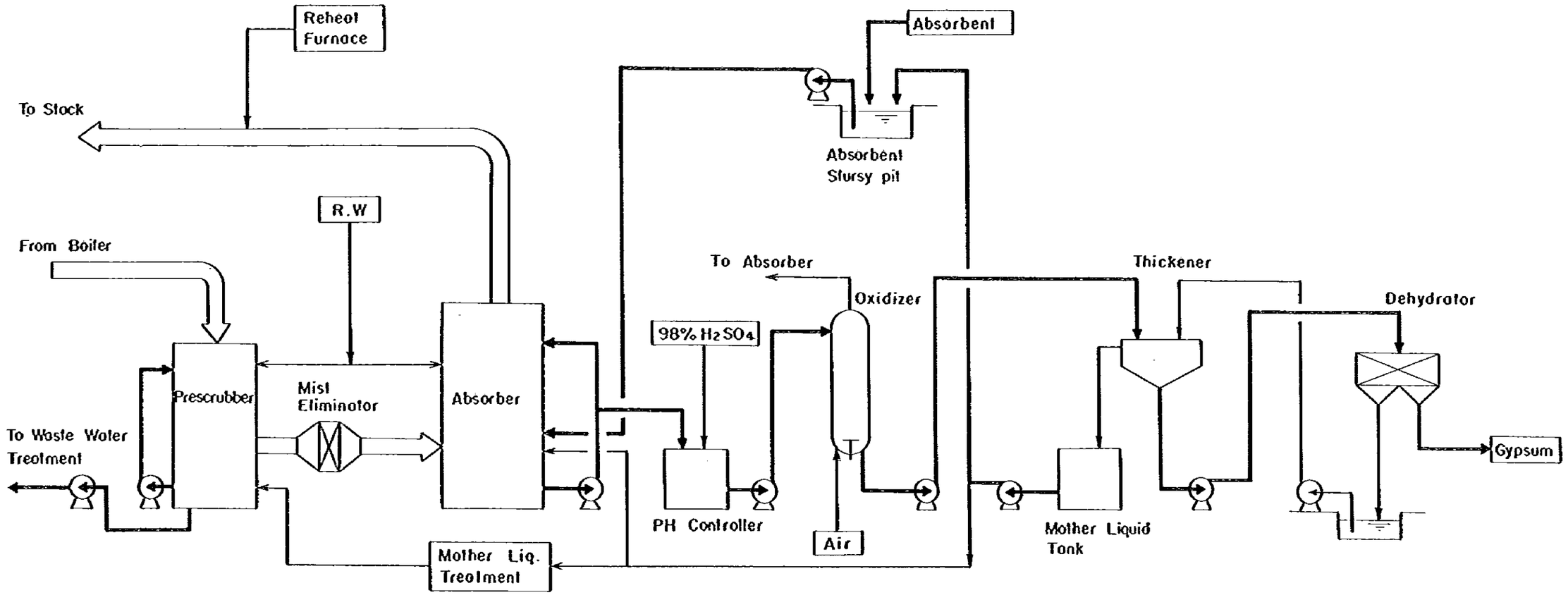


Table - 5 Classification of Wet F G D Processes

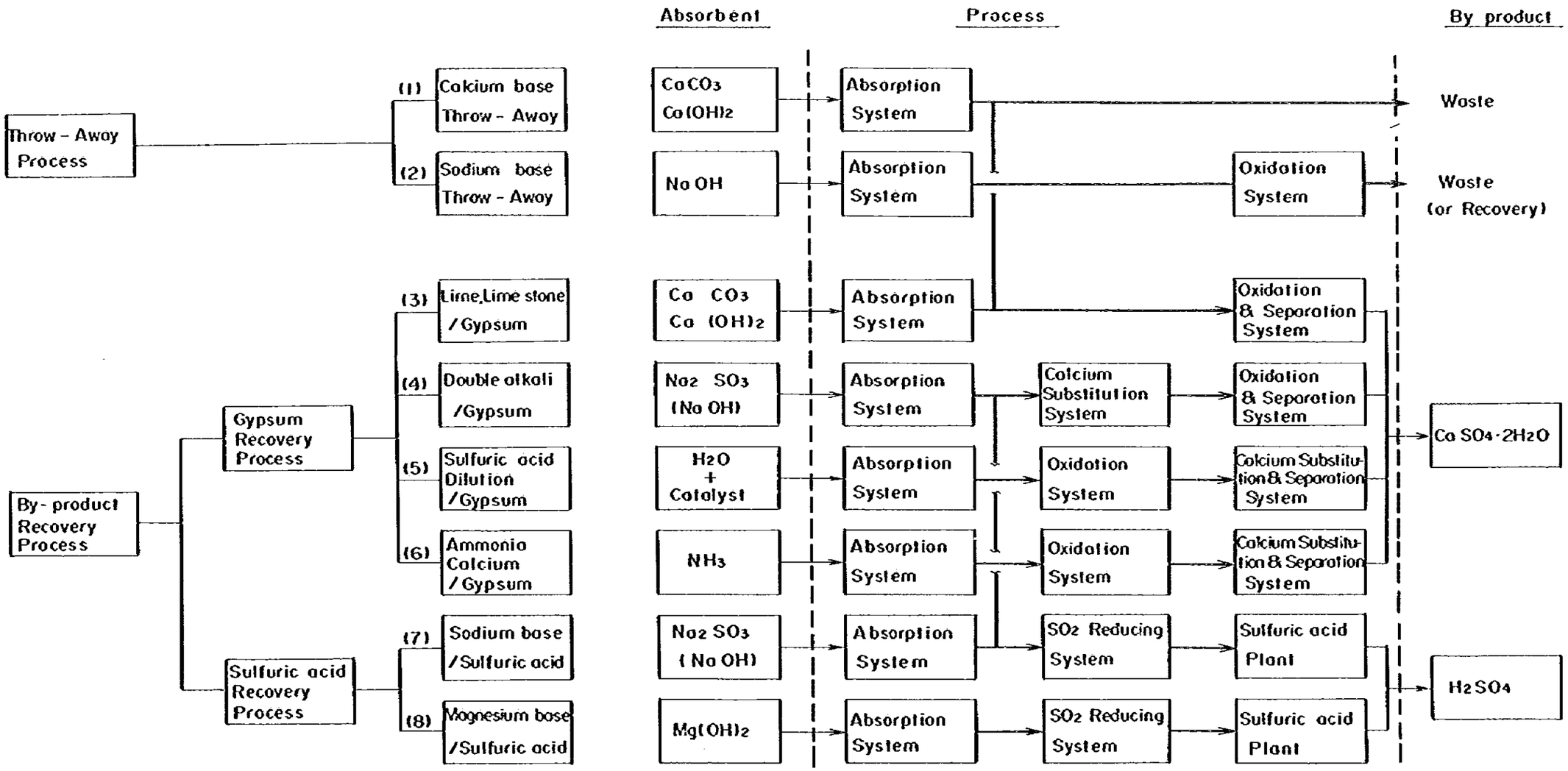
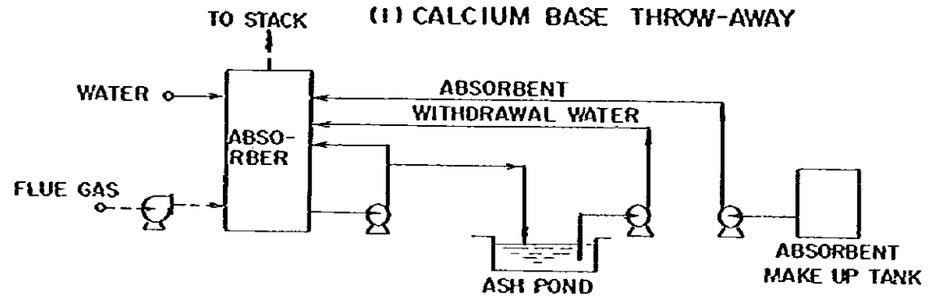
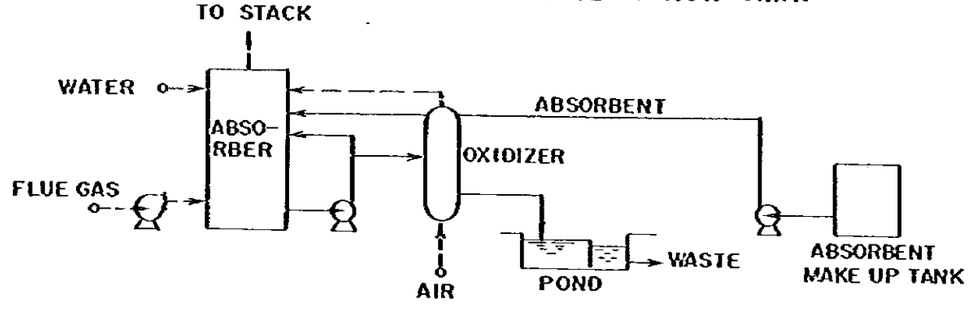
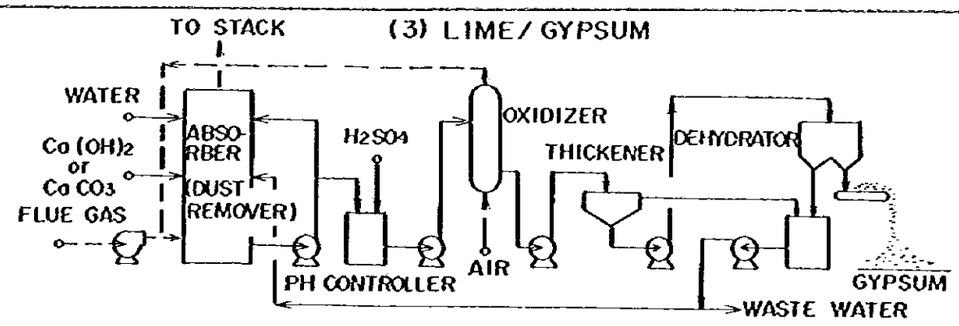
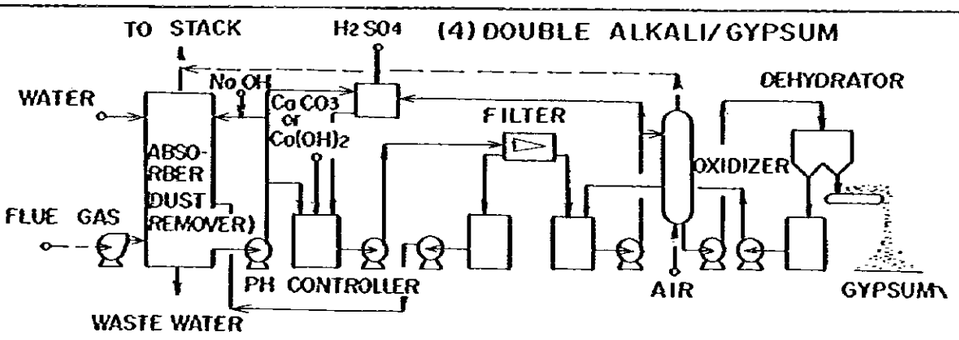
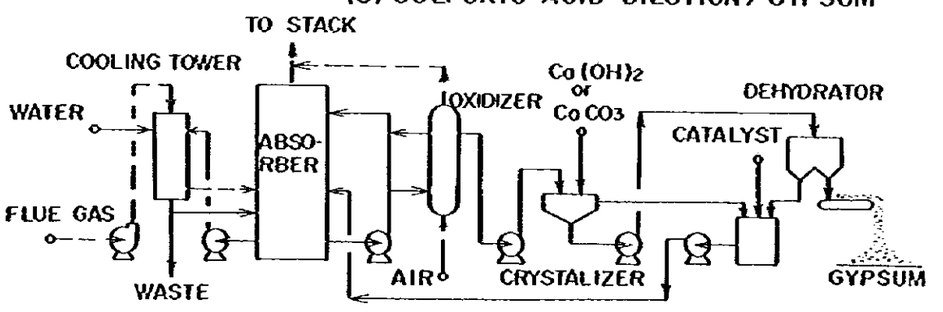
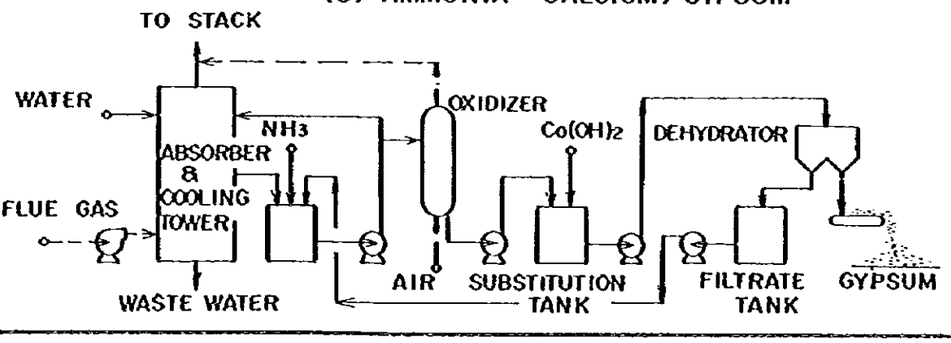


Table - 6 Description of Wet F G D Processes

	Process	Main Reactions.	Flow Chart
Throw - Away Process	(1) Calcium base / Throw - Away Sulfur dioxide reacts on limestone or calcium hydroxide resulting in the production of calcium sulfite which is thrown away to osh pond.	$CaCO_3$ + SO_2 → $\{CaSO_3 \cdot 1/2H_2O$, $CaSO_4 \cdot 2H_2O\}$ → Waste or $Ca(OH)_2$ + SO_2 → $\{CaSO_3 \cdot 1/2H_2O$, $CaSO_4 \cdot 2H_2O\}$ → Waste	(1) CALCIUM BASE THROW-AWAY 
	(2) Sodium base / Throw - Away Sulfur dioxide reacts on caustic soda resulting in the production of sodium sulfite. By airing it Glauber's salt is produced and thrown away.	NaOH + SO_2 → $Na_2SO_3 + H_2O$ Na_2SO_3 + O_2 → Na_2SO_4 → Waste	(2) SODIUM BASE THROW-AWAY 

Gypsum Recovery Process

Process	Main Reactions	Flow Chart
(3) Lime, Limestone / Gypsum Sulfur dioxide reacts on limestone or calcium hydroxide resulting in the production of calcium sulfite. By airing it gypsum is produced.	$CaCO_3 \xrightarrow{SO_2} CaSO_3 \cdot 1/2H_2O + CO_2$ $CaSO_3 \cdot 1/2H_2O \xrightarrow{O_2} CaSO_4 \cdot 2H_2O$ or $Ca(OH)_2 \xrightarrow{SO_2} CaSO_3 \cdot 1/2H_2O + H_2O$ $CaSO_3 \cdot 1/2H_2O \xrightarrow{O_2} CaSO_4 \cdot 2H_2O$	
(4) Double Alkali / Gypsum Sulfur dioxide reacts on sodium s sulfite resulting in the production of hydrogen sulfite. By adding lime to it calcium sulfite is produced. and by airing it gypsum is produced.	$Na_2SO_3 \xrightarrow{SO_2} NaHSO_3$ $CaSO_3 \cdot 1/2H_2O + Na_2SO_3 + CO_2$ (Ca CO3) $CaSO_3 \cdot 1/2H_2O \xrightarrow{O_2} CaSO_4 \cdot 2H_2O$ or $CaSO_3 \cdot 1/2H_2O + Na_2SO_3 + H_2O$ (Ca(OH)2)	
(5) Sulfuric Acid Dilution/Gypsum Sulfur dioxide is absorbed by water containing a catalyst resulting in the production of sulfurous acid. By airing it sulfuric acid is produced. By adding lime to the acid, gypsum is produced.	$H_2O \xrightarrow{SO_2} H_2SO_3 \xrightarrow[(CaI)]{O_2} H_2SO_4 \xrightarrow{CaCO_3 \text{ or } Ca(OH)_2} CaSO_4 \cdot 2H_2O$	
(6) Ammonia Calcium/Gypsum Sulfur dioxide reacts on ammonia water resulting in the production of sulfite (hydrogen sulfite). By airing it ammonia sulfate is produced, and by adding lime to it gypsum is produced.	$NH_3 \xrightarrow{SO_2} \{(NH_4)_2SO_3, NH_4HSO_3\} \xrightarrow{O_2} (NH_4)_2SO_4$ $(NH_4)_2SO_3 \xrightarrow{NH_3}$ $(NH_4)_2SO_4 \xrightarrow{Ca(OH)_2} CaSO_4 \cdot 2H_2O + NH_3$	

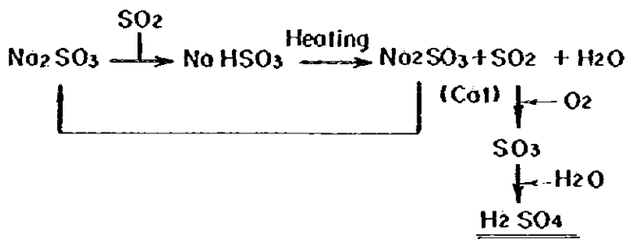
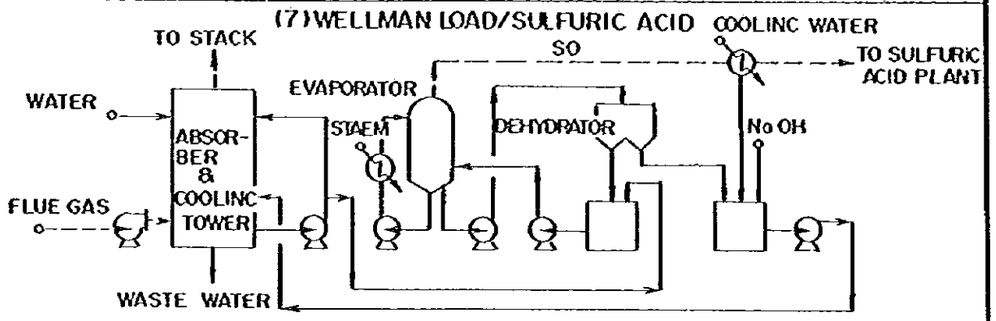
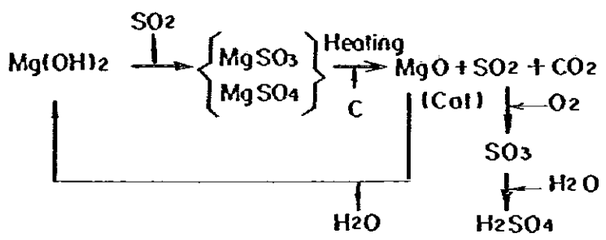
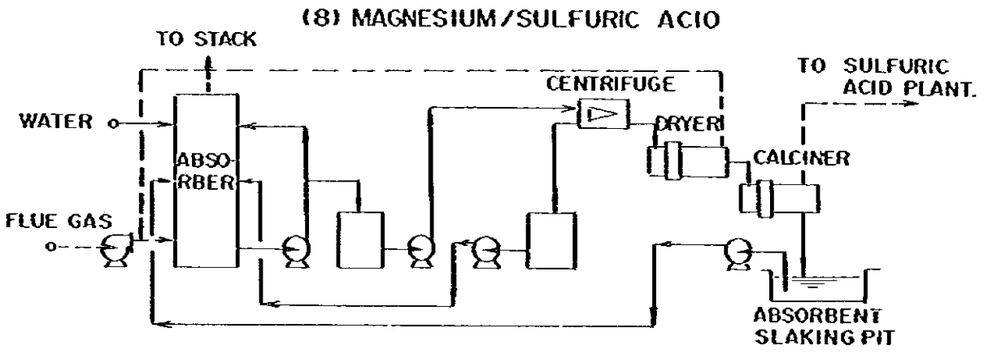
	Process	Main Reactions	Flow Chart
Sulfuric Acid Recovery Process	(7) Sodium base/Sulfuric Acid Sulfur dioxide reacts on sodium sulfite resulting in the production of Sodium bisulfits. By heating it sodium sulfite and sulfur dioxide are recovered. The former is used again in the first process while sulfuric acid is produced from the latter.		
	(8) Magnesium base/Sulfuric Acid Sulfur dioxide reacts on magnesium hydroxide resulting in the production of magnesium sulfite. By heating it magnesium oxide and sulfur dioxide are recovered. The former is used again in the first process after adding water. From sulfur dioxide sulfuric acid is produced.		

Table - 7 Desulfurization Installations in The Electric Utilities of Japan

Power Company	Desulfurization Process	Maker	Power plant	Unit	Out put (MW)	Fuel	Start - up	Gas Volume (Nm^3/H)	Capacity (%)	Efficiency (%)	Remarks
E P D C	Wet, Limestone - Gypsum	Mitsui Miike Machinery	Takasago	1	250	Coal	1975 - 2	840.000	100	93.3	E P D C: Electric power Deveopment Co.Ltd.
		Mitsui Miike Machinery	Takasago	2	250		1976 - 3	840.000	100	93.3	
		I H I	Isogo	1	265		1976 - 3	900.000	100	90	I H I ; Ishikawajima - Harima Heavy Industries Co, Ltd.
		I H I	Isogo	2	265		1976 - 6	900.000	100	90	
		Babcock - Hitachi K.K	Takehara	1	250		1977 - 2	852.000	100	94.2	
		IHI, Mitsui Miike Machinery	Matsushima	1	500		1980 - 1	1.300.000	75	95	
		Babcock - Hitachi K.K Mitsui Miike Machinery	Matsushima	2	500		1980 - 7	1.300.000	75	95	
Hokkaido	Wet, Limestone - Gypsum	Babcock - Hitachi K.K	Date	1	350	H8C oil	1978 - 12	260.000	25	90	
		Babcock - Hitachi K.K	Tomakomai-Higashi	1	350	Coal	1980 - 8	610.000	50	90	
Tōhoku	Wet, Limestone - Gypsum	Mitsubishi Heavy Industries	Hachinohe	4	250	Heavy Oil	1974 - 2	380.000	50	90	tie up with Kureha chemical Industries
		Mitsubishi Heavy Industries	Higashi-Niigata	1	600		1976 - 6	420.000	25	90	
	Wet, Double Alkali-Gypsum	Kawasaki Heavy Industries	Shin - Sendai	2	600		1974 - 3	420.000	25	96	
	Wet, Sodium-Sulfuric Acid	Mitsubishi-Kakoki Kaisha	Niigata	4	600		1977 - 3	760.000	50	90	Wellman - Load
	Wet, Double Alkali-Gypsum	Kawasaki Heavy Industries	Akita				1977 - 9	1. 050.000			
Tokyo	Dry, Active Carbon	Babcock - Hitachi K.K	Kashima	3	600	Heavy Oil	1972 - 7	420.000	25	80	
	Wet, Limestone - Gypsum	Mitsubishi Heavy Industries	Yokosuka	1	265		1974 - 1	400.000	50	90	
Chubu	Wet, Sodium-Sulfuric Acid	Mitsubishi-Kakoki Kaisha	Nishi - Nagoya	1	220	Heavy Oil	1973 - 5	620.000	100	90	
	Wet, Lime - Gypsum	Mitsubishi Heavy Industries	Owase - Mita	1	375		1976 - 3	1. 200.000	100	90	
		Mitsubishi Heavy Industries	Owase - Mita	2	375		1976 - 5	1. 200.000	100	90	
Hokuriku	Wet, Sulfuric Acid Dilution - Gypsum	Chiyoda chomical Eng. & Construction Co,Ltd.	Toyama - Shinkō	1	500	Heavy & Crude Oil	1974 - 10	750.000	50	90	
			Fukui	1	350		1975 - 6	1. 050.000	100	96	
Kansai	Wet, Lime - Gypsum	Mitsubishi Heavy Industries	Amagasaki-Higashi	2	156	Heavy Oil	1972 - 3	100.000	25	90	Additional Indstallation
		Mitsubishi Heavy Industries	Kainan	4	600		1973 - 12	400.000	25	90	
		Mitsubishi Heavy Industries	Amagasaki-Higashi	2	156		1975 - 1	375.000	75	90	
	Wet, Lime stone - Gypsum	Babcock - Hitachi K.K	Osaka	3	156		1975 - 3	500.000	100	90	
		Babcock - Hitachi K.K	Osaka	2	156		1975 - 12	500.000	100	90	
	Wet, Lime - Gypsum	Mitsubishi Heavy Industries	Amagasaki-Higashi	1	156		1976 - 10	475.000	100	90	
	Wet, Lime stone - Gypsum	Babcock - Hitachi K.K	Osaka	4	156		1976 - 10	500.000	100	90	
Chūgoku	Wet, Lime stone - Gypsum	Babcock - Hitachi K.K	Mizushima	2	156	Heavy Oil	1974 - 4	310.000	66	80	
		Babcock - Hitachi K.K	Tamashima	3	500	Heavy & Crude Oil	1975 - 7	1.460.000	100	96	
		Babcock - Hitachi K.K	Tamashima	2	350		1976 - 3	1.000.000	100	96	
		Mitsubishi Heavy Industries	Shimonoseki	2	400	Heavy Oil	1977 - 4	1.200.000	100	90	
Shikoku	Wet, Double Alkali-Gypsum	Kawasaki Heavy Industries	Anon	3	450	Heavy Oil	1975 - 8	1.260.000	100	97	tie up with Kureha chemical Industries
		Kawasaki Heavy Industries	Sakaide	3	450		1975 - 10	1.260.000	100	97	
Kyushu	Wet, Lime stone - Gypsum	Mitsubishi Heavy Industries	Karita	2	375	Heavy Oil	1974 - 6	550.000	50	90	
		Mitsubishi Heavy Industries	Karatsu	2	375		1976 - 3	570.000	50	90	
		Mitsubishi Heavy Industries	Ainoura	1	375		1976 - 4	730.000	75	90	
		Mitsubishi Heavy Industries	Ainoura	2	500		1976 - 5	730.000	50	90	
		Mitsubishi Heavy Industries	Karatsu	3	500		1976 - 6	730.000	50	90	
	Wet, Double Alkali-Gypsum	Kawasaki Heavy Industries	Buzen	1	500		1977 - 12	736.000	50	90	tie up with Kureha chemical Industries
Others	Wet, Lime - Gypsum	Mitsubishi Heavy Industries	Mizushima - Kyodo	5	156	Heavy Oil	1976 - 1	611.000	100	90	
	Wet, Limestone - Gypsum	Mitsubishi Heavy Industries	Niigata - Kyodo	1	350		1976 - 1	530.000	50	90	
		Mitsubishi Heavy Industries	Niigata - Kyodo	2	350		1977 - 3	530.000	50	90	
		Mitsubishi Heavy Industries	Sakata - Kyodo	1	350		1977 - 10	1.100.000	100	90	
		Mitsubishi Heavy Industries	Sakata - Kyodo	2	350		1978 - 10	1.100.000	100	90	
		I H I	Sumitomo - Kyodo	3	156		1975 - 12	450.000	100	90	
		Mitsubishi Heavy Industries	Fukui - Kyodo	1	250		1978 - 8	750.000	100	95	
		Mitsubishi Heavy Industries	Kashima-Minami-Kyodo	2	—		1976 - 9	431.000	—	90	
	Wet, Sulfuric Acid Dilution Gyp	Chiyoda chemical E & C	Toyama - Kyodo	1	250		1975 - 9	750.000	100	92.5	

Table - 8 Features of F G D Processes

F G D Process		Characteristics of Process	Manufacturers in Japan
Throw - Away	(1) Calcium base	1. Desulfurization efficiency of more than 90% 2. The simplest process 3. Easy operation 4. The cheapest construction cost (no by-product) 5. Location conditioned by land availability because of the necessity of large ash pond to throw away calcium sulfite.	Mitsui - Miike Machinery
	(2) Sodium base	1. Desulfurization efficiency of more than 90% 2. The simplest process 3. Easy operation 4. Cheap construction cost (no by-product) 5. Expensive operation cost (large consumption of absorbent) 6. Very large quantity of waste water to be treated (unsuitable for large boiler) 7. Suitable process for the paper and pulp factory which consumss Glauber's salt	Ishikawajima-Harima Heavy Industries
Gypsum Recovery	(3) Lime - Limestone	1. Desulfurization efficiency of more than 90% 2. Simple process 3. Easy operation 4. Necessity of controlling and removing scale in the absorption liquid circulating system	Mitsubishi Heavy Industries Mitsui - Miike Machinery Babcock-Hitachi K.K Ishikawajima-Harima Heavy Industries
	(4) Double Alkari (Indirect lime-limestone process)	1. Desulfurization efficiency of more than 90% 2. Expensive construction cost 3. Complicated process 4. Difficult operation 5. Unsuitable process in the case of the high concentration of oxgen in flue gas (large consumption of absorbent)	Kawasaki Heavy Industries (Tied up with Kureha Chemical Industries) Showa Denko K.K (Tied up with Ebara Manufacturing Co.) Tsukishima Machinery
	(5) Sulfuric Acid Dilution (Indirect lime-limestone process)	1. Desulfurization efficiency of more than 90% 2. Simple process 3. Easy operation 4. Expensive construction cost high grade of materials) 5. Expensive operation cost (energy cost) 6. Necessity of catalyst (Mg acts as negative catalyst) 7. Large quantity of waste water to be treated	Chiyoda Chemical Engineering & Construction Co. Ltd,.
	(6) Ammonia Calcium Indirect lime-limestone process)	1. Desulfurization efficiency of more than 95% 2. Complicated process 3. Difficult operation 4. Expensive operation cost (absorbent) 5. Generation a plume of smoke owing to NH_3 leakage (particularly, in the case of the oil-fired power plant) 6. Treatment of NH_3 in the waste water 7. No actual use for large F G D plant	Nippon Kokan K.K.
Sulfuric Acid Recovery	(7) Sodium base	1. Desulfurization efficiency of more than 95% 2. Complicated process 3. Difficult operation 4. Expensive construction cost (high grade materials) 5. Unsuitable process in the case of the high concentration of oxgen in flue gas (large consumption of absorbent) 6. Being more economical for the higher sulfur content of flue gas 7. Being able to produce simple sulfur if desired	Mitsubishi Kakoki Kaisha (Wellman Load)
	(8) Magnesium base	1. Desulfurization efficiency of more than 95% 2. Complicated process (in particular, necessity of handling of powder) 3. Difficult operation 4. Expensive construction cost 5. Being economical for the higher sulfur content of flue gas 6. Being able to produce simple sulfur if desired 7. No waste water treatment in the case of the oil-fired thermal power plant	Mitsui Miike Machinery

Table-9 Evaluation of F G D Process

Evaluation Item / Name of Process		Process			Facility of Operation	Actual use	Cost	
		Desulfurization Efficiency	Simpticity	Secondary Pollution			Construction	Operation
Throw-away Process	(1) Calcium base	○	◎	△	◎	○	◎	○
	(2) Sodium base	◎	◎	○	◎	○	◎	△
Gypsum recovery Process	(3) Lime-Limestone	○	○	○	○	◎	○	○
	(4) Double Alkali	◎	△	○	△	○	△	○
	(5) Sulfuric acid Dilution	○	○	○	○	○	△	△
	(6) Ammonia-Calcium	◎	△	△	△	△	○	△
Sulfuric acid recovery Process	(7) Sodium base	◎	×	○	×	○	×	○
	(8) Magnesium base	◎	×	◎	×	○	×	○

Remarks ; ◎ Superior
○ Good
△ Bad
× Inferior

ANNEX 2 ON UTILIZATION OF FLY-ASH

A great deal of ash is produced during the course of coal combustion in a coal-fired thermal power station, which is different from the situation of an oil-fired power station.

Since utilization of a low-caloried fuel such as lignite necessitates larger quantities of fuel for operation of the same scale of unit in comparison with an oil-fired thermal power station, it is natural that larger quantities of ash should be produced at a power station.

In case a power plant with an installed capacity of one (1) unit of 300 MW is operated at a plant factor of 70%, the quantities of ash to be produced at the power plant for a period of thirty(30) years are estimated at 6,600,000 tons.

In the event such ash is disposed into lowered places (such as holes, lagoons, etc.) three (3) meters in depth, a required area of land is roughly calculated to be approximately 1,600,000 square meters. In addition, it is essential that adequate consideration be given to possible countermeasures against scattering and outflow of disposed articles which are apt to occur because of wind and rain.

Tentatively Conceived Nature of Coal from the Proposed Lakhra Coal Mine

Calorific Value:	4,613 kcal/kg on a air-dry basis
Inherent Moisture:	9.5%
Ash Content:	23.7%

Ash produced at a coal-fired boiler can be divided into clinker, cinder ash and fly-ash. The composition ratios of said categories of ash are around 10 to 20%, 5 to 10% and 70 to 85%, respectively. Various studies have been made on the effective utilization of cinder ash and fly-ash which account for approximately 75 to 95% of the total composition. The use of these articles established up to now is as stated below.

(1) Use of Fly-ash as Mixing Material of Cement

The quantity of cement can be saved by mixing good-qualitied fly-ash with concrete in proper manner. Besides, the following advantages could be anticipated.

1) The workability of concrete will be improved, which will reduce the quantity of water per cubic meter of concrete.

2) It will be possible to minimize temperature rise of concrete caused by the heat of hydration.

3) The intensity of concrete will be strengthened.

4) The shrinkage of concrete will become lesser.

5) The permeability of concrete will be improved, and persistence of concrete against chemical erosion will be stronger.

(2) Use of Fly-ash as Materials for Cement

The major components of cement are calcium, silicon, aluminum oxide and ferrous oxide. Clay is used for obtaining silicon and aluminium.

As one of a series of measures for utilization of fly-ash having the same ingredients as clay, the former instead of the latter is used for making cement.

In order to maintain the necessary intensity of concrete, the quantity of fly-ash is limited to less than 5% the total quantities of materials forming cement.

(3) Land Improvement

Since fly-ash is of alukalinity, it is used for betterment of acid soil. Roughly grained fly-ash is utilized as "green ash" for improvement of land. Besides, fly-ash is also usable not only for improvement of acid soil in plowed fields but also for facilitating drainage of water from the said places.

(4) Packing Materials for Sealing of Mined-out Area

ANNEX 3 UTILIZATION OF GYPSUM

(1) Introduction

Since the lignite to be used as fuel for Lakhra Thermal Power Station has a very high sulfur content, it is planned to install flue gas desulfurization facilities at the power station to prevent atmospheric pollution by sulfur oxides.

The system of the flue gas desulfurization plant is planned to be that of absorbing exhaust gas, using limestone as the absorbent and recovering gypsum as a by-product, namely, the limestone gypsum recovery method.

The installed capacity, based on U.S. Federal regulations, will be capable of treating one half of the capacity of flue gas from the power station so that approximately 120,000 tons of gypsum can be produced annually at the flue gas desulfurization plant.

Regarding methods of using gypsum produced from the flue gas desulfurization plant, there are some methods already in practical use in various countries of the world, while others are undergoing studies, and it may be said that practically almost all of the uses are in connection with building materials.

(2) Classification of Gypsum

Gypsum obtained as a by-product from flue gas desulfurization plant is generally gypsum dihydrate ($CaSO_4 \cdot 2H_2O$), and this is calcined to make it a hemihydrate gypsum ($CaSO_4 \cdot 1/2H_2O$) for various uses.

From the standpoint of uses, gypsum may be classified according to the following:

1) Beta type hemihydrate gypsum
2) Alpha type hemihydrate gypsum
3) Type II anhydrous gypsum

Hemihydrate gypsum which results from calcining gypsum dihydrate at approximately 100°C to 250°C is generally called calcined gypsum and is used for plaster and gympsum board.

Strength is higher with the alpha type than with the beta type, but gypsum normally called calcined gypsum is a mixture of the alpha and beta types.

When gypsum is heated to above approximately 300°C, it is dehydrated and becomes anhydrous gypsum.

Anhydrous gypsum does not harden to much strength on addition of water, but when calcined upon mixing with a small amount of additives, it becomes Type II anhydrous gypsum which is extremely hard after setting so that it is used not only as wall material but also as floor material in Europe and the United States.

(3) Uses for Gypsum

The uses for gypsum in Japan are the following;

1) Gypsum Board, Plaster

Used as interior finishing materials.

2) Panel

Used in the form of thick gypsum boards for nonbearing walls of ordinary partitions and fire partitions.

3) Fire-resistant Covering

Bonded to structural steel in frameworks of multistory buildings in the form of panels, blocks or boards, or injected around steel to improve fire resistance.

4) Additive for Cement

Approximately 3% is added to cement for the purpose of adjusting the hardening time of concrete.

PART V SCHEDULE, COSTS AND ECONOMIC AND FINANCIAL ANALYSES.

PART V SCHEDULE, COSTS AND ECONOMIC AND FINANCIAL ANALYSES.

CHAPTER 1 IMPLEMENTATION SCHEDULE OF THE LAKHRA COAL MINE DEVELOPMENT AND THE COAL FIRED POWER STATION

1-1 Implementation Schedule

In order to develop the Lakhra coal mine with a capacity of 1,200,000 tonnes per annum and to set up the 300 MW coal fired power station at Jamshoro, an implementation schedule shown in Fig. 3-1 starts with the approval expected to be made by WAPDA to the Government of Pakistan for obtaining finance required for the project and ends with the final disbursement of the loan provided by the financial institution and the schedule also includes preparatory work to be undertaken by WAPDA, such as preparation and issuance of tender documents, award of contracts, opening of necessary L/C, etc. as well as construction work, supervisory work by the consultants, issuance by WAPDA of final acceptance certificates for the coal mine and the power station.

Based on the request made by WAPDA delegates who visited Japan in November 1980, the implementation schedule was made on condition that preparation work at site shall be completed within 24 months from the receipt of the feasibility report by WAPDA. Since coal production at the rate of 1.2 mil. tonnes per annum will take about 45 months from the time of commencement, 47 months is estimated for the completion of the power station. Therefore about 71 months will be required to start commercial operations of the power station from the receipt of the feasibility report by WAPDA.

1-2 Schedule Before Construction Work

In preparing the implementation schedule, it was assumed that 24 months counted from the receipt by WAPDA of the feasibility report would be needed for WAPDA to finish any and all required preparatory work for the commencement of the construction work at site.

(1) Consulting Work Rendered by the Consultants ..... 12 months

On receipt of letters of credit by the consultants, the consultants shall immediately undertake site survey, review of the feasibility report and compile "tender documents" together with detailed design and drawings which shall be forwarded to the financial institutions for their approval.

(2) Offers by Bidders

WAPDA shall draw up their notices of tenders for suply of machinery and equipment and for civil and construction work for the project several times in half a month to the public through daily new papers or magazines in the industries concerned.

Bidders who are interested in the tender have to obtain tender documents from WAPDA so that they may submit their offers to WAPDA by the due data of tender closing upon furnishing bid bonds. The estimated time required by the bidders for making their offer shall be limited to 2 months and a half.

(3) Contract Finalization

WAPDA and the consultants shall jointly undertake tender evaluation for making a short list of prospective bidders showing order of priority with whom negotiations shall be started.

The short list is to be submitted to the financial institutions for their approval. WAPDA shall enter into negotiation for the contracts with the prospective bidders according to the order of the short list.

Contracts shall only be made by WAPDA based on the results of negotiations with the prospective bidders which has to be reported to and approved by the financial institutions.

(4) Opening L/Cs in Favour of Contractors ..... 5 months

WAPDA is requested to open irrevocable letters of credit in favour of contractors within 5 months from the date on which their contracts become effective.

1.3 Construction Schedule

1.3.1 Coal Mine Development and Railway Construction

The development schedule shall have 33 months of lead time for construction work to commence coal production at the end of 1985, which includes design work for coal mine development, procurement of the necessary machinery and equipment and other required work such as initial construction work, construction of surface facilities, stripping work for open pits, development work for underground mine, construction of coal preparation plant and construction of railway. By completing the above entire construction work within 33 months, WAPDA will be able to start coal production at the 1st longwall face in underground mine by December 1985 provided the letters of credit are opened by WAPDA in favour of the contractors within 24 months from the date of receiving the feasibility report by WAPDA. The schedule is estimated on the basis of 300 days of work a year and 8 hrs of work a day, and 3 shifts for workers in underground and open pit.

(1) Preparatory Work by WAPDA before April 1983

To meet the target for power station to start commercial operation in 1978/88, the most critical work which has to be completed is the stripping work of overburden at open pit. Detailed drillings, construction of access roads to the pit for transporting heavy mining equipment and site survey for maintenance shop for equipment used in the pit are also critical work and such work is to be completed by April 1983 before the stripping work of overburden of open pit taken place.

In addition to the above, preparatory stripping work to proposed open pit and preparation for mining equipment to start operation should be completed by the time stated in the above.

To complete all the above work in time, orders for the supply of main equipment such as heavy mining equipment for stripping of overburden, main equipment of substations and machinery/equipment for maintenance shop should be placed with contractors and irrevocable letters of credit shall be opened by WAPDA in their favour by the end of March, 1983

without fail. Therefore the necessary procedures for procurement of this main machinery and equipment shall be decided 3 months before placing orders by WAPDA.

(2) Surface Facilities

Construction of surface facilities, construction work for access roads should commence in April 1983 to keep pace with the progress of the preparatory work.

Construction for a maintenance shop for the heavy mining equipment should be completed during June 1983 to May 1984. Equipment of water supply and drainage should be completed in 1984, whereas a emergency power generating plant, work shops for electrical and underground machinery are to be completed within 6 months in the first half of the same year. Erection of electrical facilities and construction of administration and mine offices are to be completed by December 1985.

(3) Coal Preparation Plant

A coal preparation plant including as trial test shall be completed within 27 months from October 1983 (by December 1985) and this schedule is composed of disign work in 3 months and fabrication, transportation, construction of the plant in 21 months with trial test in 2 months.

(4) Underground Mining

Preparatory work for drifting underground entries will have to continue for 3 months starting from the beginning of October 1983 followed by placing orders for the required equipment/meterials with the contractors in April 1983.

The following drifting works should be started in January 1984 and the full production can be achieved by December 1987 started with initial production at 1st longwall face in 1986 and at 2nd longwall face in 1987.

for inclined shaft:	8 months
for main entires:	8 months
for gate entries and preparation of longwalls:	8 months
Total:	24 months

(5) Open Pit Mining

The necessary preparing work shall be completed by April 1983 and stripping work of overburden shall also be started by introducing heavy mining machinery. About 5 mil. cubic metres of overburden in the west pit and east pit will be stripped in 1983, thereafter, about 7.78 mil. cubic metres in 1984 and 8.9 mil. cubic metres each both in 1985 and in 1986 will be stripped.

Two heavy duty electric shovels are to be employed for the above stripping work.

(6) Railway Construction

Since April 1983, leveling and civil work for rail-track will have to be started in entire sections and further laying rails and construction of terminals for loading and unloading should be completed in 1984 and by the middle of 1985 respectively.

Commercial operation of the railway shall be started by the middle of 1986 after a trial for a reasonable period in 1986.

(7) Coal Production During the Construction Period

Coal production can be expected even before start of commerical operations at the power station. The amount of the coal referred in the above would be 127,000 tonnes in 1984, 319,000 tonnes in 1985 and 733,000 tonnes in 1986, which makes 1,179,000 tonnes as in total.

Most of the coal produced before commerical operations at the power station will be sold for domestic consumption but the rest will be stocked in the desert.

(8) Summary

The following are the targets for the implementation schedule of the coal mine development.

Underground mine:

27 months is required for initial production and full production can be expected within 39 months.

Open pit mine:

48 months for initial production and
60 months for full production will be required.

Surface facilities:

33 months is required.

Coal preparation plant:

27 months is required.

Railroad:

39 months is required for completion.

1.3.2 Construction of the Power Station

The construction schedule shall be 47 months which covers design and supply of plant machinery, ocean and inland transportation for plant machinery, civil and construction work, erection and trial testing.

The construction has to be commenced on receipt of satisfactory letters of credit by the contractors in their favour provided the letters of credit are opened by WAPDA within 24 months from the date of receiving the feasibility report from JICA. The schedule is estimated on the basis of 23 days work a month and 8 hours work a day.

The following are the divisions of the work with time required for completion.

(1) Design and Manufacturing

Design and manufacturing of the machinery for power station shall be started by the manufacturers on receipt of letters of credit by the contractor. Manufacturing of the machinery for the power station shall take about 19 months including their trial tests and packings for transportation. Rotor for turbine and generator is the item which will take the longest period to manufacture among the machinery for the power station.

(2) Transportation

Should the machinery be fabricated by the manufacturers, shipments will be made upon receipt of the necessary export and import lincenses from Customs authorities.

Two month is required for transportation from the port of outlet to Karachi, procedures for Custom clearance at Karachi and for fowarding to the site.

(3) Civil and Construction Work

Construction of provisional facilities and buildints required for construction and leveling of the land at site shall require 9 months.

Civil work for circulating water required for the power station i.e. construction of canals for intake and discharge of water is required for 29 months, however, the above civil work should be completed by the time electricity is supplied to the site and trial tests of auxiliary machinery are undertaken. Further 9 months for foundation of the main buildings and 27 months for construction of the main buildings starting from the steel structure fabrication are envisaged.

All of the civil and construction work including repair work, if any shall be completed by the time of steam admission to the turbine.

(4) Fabrication of Power Generation Equipment, Erection and Trial Tests

Fabrication of the boiler starts with lifting a boiler drum and ends with water pressure tests for the part of boiler where high pressure is induced.

Erection of auxiliary equipment and other work at the site shall be undertaken by the trial.

16 months in total is required to complete all the above work.

Although the work for earthing electric machinery in the power station is carried out in parallel with a part of civil and construction work, erection of turbine, generator and instruments

are to be completed by the time of steam admission to the boiler. In other works time required from the lifting drum to the completion of the above work would be 20 months.

Before starting commercial operation, trials for the auxiliary equipment at site will be carried out one by one when electricity is provided by WAPDA, however, 3 months is required to complete both the off load test and the load test on the whole power station including adjustment work.

Major divisions of the contruction works defined for one unit of 300 MW power station, time expected to commence each of the divisional work and months required for completing each of those work are stated as under:

Work	Commencement	Months required
Preparatory work	Apr. 1983	–
Foundation	Oct. 1983	6 months
Steel structure fabrication	Jul. 1984	15 months
Lifting boiler drum	Apr. 1985	24 months
Water pressure test for boiler	Nov. 1985	31 months
Supply of electricity at sites	Mar. 1986	35 months
Start firing of boiler	Aug. 1986	40 months
Steam admission to turbine	Dec. 1986	44 months
Commercial operation	Mar. 1987	47 months

1.4 Final Disbursement

When 2nd longwall of the coal mine comes into operation and all of the construction work of the power station is completed, a take-over trial test is due to be undertaken in the presence of both WAPDA and the contractors.

The final payment in the forms of either foreign exchange or local currency have to be settled between WAPDA and the contractors within one month from the date of approval given by WAPDA for the result of the take-over trial test.

Entire disbursement for the project shall be made by Decmeber 1987 in any case.

1.5 Executing Organization and Administration

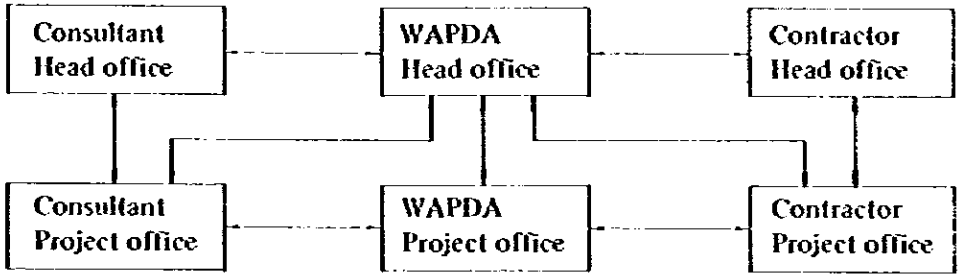
During the entire schedule of the project implementation, it is advisable for WAPDA to emply consultants for obtaining support or execution and administration of the project.

Execution of the construction work shall be devided into four major sections stated below.

1. Coal mine development
2. B/T/G with desulfurating plant
3. Civil and construction works
4. Coal handling plant

Among the above sections, priority is to be given to the development of the open pit mines of the coal mine development when compared with others, therefore, the work should be started without loss of time.

An organization chart and relationship among WAPDA, the consultants and the contractor is shown as follows:



(1) Work to be Undertaken by WAPDA

1) Application for the finance

Marking an application for the finance to the financial institution through the Government of Pakistan along with the "implementation plan" explaining the outline and the financial plan of the project.

2) Selection of the consultants

Defining the "Terms and Reference" for the consultancy work, evaluating the proposals offered from consultans, making contracts with the consultants and opening letters of credit in favour of the consultants.

3) Compiling a tender documents

Determination and finalization of the tender documents, together with specification and drawings based on a draft submitted by the consultants.

4) Inviting tender and awarding contractors

Announcing the tenders and evaluating the bids from tenders under the assistance rendered by the consultants, thereafter awarding contractors with contracts and opening letters of credit in favour of the contractors.

5) Preparatory work before commencing construction

Acquisition of land for the project sites, supply of electricity and water at sites and any other preparatory work to start construction.

6) Approval of documents and drawings

Appraising and giving approval of the documents and the drawings submitted by the contractors.

7) Policy for the project execution

Making decision on WAPDA's personnel plan for the construction work, organization for project execution, plan for the construction work, testing programme for divisional work and procedures for take-over trial test.

8) Issuance of take-over certificate

Issuing a take-over certificate after the result of trial tests in accordance with the procedures decided by WAPDA under the cooperation rendered by the consultants.

9) Leadership coordination and control for execution of the whole project.

10) Payment to the contractors.

(2) Work to be Undertaken by the Consultants

The following is the major work for which the consultants are responsible.

1) Review of the feasibility report and undertaking detail design on receipt of letters of credit in favour of the consultants from WAPDA.

2) Tender documents and specifications

Drafting tender documents and any other related documents with specifications for WAPDA such as an invitation letter, general and specific terms and conditions of the tender, technical specifications, detals of engineering matters, a bid from, etc.

3) Tender evaluation

Screening of bids submitted by tenderers according to evalvation standard and manner agreed upon between WAPDA and the consultants and preparation of a report dealing with the results of their evaluation and recommendation thereof to WAPDA.

4) Assistance in finalizing contracts

Necessary assistance to WAPDA in finalizing contracts with contractors.

5) Assistance in approval of documents

Necessary assistance to WAPDA for appraisal and recommendation on the documents and drawings submitted by the contractors to WAPDA.

6) Assistance in inspections at manufacturer's factories, which are undertaken outside Pakistan.

7) Assistance in supervision for construction work

Technical assistance rendered to the supervisory staff of WAPDA at project sites.

8) Assistance in tests

Assistance in evaluation and result of the tests beging carried out by the contractors and in making a recommendation on the result of tests to WAPDA. Necessary technical assistance and recommendation to WAPDA for issuing the take-over certificate to the contractors.

9) Monthly report

Making a monthly report comprising work undertaken by the consultants and recommendation for progress of the construction work to WAPDA and also making a final report on the completion of the work when the construction work is entirely completed.

Implementation Schedule for Construction of Lakhra Coal Mine and Thermal P

Description		Months	1981 J F M A M J J A S O N D	1982	1983	1984	1985	1986
Major* Event	Preparation of Tender Documents & Issure	12.0						
	Receipt and Evaluation of Bids	6.0						
	Award of Contract	5.0						
	Appointment of Consultants for Construction	4.0						
	Opening of L/C for Construction	5.0						
Coal Mine	Detailed Survey & Drilling	(27.0)	Survey	Drilling	Desk Work			
	Preparatory Work	9.0						
	Road & Railroad	48.0						
	Preparation Plant	27.0				Substation& Work shop		
	Other Surface Facilities	33.0				Preparation	Developping	Initial Production
	Underground Mine	27.0 12.0					(4,000t) Initial Production (18,000t)	(131,000t)
	Open Pit	57.0		(Pre - Stripping)			(123,000t) (301,000t)	(602,000t)
Power Station	Preparatory Work	9.0						
	Water Intake & Discharge	29.0						
	Building & Houses	30.0						
	Equipment	19.0				Design & Fabrication	Storage Yard	Handling Equipment
	Coal Handling	19.0				Foundation	Structural Work	
	Generating Unit 300 MW	42.0						Installation
Consultancy Service		Years 5 11/12						
Coal Production (As Received Base) '000 MT					0	127	319	733

* The pre-production schedule has been prepared in response to a request made by the Pakistani delegation at a meeting held in Tokyo in November, 1980.

FIGURE 1-1

dule for Construction of Lakhra Coal Mine and Thermal Power Station

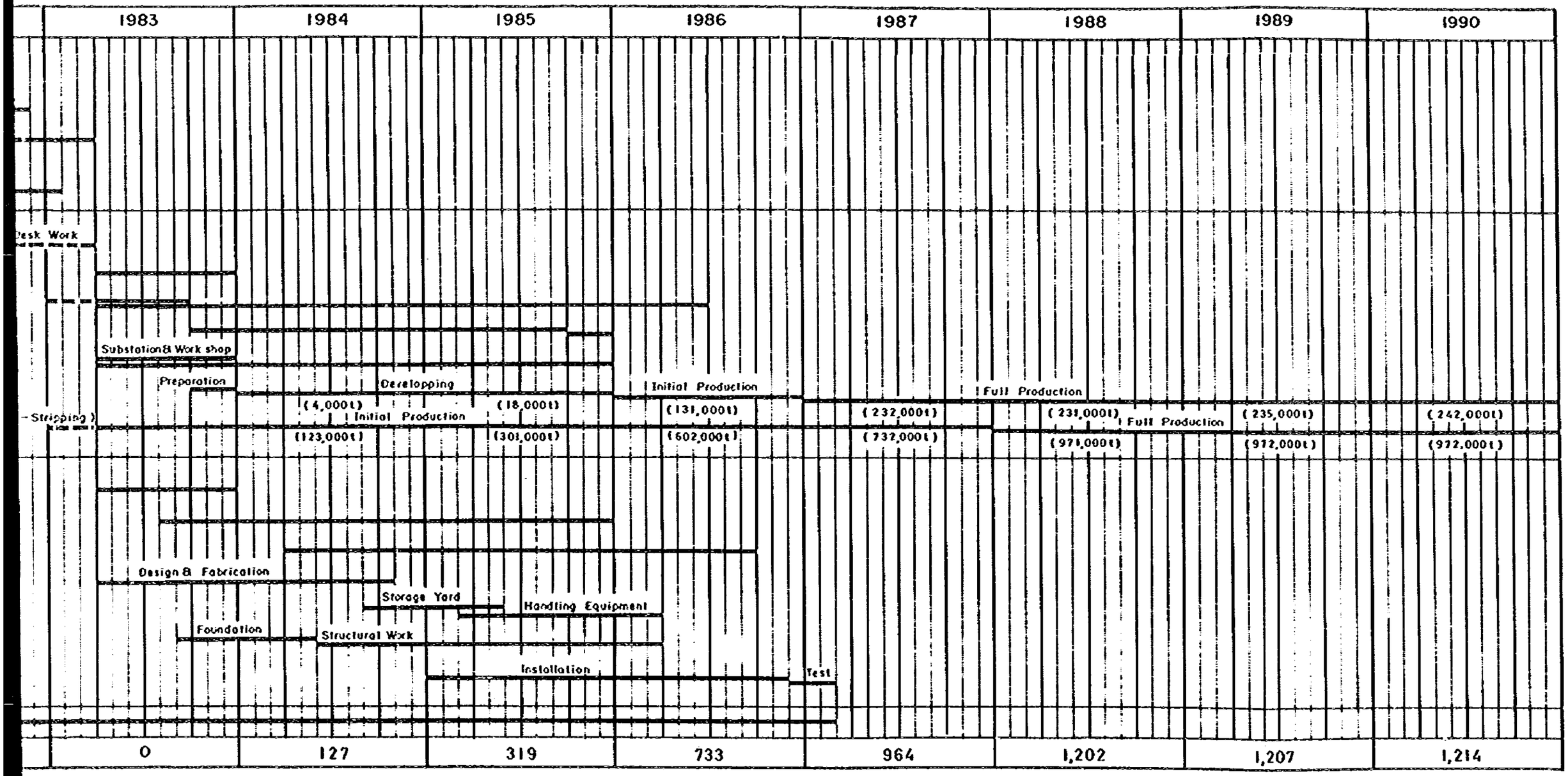


FIGURE 1 - 2

Construction Schedule of Lakhra Coal Mine

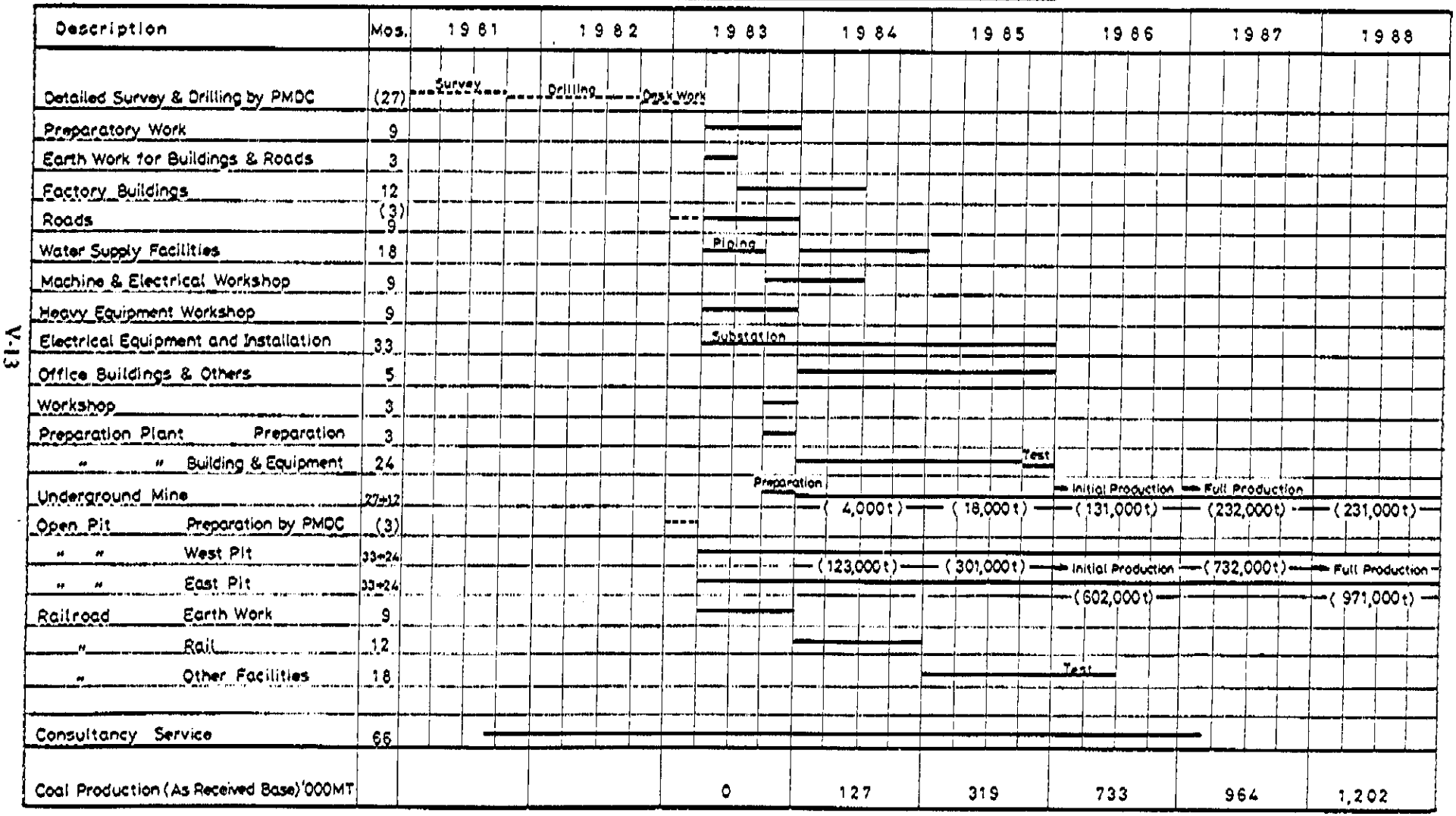
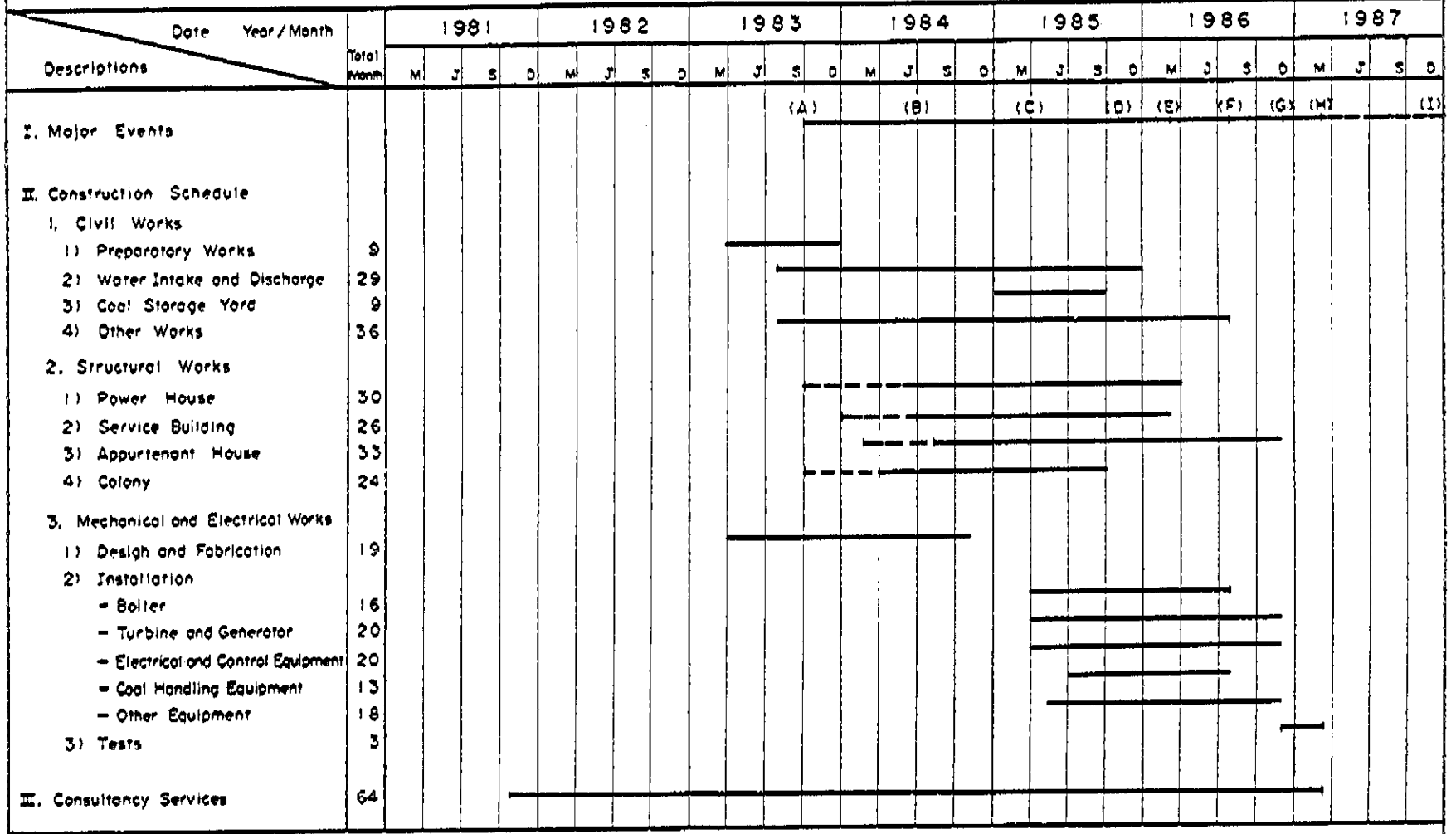


FIGURE 1-3 Construction Schedule for Lakhra Coal-Fired Thermal Power Station (300 MW x 1 Unit)



Note,
(A) Commencement of Foundation Works
(B) Commencement of Structural Works
(C) Drum Lifting
(D) Hydro Static Test
(E) Initial Power Recieve
(F) Initial Firing
(G) Steam Admission to Turbine
(H) Commissioning
(I) Final Disbursement

CHAPTER 2 ESTIMATED CAPITAL COSTS

2-1 General Description

The estimated capital costs in this study are composed of the following ones;

> Direct costs inclusive of equipment cost, construction cost and contingency, and indirect costs inclusive of import duties, engineering fee, administration cost and interest during construction.

The above mentioned capital costs are calculated in the foreign currency and local currency portions, respectively.

The costs in the foreign currency portion include the each FOB price of machinery and tools, electrical equipment, materials and supplies as well as spare parts thereof for five years to come, ocean freight and engineering fee for expatriate personnel.

The costs in the local currency portion include salaries and wages of WAPDA & PMDC officials and laborers, local materials such as cement and aggregate domestically produced and purchased for construction work, and inland transportation and import duties of construction machinery and tools imported from overseas countries.

In particular, it is worthwhile stating that the marine cargo insurance premium is quoted in the local currency portion in accordance with the policy of Pakistan.

The capital costs stated above have been estimated both in the foreign and local currency portions, based on the following conditions.

(1) Requirements in Foreign and Pakistani Currencies and Estimated Under the Following Conditions:

1) Requirement in a foreign currency:
Obtained based on the prices prevailing in Japan as of June 1980 (on a C&F basis).

2) Requirement in the Pakistani currency:
Obtained, with prices prevailing in Pakistan as of June 1980 reckoned as a reference standard.

(2) Currency exchange rates adopted are as follows:

1 US $ = 10 Rs
1 US $ = 220 ¥
1 Rs = 22 ¥

(3) Import Duties

40% of the C&F price is reckoned as import duties.

(4) Contingencies

5% of the costs for civil engineering, construction work and electrical equipment is reckoned as the contingencies which are to be applied to an inevitable design modification and to an item not taken into account upon estimation of prices.

(5) Administration Cost

4% of direct costs is reckoned as the administration cost covering those expenses necessary for WAPDA & PMDC to undertake the Project, which will be incurred in head and field offices and in connection therewith.

(6) Engineering Fee

5% of direct cost is estimated as the engineering fee which includes personnel expenses, enumeration, overheads, travelling expenses, various communication expenses, etc. which will be incurred in employment of consultants. This fee, meanwhile, includes expenses necessary for WAPDA & PMDC personnel to stay in a foreign country in connection with the performance of work related to the services of consultants which includes evaluation of bids.

(7) Interest during Construction

In consideration of the implementation program and conceivable terms and conditions of loans normally applied to the projects of WAPDA & PMDC, interest during construction is calculated at 8.75% for a loan in a foreign currency portion and at 12.5% for that in the Pakistani currency portion, respectively.

(8) Assumptions

The following expenses, however, have been excluded from the estimates in this report:

- Land procurement cost and compensation expenses of any nature
- House, guest house, mosque, recreation facility and the like.
- Taxes imposed on engineering fee and income tax for foreign engineers.
- Escalation

Details of this estimated capital costs is shown in Tables 2-1 to 2-16.
These costs could be summarized by main item and by currency as shown in the next page.

CAPITAL COST

TOTAL OF MINE AND POWER STATION
(000,000's) RUPEES

Description	Mine			Power Station			Total		
	Foreign currency	Local currency	Total	Foreign currency	Local currency	Total	Foreign currency	Local currency	Total
Purchase, Installation & Erection of Equipment	1,131	350	1,481	2,405	1,065	3,470	3,536	1,415	4,951
Contingency	56	18	74	121	53	174	177	71	248
Direct Cost	1,187	386	1,555	2,526	1,118	3,644	3,713	1,486	5,199
Import Duty	–	452	452	–	905	905	–	1,357	1,357
Engineering Fee	58	19	77	147	35	182	205	54	259
Administration Cost	–	62	62	–	146	146	–	208	208
Indirect Cost	58	533	591	147	1,086	1,233	205	1,619	1,824
Total	1,245	901	2,146	2,673	2,204	4,877	2,918	3,105	7,023
Interest During F.C.	–	188	376	–	620	1,348	–	808	1,724
Construction L.C.	–	188		–	728		–	916	
Grand Total	1,245	1,277	2,522	2,673	3,552	6,225	3,918	4,829	8,747

Freight, taxes and duty included.
The estimates reflect 1980 June price levels.
No escalation.

2-2 Mine Development

The estimated capital costs have been calculated as the period of construction will be from 1983 to 1985.

Based on the PMDC PC-1 report (Feb. 12, 1976), the estimated capital costs have been calculated as follows:

(1) Production Facilities –

- Site work, and construction cost of road, factory buildings and preparation plant.
- Mechanical and electrical equipment purchased and installation costs applicable to the mine operation.
- Machines and materials for mine development and construction costs applicable to the mine operation.
- Mine development and construction costs have been included the costs of road heading for underground mining, overburden stripping for open pit, maintenance of equipment parts and power cost, etc.
- Preliminary expenses during the initial 36 months of the project.
  Preliminary expenses cover such costs as the cost of drilling and technical fee of foreign engineers.

(2) Ancillary Facilities –

- Construction costs of office buildings, furnitures, etc.

(3) Service & Welfare Facilities –

- Officers' salaries and workers' wages during the initial 36 months of the project.

(4) Railway Facilities –

- Construction of track and mechanical and electrical equipment purchased and installation cost
- Loading and unloading facilities

The costs for detailed exploration and drilling in 1981 and 1982 have not been included.

Escalation has not been included.

Based on the above, the estimated capital costs have been calculated.

Details of the estimates are shown in Table 2-1 to Table 2-12.
Summaries of the estimates are shown in following tables:

ESTIMATED CAPITAL COST
(000,000's) Rupees

Description	Foreign currency	Local currency	Total
Production Facilities	1,022	222	1,244
Ancillary Facilities	3	20	23
Service, Welfare Facilities	–	23	23
Sub-Total	1,025	265	1,290
Railway Facilities	106	85	191
Contingency	56	18	74
Sub-Total	162	103	265
Direct Cost Total	1,187	368	1,555
Import Duty	–	452	452
Engineering Fee	58	19	77
Administration Cost	–	62	62
Indirect Cost Total	58	533	591
Total	1,245	901	2,146
Interest During F.C.	–	188	376
Construction L.C.	–	188	
Grand Total	1,245	1,277	2,522

Freight, taxes and duty included.
The estimates reflect 1980 June price levels.
No. escalation.

ESTIMATED CAPITAL COST OF MINE
(000,000's) Rupee's

Description	Foreign currency	Local currency	Total
Production Facilities	1,022	630	1,652
Ancillary Facilities	3	20	23
Service & Welfare Facilities	–	24	24
Total	1,025	674	1,699

Freight, taxes and duty included.
Contingency in direct cost not included.
The estimates reflect 1980 June price levels.
No escalation.

ESTIMATED CAPITAL COST BY FACILITIES
(000,000's) Rupee's

Description	Foreign currency	Local currency	Total
Underground Mine	85	49	134
Open Pit	803	493	1,296
Surface Facilities	71	80	151
Preparation Plant	66	52	118
Sub-Total	1,025	674	1,699

Freight, taxes and duty included.
Contingency in direct cost not included.
The estimates reflect 1980 June price levels.
No escalation.

2-3 Coal Fired Power Station

The costs necessary to construct the coal-fired thermal power station are included in the estimated capital costs.

In accordance with the implementation schedule, moreover, costs are estimated at prices prevailing as of June, 1980 on the assumption that 300 MW unit will be completed in March 1987.

The estimated costs include the following ones:

- Construction of camps (contractors' offices, lodging, mess hall, canteen, etc.) necessary for the construction work, roadways for work, etc.
- Fuels and chemicals necessary for acceptance tests.

The construction costs to be incurred on this Project roughly estimated as shown in Table 2-13.

The fund requirement by year is estimated based on the implementation schedule under the following conditions:

(1) Civil Engineering and Construction Works - - - - progress payment.

(2) Equipment cost (C&F)

- 10% of C&F value - - - - upon signing the contract
- 80% of C&F value - - - - upon shipment
- 10% of C&F value - - - - upon completion of acceptance test

(3) Installation Work - - - - progress payment

(4) Contingencies - - - - proportion to the amount of annual direct work costs

(5) Administration

- Costs after the commencement of work are estimated in proportion to the annual payment of direct work costs

Work costs by year estimated under the above-mentioned conditions are as shown in Table 2-14.

TABLE 2-1

CAPITAL COST

TOTAL OF MINE AND RAILWAY

(000.000's) Rupees

Year / Item	TOTAL			1981			1982			1983			1984			1985		
	Foreign	Local	Total	Foreign	Local	Total	Foreign	Local	Total	Foreign	Local	Total	Foreign	Local	Total	Foreign	Local	Total
Mine	1,025	265	1,290	-	-	-	-	-	-	530	71	601	271	102	373	224	92	316
Railway	106	85	191	-	-	-	-	-	-	-	49	49	17	33	50	89	3	92
Contingency	56	18	74	-	-	-	-	-	-	27	6	33	15	7	22	14	5	19
Direct Sub-total	1,187	368	1,555	-	-	-	-	-	-	557	126	683	303	142	445	327	100	427
Import Duty	-	452	452	-	-	-	-	-	-	-	212	212	-	114	114	-	126	126
Engineering Fee	58	19	77	11	3	14	11	3	14	12	4	16	12	6	18	12	3	15
Administration	-	62	62	-	4	4	-	6	6	-	16	16	-	17	17	-	19	19
Indirect Sub-total	58	533	591	11	7	18	11	9	20	12	232	244	12	137	149	12	148	160
Total	1,245	901	2,146	11	7	18	11	9	20	569	358	927	315	279	594	339	248	587
Interest during Construction	-	376	376	-	2	2	-	2	2	-	52	52	-	129	129	-	191	191
GRAND TOTAL	1,245	1,277	2,522	11	9	20	11	11	22	569	410	979	315	408	723	339	439	778

Freight, taxes and duty included.
The estimates reflect 1980 June price levels.
No escalation.

TABLE 2-2

CAPITAL COST SUMMARY

(000's) RUPEES

Description	1983					1984					1985					Total				
	Foreign	Local			Total	Foreign	Local			Total	Foreign	Local			Total	foreign	Local			Total
		Direct	Tax	Total			Direct	Tax	Total			Direct	Tax	Total			Direct	Tax	Total	
(MINE)																				
A. PRODUCTION FACILITIES																				
Land & Improvement	-	279	-	279	-	-	-	-	-	-	-	-	-	-	-	-	279	-	279	279
Buildings	-	7,914	-	7,914	7,914	3,935	22,612	1,612	24,224	28,159	2,047	8,195	818	9,013	11,060	5,982	38,721	2,430	41,151	47,133
Machinery & Equipment	444,216	16,363	182,129	198,492	642,708	181,771	6,223	74,503	80,726	262,497	131,088	8,382	53,727	62,109	193,197	757,075	30,968	310,359	341,327	1,098,402
Electrical Equipment	25,945	673	10,637	11,310	37,255	6,078	118	2,490	2,608	8,686	8,633	1,369	3,533	4,907	13,540	40,656	2,160	16,655	18,825	59,481
Preliminary Expense	13,398	1,022	-	1,022	14,420	9,400	166	-	166	9,566	5,529	166	-	166	5,695	28,327	1,354	-	1,354	29,681
Construction & Development	45,064	33,375	18,886	52,261	98,325	67,722	51,350	27,766	79,116	146,838	76,575	63,637	31,395	95,032	171,607	190,361	148,362	78,047	226,409	416,770
SUB-TOTAL	529,623	59,626	211,652	271,278	800,901	268,906	80,469	106,371	186,840	455,746	223,872	81,749	89,478	171,227	395,099	1,022,401	221,844	407,501	629,345	1,651,746
B. ANCILLARY FACILITIES	845	6,430	347	6,777	7,623	2,279	12,687	934	13,621	15,900	220	455	90	545	765	3,345	19,572	1,371	20,943	24,288
C. SERVICE & WELFARE	-	5,268	-	5,268	5,268	-	8,184	-	8,184	8,184	-	9,482	-	9,482	9,482	-	22,934	-	22,934	22,934
TOTAL	530,469	71,324	211,999	283,323	813,792	271,185	101,340	107,305	208,645	479,830	224,092	91,686	89,568	181,254	405,346	1,025,746	264,350	408,872	673,222	1,698,968
(RAILWAY)																				
Road (Track)	-	49,160	-	49,160	49,160	17,400	33,080	7,134	40,214	57,614	-	-	-	-	-	17,400	82,240	7,134	89,374	106,774
Building	-	-	-	-	-	-	-	-	-	-	840	1,091	344	1,435	2,275	840	1,091	344	1,435	2,275
Machinery & Equipment	-	-	-	-	-	-	-	-	-	-	78,323	1,484	32,112	33,595	111,919	78,323	1,484	32,112	33,595	111,919
Electrical Equipment	-	-	-	-	-	-	-	-	-	-	9,371	173	3,842	4,015	13,386	9,371	173	3,842	4,015	13,386
TOTAL	-	49,160	-	49,160	49,160	17,400	33,080	7,134	40,214	57,614	88,534	2,748	36,298	39,045	127,580	105,934	84,988	43,432	128,420	234,354
GRAND TOTAL	530,469	120,484	211,999	332,483	862,952	288,585	134,420	114,439	248,859	537,444	312,626	94,434	125,866	220,300	532,926	1,131,680	349,338	452,304	801,642	1,933,322

Freight, taxes and duty included.
The estimates reflect 1980 June price levels.
No escalation.

TABLE 2-3
CAPITAL COST
SUMMARY
(000's) RUPEES

Sheet 1

Description	1983			1984			1985			TOTAL		
	Foreign	Local	Total	Foreign	Local	Total	Foreign	Local	Total	Foreign	Local	Total
A. Production Facilities												
i) Land and improvement	-	279	279	-	-	-	-	-	-	-	279	279
ii) Buildings:-												
a) Factory buildings												
Surface Facilities	-	1,134	1,134		1,036	1,036	-	-	-	-	2,170	2,170
Preparation plant	-	-	-	3,935	14,194	18,129	2,047	9,013	11,060	5,982	23,207	29,189
Sub-Total	-	1,134	1,134	3,935	15,230	19,165	2,047	9,013	11,060	5,982	25,377	31,359
b) Road	-	6,780	6,780	-	-	-	-	-	-	-	6,780	6,780
c) Water supply	-	-	-	-	8,994	8,994	-	-	-	-	8,994	8,994
Total	-	7,914	7,914	3,935	24,224	28,159	2,047	9,013	11,060	5,982	41,151	47,133
iii) Machinery & Equipment												
Underground mine	-	-	-	7,222	3,096	10,318	66,404	28,613	95,017	73,626	31,709	105,335
Open pit	421,263	187,948	609,211	148,113	66,293	214,406	41,410	18,762	60,172	610,786	273,003	883,791
Surface facilities	22,953	10,544	33,497	3,356	1,485	4,841	-	-	-	26,309	12,029	38,338
Preparation plant	-	-	-	23,078	9,852	32,930	23,274	14,734	38,008	46,352	24,586	70,938
Sub-Total	444,216	198,492	642,708	181,771	80,726	262,497	131,088	62,109	193,197	757,073	341,327	1,098,402
iv) Electrical equipment												
Surface facilities	25,945	11,310	37,255	4,205	1,808	6,013	6,759	2,913	9,672	36,909	16,031	52,940
Preparation plant	-	-	-	1,873	800	2,673	1,874	1,994	3,868	3,747	2,794	6,541
Sub-Total	25,945	11,310	37,255	6,078	2,608	8,686	8,633	4,907	13,540	40,656	18,825	59,481
v) Preliminary expenses												
Underground mine	-	-	-	865	-	865	865	-	865	1,730	-	1,730
Open pit	9,510	-	9,510	2,463	-	2,463	446	-	446	12,419	-	12,419
Surface facilities	2,892	1,022	3,914	275	166	441	396	166	562	3,563	1,354	4,917
Preparation plant	996	-	996	5,797	-	5,797	3,822	-	3,822	10,615	-	10,615
Sub-Total	13,398	1,022	14,420	9,400	166	9,566	5,529	166	5,695	28,327	1,354	29,681
vi) Construction & Development												
Underground mine	-	90	90	5,622	5,199	10,821	4,596	7,131	11,727	10,218	12,420	22,638
Open pit	46,064	52,065	98,129	61,914	73,116	135,030	71,584	85,544	157,128	179,562	210,725	390,287
Surface facilities	-	106	106	186	801	987	395	1,417	1,812	581	2,324	2,905
Preparation plant	-	-	-	-	-	-	-	940	940	-	940	940
Sub-Total	46,064	52,261	98,325	67,722	79,116	146,838	76,575	95,032	171,607	190,361	226,409	416,770

Freight, taxes and duty included.
The estimates reflect 1980 June price levels.
No escalation.

TABLE 2-3

(continued)

Sheet 2

Description	1983			1984			1985			TOTAL		
	Foreign	Local	Total	Foreign	Local	Total	Foreign	Local	Total	Foreign	Local	Total
TOTAL	529,623	271,278	800,901	266,906	188,840	455,746	223,872	171,227	395,099	1,022,401	629,345	1,651,746
B. Ancillary Facilities												
I) Office building, ware house, etc.	-	6,133	6,133	-	7,237	7,237	-	100	100	-	13,470	13,470
II) Furniture & fixtures				2,200	6,050	8,250	220	145	365	2,420	6,195	8,615
III) Transport for use within the factory for supplies and marketing	846	644	1,490	79	334	413	-	300	300	925	1,278	2,203
Total	846	6,777	7,623	2,279	13,621	15,900	220	545	765	3,345	20,943	24,288
C. Service and Welfare Facilities												
I) Buildings												
II) Contingency												
III) Deffered revenue expenditure												
Underground	-	20	20	-	1,663	1,663	-	2,174	2,174	-	3,865	3,865
Open pits	-	2,904	2,904	-	3,428	3,428	-	3,428	3,428	-	9,760	9,760
Surface facilities		2,336	2,336	-	3,059	3,059	-	3,559	3,559	-	8,954	8,954
Preparation plant	-	-	-	-	-	-	-	270	270	-	270	270
Abandonment	-	-	-	-	34	34	-	51	51	-	85	85
Total	-	5,260	5,260	-	8,184	8,184	-	9,482	9,482		22,934	22,934
Grand-Total	530,469	283,323	813,792	271,185	208,645	479,830	224,092	181,254	405,346	1,025,746	673,222	1,698,968
CLASSIFICATION OF CAPITAL COST												
Underground mine	-	118	118	13,709	9,992	23,701	71,665	37,969	109,634	85,374	48,079	133,453
Open pit	476,837	242,917	719,754	212,492	142,837	355,329	113,440	107,734	221,174	802,769	493,488	1,296,257
Surface facilities	52,636	40,288	92,924	10,301	30,970	41,271	7,770	8,600	16,370	70,707	79,858	150,565
Preparation plant	996	-	996	34,683	24,846	59,529	31,017	26,951	57,968	66,696	51,797	118,493

Freight, taxes and duty included.
The estimates reflect 1980 June price levels.
No escalation.

TABLE 2-4

CAPITAL COST

UNDERGROUND MINE

(000's) RUPEES

Description	1983			1984			1985			TOTAL		
	Foreign	Local	Total	Foreign	Local	Total	Foreign	Local	Total	Foreign	Local	Total
A. Production Facilities												
iii) Machinery Equipment												
Coal mining machinery	-	-	-	-	-	-	25,774	11,075	36,849	25,774	11,075	36,849
Road heading machinery				1,640	704	2,344	672	290	962	2,312	994	3,306
Transportation machinery	-	-	-	3,440	1,470	4,910	32,477	13,989	46,466	35,917	15,459	51,376
Drainage machinery	-	-	-	54	23	77	393	168	561	447	191	638
Ventilation machinery				713	305	1,018	2,833	1,240	4,073	3,546	1,545	5,091
Air & Water machinery	-	-	-	411	181	592	2,233	983	3,216	2,644	1,164	3,808
Other machinery				964	113	1,377	2,022	868	2,890	2,986	1,281	4,267
Total				7,222	3,096	10,318	66,404	28,613	95,017	73,626	31,709	105,335
v) Preliminary Expense				865	-	865	865	-	865	1,730	-	1,730
vi) Construction & Development												
Arch support				2,713	1,159	3,872	1,889	808	2,697	4,602	1,967	6,569
I - Beam				34	14	48	745	319	1,064	779	333	1,112
Rails				1,753	749	2,502	805	343	1,148	2,558	1,092	3,650
Pipes				516	219	735	429	182	611	945	401	1,346
Timber				-	28	28	-	90	90	-	118	118
Explosives				-	277	277	-	239	239	-	516	516
Detonator (M.S.D.)				513	219	732	442	189	631	955	408	1,363
Ventilation tube				33	13	46	51	21	72	84	34	118
Oils				-	1,745	1,745	-	2,245	2,245	-	3,990	3,990
Rock dust				-	50	50	-	100	100	-	150	150
Concrete				-	28	28	-	67	67	-	95	95
Others				60	31	91	92	44	136	152	75	227
Sub-Total				5,622	4,532	10,154	4,453	4,647	9,100	10,075	9,179	19,254
Machinery maintenance				-	-	-	143	140	283	143	140	283
Portal	-	90	90	-	220	220	-	-	-	-	310	310
Power	-	-	-	-	447	447	-	2,344	2,344	-	2,791	2,791
Sub-Total	-	90	90	-	667	667	143	2,484	2,627	143	3,241	3,384
Total	-	90	90	5,622	5,199	10,021	4,596	7,131	11,727	10,218	12,420	22,638

Freight, taxes and duty included.
The estimates reflect 1900 June price levels.
No escalation.

TABLE 2-5

CAPITAL COST

OPEN PIT

(000's) RUPEES

Description	1983			1984			1985			TOTAL		
	Foreign	Local	Total	Foreign	Local	Total	Foreign	Local	Total	Foreign	Local	Total
A, Production Facilities												
iii) Machinery & Equipment												
Mining Machinery	304,180	137,768	441,948	110,245	50,122	160,367	30,520	14,111	44,631	444,945	202,001	646,946
Service Vehicles and Equipment	7,709	3,434	11,143	62	27	89	144	62	206	7,915	3,523	11,438
Spare parts	109,374	46,746	156,120	37,808	16,144	53,952	10,746	4,589	15,335	157,928	67,479	225,407
Total	421,263	187,948	609,211	148,115	66,293	214,408	41,410	18,762	60,172	610,788	273,003	883,791
v) Preliminary Expense	9,510	-	9,510	2,463	-	2,463	446	-	446	12,419	-	12,419
vi) Construction Development												
Parts supply	15,991	6,828	22,819	23,835	10,177	34,012	27,784	11,864	39,648	67,610	28,869	96,479
Truck Tyre	6,889	2,942	9,831	10,897	4,653	15,550	12,914	5,514	18,428	30,700	13,109	43,809
Explosives	23,184	9,899	33,083	27,182	11,607	38,789	30,886	13,188	44,074	81,252	34,694	115,946
Repair Material	-	3,198	3,198	-	4,767	4,767	-	5,557	5,557	-	13,522	13,522
Electric power	-	1,054	1,054	-	1,608	1,608	-	1,788	1,788	-	4,450	4,450
Fuel & Oil	-	28,144	28,144	-	40,304	40,304	-	47,633	47,633	-	116,081	116,081
Total	46,064	52,065	98,129	61,914	73,116	135,030	71,584	83,544	157,128	179,562	210,725	390,287

Freight, taxes and duty included.
The estimates reflect 1980 June price levels.
No escalation.

TABLE 2-6
CAPITAL COST
SURFACE FACILITIES
(000's) RUPEES

Sheet 1

Description	1983			1984			1985			TOTAL		
	Foreign	Local	Total	Foreign	Local	Total	Foreign	Local	Total	Foreign	Local	Total
A. Production Facilities												
I) Land & Improvement												
Earth work for building	-	204	204	-	-	-	-	-	-	-	204	204
Earth work for road	-	75	75	-	-	-	-	-	-	-	75	75
Total	-	279	279	-	-	-	-	-	-	-	279	279
II) Buildings												
a) Factory buildings												
Substations power house	-	1,134	1,134	-	-	-	-	-	-	-	1,134	1,134
Compressor, fan & others		-	-	-	1,036	-	-	-	-	-	1,036	1,036
Total	-	1,134	1,134	-	1,036	-	-	-	-	-	2,170	2,170
b) Roads												
Coal haulage	-	2,160	2,160	-	-	-	-	-	-	-	2,160	2,160
Others		4,620	4,620	-	-	-	-	-	-	-	4,620	4,620
Total		6,780	6,780	-	-	-	-	-	-	-	6,780	6,780
c) Water supply facilities												
Water intake facilities	-	-	-	-	574	574	-	-	-	-	574	574
Water purification facilities	-	-	-	-	4,616	4,616	-	-	-	-	4,616	4,616
Water distribution	-	-	-	-	3,804	3,804	-	-	-	-	3,804	3,804
Total	-	-	-	-	8,994	8,994	-	-	-		8,994	8,994

Freight, taxes and duty included.
The estimates reflect 1980 June price levels.
No. escalation.

TABLE 2-6
CAPITAL COST
SURFACE FACILITIES
(000's) RUPEES (continued)

Sheet 2

Description	1983			1984			1985			TOTAL		
	Foreign	Local	Total	Foreign	Local	Total	Foreign	Local	Total	Foreign	Local	Total
iii) Machinery & Equipment												
Water Supply Equipment	-	-	-	1,200	553	1,753	-	-	-	1,200	553	1,753
Pipe lines	12,690	6,033	18,723	-	-	-	-	-	-	12,690	6,033	18,723
Machine repair shop	2,760	1,230	3,990	-	-	-	-	-	-	2,760	1,230	3,990
Heavy vehicle repair shop	6,263	2,750	9,013	-	-	-	-	-	-	6,263	2,750	9,013
Power house machinery	540	232	772	2,156	932	3,088	-	-	-	2,696	1,164	3,860
Electrical repair shop	700	299	999	-	-	-	-	-	-	700	299	999
Total	22,953	10,544	33,497	3,356	1,485	4,841	-	-	-	26,309	12,029	38,338
iv) Electrical Equipment & Installation												
a) Surface Power Distribution												
Overhead line	3,565	1,616	5,181	-	-	-	-	-	-	3,565	1,616	5,181
Mine substation	7,978	3,462	11,440	-	-	-	-	-	-	7,978	3,462	11,440
Lighting & others	720	319	1,039	117	55	172	-	-	-	837	374	1,211
Spare parts	442	190	632	-	-	-	-	-	-	442	190	632
Total	12,705	5,587	18,292	117	55	172	-	-	-	12,822	5,642	18,464
b) Open pits												
Overhead line	2,310	1,032	3,342	-	-	-	-	-	-	2,310	1,032	3,342
Substation	4,720	2,026	6,746	-	-	-	-	-	-	4,720	2,026	6,746
Mobile switching station	700	304	1,004	-	-	-	-	-	-	700	304	1,004
Cable	5,306	2,274	7,580	-	-	-	-	-	-	5,306	2,274	7,580
Spare parts	204	87	291	-	-	-	-	-	-	204	87	291
Total	13,240	5,723	18,963	-	-	-	-	-	-	13,240	5,723	18,963

Freight, taxes and duty included.
The estimates reflect 1980 June price levels.
No escalation.

TABLE 2-6
CAPITAL COST
SURFACE FACILITIES
(000's) RUPEES (continued)

Sheet 3

Description	1983			1984			1985			TOTAL		
	Foreign	Local	Total	Foreign	Local	Total	Foreign	Local	Total	Foreign	Local	Total
c) Underground Mine												
3.3kV line switch, etc.				2,216	952	3,168	2,792	1,198	3,990	5,008	2,150	7,158
Air circuit breaker, etc.				649	277	926	566	244	810	1,215	521	1,736
Cable and others				751	321	1,072	1,411	602	2,013	2,162	923	3,085
Spare parts				472	203	675	368	243	611	1,040	446	1,486
Total	-	-	-	4,088	1,753	5,841	5,337	2,287	7,624	9,425	4,040	13,465
d) Communication												
Telephone system				-	-	-	609	269	878	609	269	878
Inductive radio							476	205	681	476	205	681
Wireless							270	124	394	270	124	394
Spare parts, etc.							67	28	95	67	28	95
Total	-	-	-				1,422	626	2,048	1,422	626	2,048
Grand Total	25,945	11,310	37,255	4,205	1,808	6,013	6,759	2,913	9,672	36,909	16,031	52,940
v) Preliminary Expense												
Drilling machine & spare parts	2,200	1,022	3,222	200	166	366	200	166	366	2,600	1,354	3,954
Installation of substation, etc.	692	-	692	75	-	75	196	-	196	963	-	963
Total	2,892	1,022	3,914	275	166	441	396	166	562	3,563	1,354	4,917
vi) Construction & development												
Spare parts	-	-	-	186	218	404	395	311	706	581	529	1,110
Fuel & oil	-	106	106	-	210	210		390	390	-	706	706
Power cable	-	-	-	-	213	213	-	336	336	-	549	549
Machine maintenance					160	160		380	380	-	540	540
Total	-	106	106	186	601	987	395	1,417	1,812	581	2,324	2,905

Freight, taxes and duty included.
The estimates reflect 1980 June price levels.
No escalation.

TABLE 2-6
CAPITAL COST
SURFACE FACILITIES
(000's) RUPEES (continued)

Sheet 4

Description	1983			1984			1985			TOTAL		
	Foreign	Local	Total	Foreign	Local	Total	Foreign	Local	Total	Foreign	Local	Total
6. Ancillary Facilities												
i) Office Building, warehouse, etc.												
Office buildings	-	-	-	-	5,382	5,382	-	-	-		5,382	5,382
Workshop, stores, etc.	-	4,550	4,550		1,755	1,755	-	-	-		6,305	6,305
Explosive store	-	209	209		-	-	-	-	-		209	209
Oil storage and others	-	1,374	1,374		100	100	-	-	-		1,474	1,474
Maintenance								100	100		100	100
Total		6,133	6,133		7,237	7,237		100	100		13,470	13,470
ii) Furniture & fixture												
Micro computer				2,200	3,940	3,140	220	94	314	2,420	1,034	3,454
Office				-	1,606	1,606	-	16	16	-	1,622	1,622
Rest house & canteen				-	676	676	-	9	9	-	685	685
Hospital & others				-	2,628	2,628	-	26	26	-	2,654	2,654
Total				2,200	6,050	8,250	220	145	365	2,420	6,195	8,615
iii) Transport for use within the factory for supplies & marketing												
Staff & personal cars	846	401	1,247	-	42	42	-	42	42	846	485	1,331
Ambulance	-	-	-	79	38	117	-	4	4	79	42	121
Fuel	-	243	243	-	254	254	-	254	254	-	751	751
Total	846	644	1,490	79	334	413	-	300	300	925	1,278	2,203
Grand Total	846	6,777	7,623	2,279	13,621	15,900	220	545	765	3,345	20,943	24,288

Freight, taxes and duty included.
The estimates reflect 1980 June price levels.
No escalation.

TABLE 2-7
CAPITAL COST
PREPARATION PLANT
(000's) RUPEES

Description	1983			1984			1985			TOTAL		
	Foreign	Local	Total	Freight	Local	Total	Freight	Local	Total	Freight	Local	Total
A. Production Facilities												
ii) Buildings												
a) Factory building												
Building & utility	-	-	-	3,935	7,357	11,292	2,047	5,935	7,982	5,982	13,292	19,274
Foundation	-	-	-	-	4,617	4,617	-	3,078	3,078	-	7,695	7,695
Temporary work	-	-	-	-	2,220	2,220	-	-	-	-	2,220	2,220
Total	-	-	-	3,935	14,194	18,129	2,047	9,013	11,060	5,982	23,207	29,189
iii) Machinery & equipment												
Raw coal receiving & storage	-	-	-	4,862	2,073	6,935	1,620	1,771	3,391	6,482	3,844	10,326
Raw coal treatment	-	-	-	6,611	2,824	9,435	2,203	2,165	4,368	8,814	4,989	13,803
Clean coal storage	-	-	-	4,878	2,079	6,957	1,625	1,852	3,477	6,503	3,931	10,434
Clean coal loading	-	-	-	6,727	2,876	9,603	2,242	2,136	4,378	8,969	5,012	13,981
Other equipment	-	-	-	-	-	-	6,799	3,047	9,846	6,799	3,047	9,846
Spare parts	-	-	-	-	-	-	8,785	3,763	12,548	8,785	3,763	12,548
Total	-	-	-	23,078	9,852	32,930	23,274	14,734	38,008	46,352	24,586	70,938
iv) Electrical equipment				1,873	800	2,673	1,874	1,994	3,868	8,747	2,794	6,541
v) Preliminary expense	996	-	996	5,797	-	5,797	3,822	-	3,822	10,615	-	10,615
vi) Construction & development												
Maintenance			-			-		264	264		264	264
Materials			-			-		479	479		479	479
Electric power			-			-		197	197		197	197
Total								940	940		940	940

Freight, taxes and duty included.
The estimates reflect 1980 June price levels.
No escalation.

TABLE 2-8
CAPITAL COST
RAILWAY
(000's) RUPEES

Description	1983			1984			1985			TOTAL		
	Foreign	Local	Total	Foreign	Local	Total	Foreign	Local	Total	Foreign	Local	Total
Ancillary Facilities												
Check & repair shop						-	-	975	975	-	975	975
Worker house						-	-	100	100	-	100	100
Oil tanks						-	840	360	1,200	840	360	1,200
Total			-			-	840	1,435	2,275	840	1,435	2,275
Rail & Others												
Earth work	-	52	52			-	-		-	-	52	52
Grand level work, etc.		49,108	49,108			-	-		-	-	49,108	49,108
Rail and installation				17,400	40,214	57,614	-		-	17,400	40,214	57,614
Total	-	49,160	49,160	17,400	40,214	57,614	-	-	-	17,400	89,374	106,774
Machinery & Equipment												
Diesel locomotives			-			-	30,000	12,855	42,855	30,000	12,855	42,855
Wagon & passenger cars			-			-	38,310	16,433	54,743	38,310	16,433	54,743
Belt feeder, etc.			-			-	10,013	4,308	14,321	10,013	4,308	14,321
Total			-			-	78,323	33,596	111,919	78,323	33,596	111,919
Electrical equipment & Signal equipment, etc.			-			-	9,371	4,015	13,386	9,371	4,015	13,386
GRAND TOTAL	-	49,160	49,160	17,400	40,214	57,614	88,534	39,046	127,580	105,934	128,420	234,354

Freight, taxes and duty included.
The estimates reflect 1980 June price levels.
No escalation.

TABLE 2-9

CAPITAL COST
SALARIES AND WAGES
(000'S) RUPEES

(Local Currency)

Section	Description	Year			
		1983	1984	1985	Total
Underground Mine	Officers	16	522	606	1,144
	Workers	12	1,141	1,568	2,721
	Sub-Total	28	1,663	2,174	3,865
Open Pit	Officers	852	936	936	2,724
	Workers	2,052	2,492	2,492	7,036
	Sub-Total	2,904	3,428	3,428	9,760
Administration	Officers	1,450	1,691	1,807	4,948
	Workers	886	1,368	1,752	4,006
	Sub-Total	2,336	3,059	3,559	8,954
Preparation Plant	Officers	-	-	126	126
	Workers	-	-	144	144
	Sub-Total	-	-	270	270
Total	Officers	2,318	3,149	3,475	8,942
	Workers	2,950	5,001	5,956	13,907
	Total	5,268	8,150	9,431	22,849

The estimates reflect 1980 June price levels.
No escalation.

TABLE 2-10

CAPITAL COST
SALARIES
(000'S) RUPEES

(Local Currency)

Section	Description	Salary *	Year			
			1983	1984	1985	Total
Underground Mine	Mine Manager	3,620	11	43	43	97
	Deputy Mine Manager	3,055	-	73	73	146
	Assistnat Mining Engineer	2,545	-	92	92	184
	Longwall Face Foreman	1,155	-	-	-	-
	Pillar Splitting Foreman	1,155	-	-	-	-
	Road Heading Foreman	1,155	3	83	167	253
	Ventilation Foreman	1,155	-	14	14	28
	Road Maintenance Foreman	1,155	-	56	56	112
	Haulage Foreman	1,155	-	42	42	84
	Electrical & Mechanical Foremen	1,155	-	97	97	194
	Safetylamp Room Foremen	1,155	-	14	14	28
	Office Clerks	645	2	8	8	18
	Total		16	522	606	1,144
West Open Pit	Mine Manager	3,620	43	43	43	129
	Deputy Mine Manager	3,055	73	73	73	219
	Assistnat Mining Engineer	2,545	92	92	92	276
	Stripping Foremen	1,155	42	42	42	126
	Bankshooting Foremen	1,155	28	28	28	84
	Partings & Coal Loading Foremen	1,155	-	28	28	56
	Haulage Foremen	1,155	28	42	42	112
	Road Grading Foremen	1,155	14	14	14	42
	Reclamation Foremen	1,155	14	14	14	42
	Electrical Foremen	1,155	42	42	42	126
	Mechanical Foremen	1,155	42	42	42	126
	Office Clerks	645	8	8	8	24
	Sub-Total		426	458	458	1,362
East Open Pit	Mine Manager	3,620	43	43	43	129
	Deputy Mine Manager	3,055	73	73	73	219
	Assistnt Mining Engineer	2,545	92	92	92	276
	Stripping Foremen	1,155	42	42	42	276
	Bankshooting Foremen	1,155	28	28	28	84
	Partings & Coal Loading Foremen	1,155	-	28	28	56
	Haulage Foremen	1,155	28	42	42	112
	Road Grading Foremen	1,155	14	14	14	42
	Reclamation Foremen	1,155	14	14	14	42
	Electrical Foremen	1,155	42	42	42	126
	Mechanical Foremen	1,155	42	42	42	126
	Office Clerks	645	8	8	8	24
	Sub-Total		426	458	458	1,362
	Total		852	936	936	2,724

The estimates reflect 1980 June price levels. * Rs/man/month
No escalation.

TABLE 2-10

CAPITAL COST
SALARIES
(000'S) RUPEES

(Continued)

Sheet 2

Section	Description	Salary *	Year			
			1983	1984	1985	Total
Management	General Manager	5,650	68	68	68	204
	Deputy General Manager	5,090	122	122	122	366
	Clerks/Typist	645	23	23	23	69
	Sub-Total		213	213	213	639
General Affairs	Manager	3,620	43	43	43	129
	Deputy Manager	2,715	33	33	33	99
	Clerks/Typist	590	7	7	14	28
	Deputy Manager Security	2,715	33	33	33	99
	Security Inspectors	1,130	41	41	41	123
	Clerks	565	7	7	7	21
	Fesh Inens	645	8	8	15	31
	Sub-Total		172	172	185	530
Accounting	Accountant	3,055	37	37	37	111
	Assistant Accountant	1,630	20	20	20	60
	Account Assistants	1,155	14	14	14	42
	Cashier	1,155	14	14	14	42
	Clerks	565	7	7	7	21
	Deputy Manager Store	2,545	31	31	31	93
	Store Keepers	1,155	14	42	42	98
	Sub-Total		137	165	165	467
Labour & Social Welfare	Manager	3,620	43	43	43	129
	Deputy Manager Labour	2,715	33	33	33	99
	Supervisors, Enploy	930	11	11	11	33
	Supervisors, Control	930	-	34	34	68
	Deputy Manager, Fairprice Shop	1,630	-	-	20	20
	Sales Supervisors	860	-	-	10	10
	Account Assistant	860	-	-	10	10
	Clerk/Cashier	590	-	-	7	7
	Office Clerk	565	7	7	7	21
	Sub-Total		94	128	175	397
Civil & Water Supply	Manager	3,620	43	43	43	129
	Assistant Civil Engineer	2,715	33	33	33	99
	Overseer, Civil	1,630	20	20	20	60
	Assistant Surveyor	1,155	14	14	14	42
	Deputy Manager Water Supply	1,155	33	33	33	99
	Water Supply Foremen	1,115	14	14	14	42
	Office Clerk	565	7	7	7	21
	Sub-Total		164	164	164	492
Electrical & Mechanical	Manager	3,620	43	43	43	129
	Assistant Engineers	2,715	66	66	66	198
	General Foremen, Work Shop	2,715	33	33	33	99
	Electrical & Mechanical Foremen	1,155	28	56	56	140
	Work Shop Foremen	1,155	14	28	28	70
	Office Clerk	565	7	7	7	21
	Sub-Total		191	233	233	657

The estimates reflect 1980 June price levels. No escalation.

* Rs/man/month

TABLE 2-10

CAPITAL COST
SALARIES
(000'S RUPEES)

(Continued)

Sheet 3

Section	Description	Salary*	Year			
			1983	1984	1985	Total
System	Manager	3,620	-	43	43	86
	Analyst/Clerk	645	-	8	8	16
	Sub-Total		-	51	51	102
Training	Manager	3,620	43	43	43	129
	Trainer	1,155	28	28	83	139
	Office Clerk	565	7	7	7	21
	Sub-Total		78	78	78	289
Planning	Manager	3,620	43	43	43	129
	Assistant Engineer	2,715	65	65	65	195
	Junior Engineer	1,155	42	42	42	126
	Explosive Foreman	1,155	14	14	14	42
	Geologist	3,055	37	37	37	111
	Assistant Geologists	1,155	28	28	28	84
	Drilling Foreman	1,155	28	28	28	84
	Surveyor	2,545	31	31	31	93
	Assistant Surveyor	1,155	42	42	42	126
	Office Clerk	565	7	7	7	21
	Sub-Total		337	337	337	1,011
Safety	Manager	3,620	43	43	43	129
	Safety Crew	1,155	14	14	14	42
	Office Clerk	565	7	7	7	21
	Sub-Total		64	64	64	192
Medical	Medical Officer	3,645	-	44	44	88
	Assistant Medical Officers	2,850	-	34	34	68
	Lady Assistant Medical Officers	3,645	-	-	-	-
	Office Clerk	645	-	8	8	16
	Sub-Total		-	86	86	172
	Total		1,450	1,631	1,807	4,918
Coal Preparation & Transport	Manager	3,620	-	-	43	43
	General Foreman, Plant	2,545	-	-	31	31
	Plant Foreman	1,155	-	-	-	-
	Deputy Manager, Transport	2,545	-	-	31	31
	Transport Foremen	1,155	-	-	14	14
	Office Clerk	565	-	-	7	7
	Total		-	-	126	126
	Grand Total		2,318	3,149	3,475	8,942

The estimates reflect 1983 June price levels. No escalation.

* Rs/man/month

TABLE 2-11

CAPITAL COST
WAGES
(000'S) RUPEES

Sheet 1

Section	Description	Wage	Year			
			1983	1984	1985	Total
Underground Mine	Longwall Face Workers	*	-	-	-	-
	Pillar Splitting Workers	*	-	-	-	-
	Road Heading Workers	*	12	274	547	833
	Ventilation Workers	*	-	32	32	64
	Maintenance Workers	*	-	58	212	270
	Haulage Workers	*	-	240	240	480
	Electrical & Mechanical Forezen	*	-	114	114	228
	Machine Operators	*	-	140	140	280
	Safetylamp Room Workers	*	-	70	70	140
	Electrical & Mechanical Store Workers	*	-	53	53	106
	Office Workers	*	-	160	160	320
	Total		12	1,141	1,568	2,721
West Open Pit	Stripping Workers	*	173	173	173	519
	Bankshooting Workers	*	145	145	145	435
	Parting & Coal loading Workers	*	-	128	128	256
	Haulage Workers	*	304	417	417	1,138
	Road Grading Workers	*	70	70	70	210
	Reclamation Workers	*	73	73	73	219
	Electrical Workers	*	42	42	42	126
	Mechanical Workers	*	42	42	42	126
	Office Workers	*	207	207	207	621
	Sub-Total		1,056	1,297	1,297	3,650
East Open Pit	Stripping Workers	*	173	173	173	519
	Bankshooting Workers	*	145	145	145	435
	Parting & Coal loading Workers	*	-	115	115	230
	Haulage Workers	*	256	340	340	936
	Road Grading Workers	*	64	64	64	192
	Reclamation Workers	*	67	67	67	201
	Electrical Workers	*	42	42	42	126
	Mechanical Workers	*	42	42	42	126
	Office Workers	*	207	207	207	621
	Sub-Total		936	1,195	1,195	3,386
	Total		2,052	2,492	2,492	7,036

The estimates reflect 1980 June price levels. * shown in operating cost
No escalation.

TABLE 2-11

CAPITAL COST
WAGES
(000'S) RUPEES

(Continued)

Sheet 2

Section	Description		Wage *	Year			Total
				1983	1984	1985	
Underground Mine	Longwall Face Workers						
	Chief Workers	*2	645	-	-	-	-
	Miners	*2	530	-	-	-	-
	Prop Drawers	*2	590	-	-	-	-
	Stablemen	*2	590	-	-	-	-
	Porp Checkers	*2	530	-	-	-	-
	Packers	*2	530	-	-	-	-
	Pullbackmen	*2	530	-	-	-	-
	Face Maintenancemen		530	-	-	-	-
	Shot Firers	*3	545	-	-	-	-
	Sub-Total			-	-	-	-
	Pillar Splitting Workers						
	Miners	*3	530	-	-	-	-
	Shot Firers	*3	545	-	-	-	-
	Sub-Total			-	-	-	-
	Road Heading Workers						
	Miners	*3	530	8	192	384	584
	Loader	*3	590	2	43	85	130
	Shot Firers	*3	545	2	39	78	119
	Sub-Total			12	274	547	883
	Ventilation Workers						
	Bratticemen		530	-	32	32	64
	Flyash Packer		530	-	-	-	-
	Gas Patrol		530	-	-	-	-
	Sub-Total			-	32	32	64
	Entry Maintenance Workers						
	Panel Maintenance		530	-	19	19	38
	Track Maintenance		530	-	32	64	96
	Gate Maintenance (include rock duster)		530	-	-	109	109
	Shot Firers		545	-	7	20	27
	Sub-Total			-	58	212	270

The estirates reflect 1980 June price levels. No escalation .

* Rs/man/month

Note: *2: Two Shifts
*3: Three Shifts

TABLE 2-11

CAPITAL COST
WAGES
(000'S) RUPEES

(Continued) Sheet 3

Section	Description	Wage*	Year			
			1983	1984	1985	Total
Underground Mine	Haulage Workers					
	Surface Workers					
	Diesel Locomotive Driver	590	-	21	21	42
	Shunters	545	-	20	20	40
	Tippler Men	590	-	14	14	28
	Tippler Helpers	530	-	38	38	76
	Underground Workers					
	Battery Locomotive Drivers	590	-	42	42	84
	Shunters Battery Locomotive	545	-	39	39	78
	Shunters Pit Mouth	545	-	33	33	66
	Shunters Pit Bottom	545	-	33	33	66
	Shunters Junction & Each Panel	530	-	-	-	-
	Sub-Total		-	240	240	480
	Electrical & Mechanical Workers					
	Electricians	645	-	31	31	62
	Electricians Apprentices	530	-	26	26	52
	Mechanics	645	-	31	31	62
	Mechanics Apprentices	530	-	26	26	52
	Sub-Total		-	114	114	228
	Machine Operators					
	Surface Workers					
	Air Compressor Operators	590	-	21	21	42
	Air Compressor Helpers	530	-	19	19	38
	Main Slope Hoist Operators	590	-	21	21	42
	Underground Workers					
	Chain Conveyor Operators	590	-	14	14	28
	B.L. Battery Charger	590	-	21	21	42
	B.L. Battery Charger Assistant	530	-	25	25	50
	Sub-Total		-	140	140	280
	Safetylamp Room Workers					
	Safetylamp Issuers	530	-	19	19	38
	Safetylamp Workers	530	-	19	19	38
	Gas Detector Supervisor	930	-	11	11	22
	Gas Detector Repair Men	590	-	21	21	42
	Sub-Total		-	70	70	140
	Electrical & Mechanical Store Workers					
	Issuers	530	-	19	19	38
	Supervisors	930	-	34	34	68
	Sub-Total		-	53	53	106
	Office Workers					
	Junior Clerks	530	-	58	58	116
	Office Attendants/Oilermen	530	-	64	64	128
	Checkmen	530	-	38	38	76
	Sub-Total		-	160	160	320
	Total		-	1,141	1,568	2,721

The estimates reflect 1980 June price levels. * Rs/man/month
No escalation.

TABLE 2-11

CAPITAL COST
WAGES
(000'S) RUPEES

(Continued)

Sheet 4

Section	Description	Wage[a]	Year 1983	Year 1984	Year 1985	Total
West Open Pit	**Stripping**					
	Shovel Operator 11.5 m³	645	46	46	46	138
	Helpers	530	38	38	38	114
	Oilers	590	43	43	43	129
	Groundmen	645	46	46	46	138
	Sub-Total		173	173	173	519
	Rockshooting					
	Drillers 9.7/8"	645	31	31	31	93
	Helpers	530	51	51	51	153
	Dozer Operators	645	31	31	31	93
	Shooters	530	32	32	32	96
	Sub-Total		145	145	145	435
	Parting Coal Loading					
	Drillers 80 m/m	645	-	15	15	30
	Helpers	530	-	26	26	52
	Dozer Operators	645	-	15	15	30
	Scraper Operators	645	-	31	31	62
	Hydraulic Excator Operators	645	-	15	15	30
	Shooters	530	-	26	26	52
	Sub-Total		-	128	128	256
	Haulage					
	Truck Drivers 120 t	645	186	231	231	648
	Truck Drivers 45 t	645	15	77	77	169
	Greasemen	530	26	32	32	90
	Mechanist & Welders Helper	530	26	26	26	78
	Crossing Watchmen	530	38	38	38	114
	Motor Patrols	530	13	13	13	29
	Sub-Total		304	417	417	1,138
	Road Grading					
	Grader Operators	645	15	15	15	45
	Dozer Operators	645	15	15	15	45
	Sprinkler	645	8	8	8	24
	General Workers	530	32	32	32	96
	Sub-Total		70	70	70	210

The estimates reflect 1980 June price levels. No escalation.

[a] Rs/man/month

TABLE 2-11

CAPITAL COST
WAGES
(000'S) RUPEES

(Continued)

Sheet 5

Section	Description	Wage[a]	Year			
			1983	1984	1985	Total
West Open Pit	Reclamation					
	Dozer Operators	645	15	15	15	45
	Scraper Operator	645	8	8	8	24
	Crusher Operators	645	15	15	15	45
	Front End Loaders	645	8	8	8	24
	Trucks 45 t	645	8	8	8	24
	General Workers	530	19	19	19	57
	Sub-Total		73	73	73	219
	Electrical Workers					
	Electricians	645	23	23	23	69
	Helpers	530	19	19	19	57
	Sub-Total		42	42	42	126
	Mechanical Workers					
	Mechanics	645	23	23	23	69
	Helpers	530	19	19	19	57
	Sub-Total		42	42	42	126
	Office Clerk					
	Junior Clerks	530	83	83	83	249
	Attendants	530	26	26	26	78
	Time Keepers	590	21	21	21	63
	Apprentices	530	77	77	77	231
	Sub-Total		207	207	207	621
	Total		1,056	1,297	1,297	3,650

The estimates reflect 1980 June price levels. No escalation.

[a] Rs/man/month

TABLE 2-11

CAPITAL COST
WAGES
(000'S) RUPEES

(Continued)

Sheet 6

Section	Description		Wage*	Year 1983	1984	1985	Total
East Open Pit	Stripping						
	Shovel Operators	11.5 m³	645	46	46	46	138
	Operators Helpers	"	530	38	38	38	114
	Oilers	"	590	43	43	43	129
	Groundmen	"	645	46	46	46	138
	Sub-Total			173	173	173	519
	Bankshooting						
	Drillers	9 7/8"	645	31	31	31	93
	Helpers	"	539	51	51	51	153
	Dozer Operators		645	31	31	31	93
	Shooters		530	32	32	32	96
	Sub-Total			145	145	145	435
	Parting Coal Loading						
	Drilling	80 m/m	645	-	15	15	30
	Helpers	"	530	-	13	13	26
	Dozer Operators		645	-	15	15	30
	Scraper Operators		645	-	31	31	62
	Hydraulic Exvator Operators		645	-	15	15	30
	Shooters		530	-	26	26	52
	Sub-Total			-	115	115	230
	Haulage						
	Truck Drivers	120 t	645	139	185	185	509
	Truck Drivers	46 t	645	15	46	46	107
	Greasemen		530	25	32	32	89
	Mechanist & Welder's Helpers		530	26	26	26	78
	Crossing Watchmen		530	38	38	38	114
	Motor Patrols		530	13	13	13	39
	Sub-Total			256	340	340	936

The estimates reflect 1980 June price levels.
No escalation.

* Rs/man/month

TABLE 2-11

CAPITAL COST
WAGES
(000'S) RUPEES

(Continued)

Sheet 7

Section	Description	Wage*	Year			Total
			1983	1984	1985	
East Open Pit	Road Grading					
	Grader Operators	645	15	15	15	45
	Dozer Operators	645	15	15	15	45
	Sprinklers	645	8	8	8	24
	General Workers	530	26	26	26	78
	Sub-Total		64	64	64	192
	Reclamation					
	Dozer Operators	645	15	15	15	45
	Scraper Operators	645	8	8	8	24
	Crusher Operators	645	15	15	15	45
	Front End Loaders	645	8	8	8	24
	Trucks 46 t	645	8	8	8	24
	General Workers	530	13	13	13	39
	Sub-Total		67	67	67	201
	Electrical Workers					
	Electricians	645	23	23	23	69
	Electricians Helpers	530	19	19	19	57
	Sub-Total		42	42	42	126
	Mechanical Workers					
	Mechanics	645	23	23	23	69
	Mechanics Helpers	530	19	19	19	57
	Sub-Total		42	42	42	126
	Office Clerk					
	Junior Clerks	530	83	83	83	249
	Attendants	530	26	26	26	78
	Tire Keepers	590	21	21	21	63
	Apprentices	530	77	77	77	231
	Sub-Total		207	207	207	621
	Total		935	1,195	1,195	3,386

The estimates reflect 1980 June price levels.
No escalation.

* Rs/man/month

TABLE 2-11

CAPITAL COST
BASES
(000'S) RUPEES

(Continued) Sheet 8

Section	Description	Wage *	Year			Total
			1983	1984	1985	
Management	Office Attendants	530	19	19	19	57
General Affairs	Head Telephone Operator	645	-	-	-	-
	Telephone Operators	590	-	-	-	-
	Cooks	545	7	7	7	21
	Vehicle Drivers	665	154	154	154	462
	Security Guards	530	19	19	19	57
	Armed Guards	530	19	19	19	57
	Junior Clerks	590	14	14	21	49
	Watchmen	545	20	59	78	157
	Office Attendants	530	19	38	51	108
	Sub-Total		252	310	349	911
Accounting	Junior Clerks	590	28	42	50	120
	Office Attendants	530	13	13	13	39
	General Workers	530	13	13	19	45
	Sub-Total		54	68	82	204
Labour & Social Welfare	Junior Clerks	590	7	28	28	63
	Salesmen	545	-	-	-	-
	Cooks	545	-	-	-	-
	Office Attendants	530	13	13	13	39
	General Workers	530	-	-	-	-
	Sub-Total		20	41	41	102
Civil & Water Supply	Draftmen/Survey Assistants	860	21	21	21	63
	Civil Workers	590	28	28	28	84
	Carpenter Shop Workers	590	-	-	21	21
	Pump Station Workers	590	-	-	-	-
	Plumbers	590	-	-	14	14
	Sewage Station Workers	590	-	-	-	-
	Junior Clerks	590	7	7	14	28
	Office Attendants	530	19	19	25	63
	General Workers	530	38	38	102	178
	Sub-Total		113	113	225	451
Electrical & Mechanical	Electrical Workers	645	8	15	31	54
	Mechanical Workers	645	8	15	31	54
	Substation Workers	590	-	21	42	63
	Power House Workers	590	21	42	42	105
	Work Shop Workers	590	-	142	212	354
	Junior Clerk	530	6	6	13	25
	Office Attendants	530	19	25	32	76
	Sub-Total		62	266	403	731

The estimates reflect 1980 June price levels.
No escalation.

* Rs/man/month

TABLE 2-11

CAPITAL COST
WAGES
(000'S) RUPEES

(Continued) Sheet 9

Section	Description	Wage*	Year			Total
			1983	1984	1985	
System	Key Punchers	590	-	7	7	14
	Junior Clerk	530	-	6	6	12
	Office Attendants	530	-	6	6	12
	Sub-Total		-	19	19	38
Training	Training Assistants	590	28	28	57	113
	Junior Clerks	539	13	13	13	39
	Office Attendants	530	19	19	19	57
	Sub-Total		60	60	89	209
Planning	Explosive Carriers	530	-	58	58	116
	Explosive Truck Drivers	645	-	23	23	46
	Drillers	565	27	27	27	81
	Draftmen	790	29	29	29	87
	Junior Clerks	539	26	26	26	78
	Drilling Helpers	530	77	77	77	231
	Survey Helpers	530	77	77	77	231
	Office Attendants	530	32	32	32	96
	Sub-Total		268	349	349	966
Safety	Safety Assistants	530	13	13	13	39
	Junior Clerks	530	6	6	6	18
	Office Attendants	530	19	19	19	57
	Sub-Total		38	38	38	114
Medical	Head Nurse	645	-	8	8	16
	Nurses	530	-	13	25	38
	Health Visitor	690	-	-	-	-
	Midwives	530	-	-	-	-
	Head Compounder	645	-	8	8	16
	Compounders	645	-	8	8	16
	Sanitary Inspectors	645	-	-	-	-
	Junior Clerks	530	-	6	6	12
	First Aid Attendants	645	-	8	23	31
	Ambulance Driver	645	-	8	8	16
	Sweepers	530	-	13	13	26
	First Aid Helpers	545	-	13	39	52
	Cooks	545	-	-	-	-
	Sub-Total		-	85	138	223
	Total		886	1,368	1,752	4,006
Coal Preparation	Patrols	530	-	-	13	13
	Central Control Men	645	-	-	15	15
	Other Plant Workers	590	-	-	-	-
	Transport Workers	590	-	-	21	21
	Junior Clerks	539	-	-	25	25
	Office Attendants	530	-	-	25	25
	Hand Pickers	530	-	-	-	-
	General Workers	530	-	-	45	45
	Total		-	-	144	144
	Grand Total		2,950	5,001	5,956	13,907

The estimates reflect 1980 June price level:

No escalation.

* Rs/man/month

TABLE 2-12

INTEREST DURING CONSTRUCTION

(000's) RUPEES

MINE

Foreign (8.75 %)

Year	1981	1982	1983	1984	1985	Total
Principal	10,000	10,000	567,000	295,000	244,000	-
10,000	438	875	875	875	875	3,938
10,000	-	438	875	875	875	3,063
567,000	-	-	24,806	49,613	49,613	124,032
295,000	-	-	-	12,906	25,813	38,719
244,000	-	-	-	-	10,675	10,675
TOTAL	438	1,313	26,556	64,269	87,851	180,427

Local (12.5 %)

Year	1981	1982	1983	1984	1985	Total
Principal	6,000	8,000	303,000	234,000	207,000	-
6,000	375	750	750	750	750	3,375
8,000	-	500	1,000	1,000	1,000	3,500
303,000	-	-	18,938	37,875	37,875	94,688
234,000	-	-	-	14,625	29,250	43,875
207,000	-	-	-	-	12,938	12,938
TOTAL	375	1,250	20,688	54,250	81,813	158,376

RAILWAY

Foreign (8.75 %)

Year	1981	1982	1983	1984	1986	Total
Principal	1,000	1,000	2,000	20,000	95,000	-
1,000	44	88	88	88	88	396
1,000	-	44	88	88	88	308
2,000	-	-	88	175	175	438
20,000	-	-	-	875	1,750	2,625
95,000	-	-	-	-	4,156	4,156
TOTAL	44	132	264	1,226	6,257	7,923

Local (12.5 %)

Year	1981	1982	1983	1984	1985	Total
Principal	1,000	1,000	55,000	45,000	41,000	-
1,000	63	125	125	125	125	563
1,000	-	63	125	125	125	438
55,000	-	-	3,438	6,875	6,875	17,188
45,000	-	-	-	2,813	5,625	8,438
41,000	-	-	-	-	2,563	2,563
TOTAL	63	188	3,688	9,938	15,313	29,190

TABLE 2-13 CONSTRUCTION COST FOR LAKHRA COAL FIRED THERMAL POWER STATION (300 MW x 1 UNIT)

(Unit: Rupees in million)

Item	Foreign Currency	Local Currency	Total
1. Equipment	1,727	-	1,727
2. Civil Works	295	300	595
3. Architectural Works	144	266	410
4. F.G.D. Plant (Gypsum Recovery Process)	109	84	193
5. Installation	130	415	545
Sub-total	2,405	1,065	3,470
6. Contingency (5% of Sub-total)	121	53	174
7. Import Duty (40% of C&F Price)	-	905	905
8. Engineering Fee (5% of direct cost)	147	35	182
9. Administration (4% of direct cost)	-	146	146
Indirect Cost	147	1,086	1,233
Total	2,673	2,204	4,877
10. Interest during Construction	-	1,348	1,348
Grand Total	2,673	3,552	6,225

Interest during construction F.C. 8.75% L.C. 12.5%

TABLE 2-14. ANNUAL EXPENDITURE REQUIREMENTS (300 MW x 1 UNIT)

(Unit: Rupees in Million)

Item \ Year	Total			1981			1982			1983			1984			1985			1986			1987		
	F.C.	L.C.	Total	F.C.	L.C.	Total	F.C.	L.C.	Total	F.C.	L.C.	Total	F.C.	L.C.	Total	F.C.	L.C.	Total	F.C.	L.C.	Total	F.C.	L.C.	Total
1. Civil & Structural Works	439	566	1,005							44	57	101	176	220	396	110	140	250	65	92	157	44	57	101
2. Mechanical, Electrical Equipment & Installation	1,857	415	2,272							186	41	227	280	60	340	929	211	1,140	276	62	338	186	41	227
3. F.G.D. Plant (Gypsum Recovery Process)	109	84	193							11	8	19	16	14	30	55	42	97	16	12	28	11	8	19
SUB-TOTAL	2,405	1,065	3,470							241	106	347	472	294	766	1,094	393	1,487	357	166	523	241	106	347
4. Contingency (5% of Sub-total)	121	53	174							12	5	17	26	14	40	53	21	74	18	8	26	12	5	17
DIRECT COST	2,526	1,118	3,644							253	111	364	498	308	806	1,147	414	1,561	375	174	549	253	111	364
5. Import Duty (40% of C&F Price)	-	905	905							-	90	90	-	178	178	-	411	411	-	136	136	-	90	90
6. Engineering Fee (5% of Direct Cost)	147	35	182	30	6	36	44	11	55	17	4	21	17	4	21	17	4	21	17	4	21	5	2	7
7. Administration (4% of Direct Cost)	-	146	146	-	7	7	-	14	14	-	22	22	-	22	22	-	37	37	-	37	37	-	7	7
INDIRECT COST	147	1,086	1,233	30	13	43	44	25	69	17	116	133	17	204	221	17	452	469	17	177	194	5	99	104
TOTAL	2,673	2,204	4,877	30	13	43	44	25	69	270	227	497	515	512	1,027	1,164	866	2,030	392	351	743	258	210	468
8. Interest During Construction (F.C 8.75%, D.C 12.5%)	-	1,348	1,348	-	2	2	-	8	8	-	37	37	-	118	118	-	277	277	-	421	421	-	485	485
GRAND TOTAL	2,673	3,552	6,225	30	15	45	44	33	77	270	264	534	515	630	1,145	1,164	1,143	2,307	392	772	1,164	258	695	953

1 Rs = 22 Yen 1 US$ = 220 Yen

Exclude escalation
Price of June 1980

TABLE 2-15 CONSTRUCTION COST FOR LAKHRA COAL-FIRED THERMAL POWER STATION (150 MW x 2 UNITS)

(Unit: Rupees in million)

Item	Foreign Currency	Local Currency	Total
1. Equipment	1,860	-	1,860
2. Civil Works	320	320	640
3. Architectural Works	150	290	440
4. F.G.D. Plant (Gypsum Recovery Process)	120	92	212
5. Installation	140	500	640
Sub-total	2,590	1,202	3,792
6. Contingency (5% of Sub-total)	130	60	190
7. Import Duty (40% of C&F Price)	-	980	980
8. Engineering Fee (5% of direct cost)	159	40	199
9. Administration Fee (4% of direct cost)	-	159	159
Indirect Cost	159	1,179	1,338
Total	2,879	2,441	5,320
10. Interest during Construction	-	1,477	1,477
Grand Total	2,879	3,918	6,797

Interest during construction F.C. 8.75% L.C. 12.5%

TABLE 2-16. ANNUAL EXPENDITURE REQUIREMENTS (150 MW x 2 UNITS)

(Unit: Rupees in Million)

Item \ Year	Total			1981			1982			1983			1984			1985			1986			1987		
	F.C.	L.C.	Total	F.C.	L.C.	Total	F.C.	L.C.	Total	F.C.	L.C.	Total	F.C.	L.C.	Total	F.C.	L.C.	Total	F.C.	L.C.	Total	F.C.	L.C.	Total
1. Civil & Structural Works	470	610	1,080							47	61	108	188	244	432	118	152	270	70	92	162	47	61	108
2. Mechanical, Electrical Equipment & Installation	2,000	500	2,500							200	50	250	300	75	375	1,000	250	1,250	300	75	375	200	50	250
3. F.G.D. Plant (Gypsum Recovery Process)	120	92	212							12	9	21	18	15	33	60	44	104	18	15	33	12	9	21
SUB-TOTAL	2,590	1,202	3,792							259	120	379	506	334	840	1,178	446	1,624	388	182	570	259	120	379
4. Contingency (5% of sub-total)	130	60	190							13	6	19	26	16	42	59	23	82	19	9	28	13	6	19
DIRECT COST	2,720	1,262	3,982							272	126	398	532	350	882	1,237	469	1,706	407	191	598	272	126	398
5. Import Duty (40% of C&F Price)	-	980	980							-	98	98	-	196	196	-	440	440	-	148	148	-	98	98
6. Engineering Fee (5% of Direct Cost)	159	40	199	32	8	40	48	12	60	18	5	23	18	5	23	19	4	23	19	4	23	5	2	7
7. Administration (4% of Direct Cost)	-	159	159	-	8	8	-	16	16	-	24	24	-	24	24	-	40	40	-	39	39	-	8	8
INDIRECT COST	159	1,179	1,338	32	16	48	48	28	76	18	127	145	18	225	243	19	484	503	19	191	210	5	108	113
TOTAL	2,879	2,441	5,320	32	16	48	48	28	76	290	253	543	550	575	1,125	1,256	953	2,209	426	382	808	277	234	511
8. Interest During Construction (F.C 8.75%, D.C 12.5%)	-	1,477	1,477	-	2	2	-	9	9	-	41	41	-	129	129	-	304	304	-	461	461	-	531	531
GRAND TOTAL	2,879	3,918	6,797	32	18	50	48	37	85	290	294	584	550	704	1,254	1,256	1,257	2,513	426	843	1,269	277	765	1,042

1 Rs = 22 Yen 1 US$ = 220 Yen

Exclude escalation
Price of June, 1980

CHAPTER 3 ESTIMATED OPERATING COSTS

3-1 Mine Development

The estimated operating costs cover such costs as salaries and wages, power cost, replacement cost, materials and supplies cost, maintenance cost, administration cost, depreciation and amortization cost, interest and transportation cost.

The costs of escalation have not been included in this study.

(1) Salaries and Wages

The salaries and wages have been calculated by reference to the figure given in PC-1 Form prepared by PMDC (dated on February 12, 1976).

Since there is an elapse of about 4 years counted from the date of preparation of the document of the present, the escalated wages and salaries have been calculated to the 1.55 times as costly as the original figure given in the said Form in view of 1.46 times increase based on a 10 percent increase by year in the wages and salaries and in consideration of amounts to be increased due to payment of extra charges for working on holidays, bonus and retirement allowance.

The figure used in this report is obtained by multiplying 2.263 (1.46 times 1.55) to the figure stated in PC-1 Form.

Thus the average amounts of wages and salaries at mine site are 9 Rs/t and 3 Rs/t, respectively.

(2) Power Costs

Electrical power consumption has been calculated on a yearly basis.

Power costs per kilowatt-hour have been calculated at Ps. 49 based on WAPDA's present tariff. The average power costs at mine site have been calculated at 5 Rs/t.

(3) Replacement and Improvement Costs

Replacement and improvement costs have been calculated based on each service life of equipment.

The average cost of this estimates at mine site has been calculated at 66 Rs/t.

(4) Materials and Supplies Costs

Materials and supplies costs include purchase costs of tires, mine timbers, explosives, oils, fuel oils and cables, etc. The estimates have been prepared based on the consumption of the above materials. The average cost at mine site has been calculated at 136 Rs/t.

(5) Maintenance Costs

Maintenance costs include the maintenance costs of electrical equipment and buildings, and machines and parts thereof, etc. Parts for machines to be needed for one year have been calculated. The average cost at mine site has been calculated at 42 Rs/t.

(6) Administration Costs

Administration costs include costs for outside service, management fee of head office, travelling expenses, etc.

The average administration costs at mine site have been calculated at 3 Rs/t.

(7) Depreciation and Amortization Cost

Based on the PMDC PC-1 Form, equipment costs have been depreciated and other costs have been amortized. Equipment costs have been equally depreciated for 30 years considering 10 % residual value. Other costs have been amortized by production method. Other costs have been included road heading expenses for underground mining, overburden stripping costs for open pit, engineering fee, administration costs and interest during construction, etc.

Average cost of depreciation and amortization at mine site has been calculated at 59 Rs/t.

(8) Interest

Repayment of loan has been calculated as follows:

Foreign loan: 8.75% p.a. repayable in 10 years with a grace period of 5 years
Local loan: 12.5% p.a. repayable in 5 years without a grace period.

Average interest at mine site has been calculated at 36 Rs/t.

(9) Credit coal

446,000 tonnes of coal outputted in 1984 and 1985 have been considerated as credit coal which will be sold in 1986.

The price of credit coal has been calculated at 359 Rs/t, which is the average cost for 30 years at mine site.

(10) Transportation cost

Transportation costs cover such costs as freight costs, depreciation cost, amortization cost and interest. The average of freight costs have been calculated at 17 Rs/t.

Depreciation cost has been calculated at 3 Rs/t.

Amortization cost has been calculated at 2 Rs/t.

Interest has been calculated at 4 Rs/t.

Details of operating cost are shown in Tables 3-1 to 3-20.

3-2 Coal Fired Power Station

The power generating cost is estimated on a kWh basis at a power sending and in consideration of the power to be generated in the Lakhra coal-fired Thermal Power Station and of the various expenses involved in the power station.

Annual plant factor	70% (50%, 60% and 70%)
Service life of plant	30 years
Station use ratio	9%
Depreciation	3.5%
Operation and Maintenance cost	8%
Fuel cost	381 Rs/t (As received basis)

Under the conditions above, the power generating cost is estimated at 93.5 Ps/kWh. A breakdown of this cost is given in Table 3-21.

TABLE 3-1

SUMMARY OF OPERATING COST

(000's) RUPEES

Description	Currency	Year															
		1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
Mine	Foreign	139,654	156,831	154,916	154,484	156,210	154,010	153,907	152,807	153,014	155,815	156,953	150,531	144,194	144,467	141,948	141,577
	Local	156,120	179,747	182,154	182,140	183,010	182,063	183,052	182,704	182,290	183,397	184,058	177,309	171,431	171,759	168,933	168,742
	Total	295,774	336,578	337,070	336,624	339,220	336,073	336,959	335,511	335,304	339,212	341,021	327,840	315,625	316,226	310,881	310,319
Depreciation on Assets	Local	38,010	38,010	38,010	38,010	38,010	38,010	38,010	38,010	38,010	38,010	38,010	38,010	38,010	38,010	38,010	38,010
Amortization	Local	19,776	26,009	32,430	32,565	32,754	33,104	33,266	33,482	33,104	32,835	32,889	32,808	32,835	33,051	33,024	33,374
Interest on Loan	Local	228,900	205,975	183,050	160,125	137,200	114,275	91,420	68,565	45,710	22,855	-	-	-	-	-	-
Sub-Total	Foreign	139,654	156,831	154,916	154,484	156,210	154,010	153,907	152,807	153,014	155,815	156,953	150,531	144,194	144,467	141,948	141,577
	Local	442,816	449,741	435,644	412,840	390,974	367,452	345,748	322,761	299,114	277,097	254,957	248,127	242,276	242,820	239,967	240,126
	Total	582,460	606,572	590,560	567,324	547,184	521,462	499,655	475,568	452,128	432,912	411,920	398,658	386,470	387,287	381,915	381,703
Railway	Foreign	667	1,560	1,561	2,454	2,454	2,454	2,454	2,454	2,454	2,454	2,454	2,454	2,454	2,454	2,454	2,454
	Local	7,015	10,275	18,034	18,446	18,481	18,546	18,576	18,616	18,546	18,496	18,506	18,491	18,496	18,536	18,531	18,596
	Total	7,682	11,835	19,595	20,900	20,935	21,000	21,030	21,070	21,000	20,950	20,906	20,945	20,950	20,990	90,985	21,050
Depreciation on Assets	Local	3,991	3,991	3,991	3,991	3,991	3,991	3,991	3,991	3,991	3,991	3,991	3,991	3,991	3,991	3,991	3,991
Amortization	Local	1,143	1,504	1,875	1,883	1,894	1,914	1,923	1,936	1,914	1,899	1,902	1,897	1,899	1,911	1,909	1,930
Interest on Loan	Local	32,613	28,313	24,013	19,713	15,413	11,113	8,890	6,668	4,445	2,223	-	-	-	-	-	-
Sub-Total	Foreign	667	1,560	1,561	2,454	2,454	2,454	2,454	2,454	2,454	2,454	2,454	2,454	2,454	2,454	2,454	2,454
	Local	44,762	44,083	47,913	44,033	39,779	35,564	33,380	31,211	28,896	26,609	24,399	24,379	24,386	24,438	24,431	24,517
	Total	45,429	45,643	49,474	46,487	42,238	38,018	35,834	33,665	31,350	29,063	26,853	26,833	26,840	26,892	26,885	26,971
TOTAL	Foreign	140,321	158,391	156,477	156,938	158,664	156,464	156,361	155,261	155,468	158,269	159,417	152,985	146,648	146,921	144,402	144,031
	Local	487,568	493,824	483,557	456,873	430,753	403,016	379,128	353,972	328,010	303,706	279,356	272,506	266,662	267,258	264,398	264,643
	Total	627,889	652,215	640,034	613,811	589,417	559,480	535,489	509,233	483,478	461,975	438,773	425,491	413,310	414,179	408,800	408,674
Credit Coal	Local	(160,114)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
GRAND TOTAL	Foreign	140,321	158,391	156,477	156,938	158,664	156,464	156,361	155,261	155,468	158,269	159,417	152,985	146,648	146,921	144,402	144,031
	Local	327,454	493,824	483,557	456,873	430,753	403,016	379,128	353,972	328,010	303,706	279,356	272,506	266,662	267,258	264,398	264,643
	Total	467,775	652,215	640,034	613,811	589,417	559,480	535,489	509,233	483,478	461,971	438,773	425,491	413,310	414,179	408,800	408,674

Freight, taxes and duty included.
The estimates reflect 1980 June price levels.
No escalation.

TABLE 3-1

SUMMARY OF OPERATING COST

(000's) RUPEES

(Continued)

Description	Currency	Year 2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	Total	Average
Mine	Foreign	141,564	141,636	151,584	151,775	151,224	151,013	151,204	144,709	144,642	99,638	96,257	94,166	91,716	68,694	4,191,150	139,705
	Local	168,760	168,814	181,000	181,058	181,661	180,453	180,741	177,862	177,561	156,324	153,163	130,628	125,987	87,977	5,089,858	169,663
	Total	310,324	310,450	332,584	332,833	331,885	331,466	331,945	322,571	322,203	255,962	249,420	224,794	217,703	156,671	9,281,048	309,368
Depreciation on Assets	Local	38,010	38,010	38,010	38,010	38,010	38,010	38,010	38,010	38,010	38,010	38,010	38,010	38,010	38,006	1,140,296	38,010
Amortization	Local	33,401	33,374	33,617	33,239	33,320	33,239	33,590	33,590	33,185	32,835	30,029	25,928	25,928	25,928	948,509	31,617
Interest on Loan	Local	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1,258,075	41,936
Sub-Total	Foreign	141,564	141,636	151,584	151,775	151,224	151,013	151,204	144,709	144,642	99,638	96,257	94,166	91,716	68,694	4,191,150	139,705
	Local	240,171	240,198	252,627	252,307	251,991	251,702	252,341	249,462	248,756	227,169	221,202	194,566	189,925	151,911	8,436,778	281,226
	Total	381,735	381,834	404,211	404,082	403,215	402,715	403,545	394,171	393,398	326,807	317,459	288,732	281,641	220,605	12,627,928	420,931
Railway	Foreign	2,454	2,454	2,454	2,454	2,454	2,454	2,454	2,454	2,454	667	667	667	667	667	61,111	2,037
	Local	18,601	18,596	18,641	18,571	18,586	18,571	18,636	18,636	18,561	17,720	17,200	16,440	16,440	16,440	527,826	17,594
	Total	21,055	21,050	21,095	21,025	21,040	21,025	21,090	21,090	21,015	18,387	17,867	17,107	17,107	17,107	588,937	19,631
Depreciation on Assets	Local	3,991	3,991	3,991	3,991	3,991	3,991	3,991	3,991	3,991	3,991	3,991	3,991	3,991	3,984	119,723	3,991
Amortization	Local	1,931	1,930	1,944	1,922	1,927	1,922	1,942	1,942	1,919	1,899	1,736	1,499	1,499	1,499	54,844	1,828
Interest on Loan	Local	-	-	-	-	-	-	-	-	-	-	-	-	-	-	153,404	5,113
Sub-Total	Foreign	2,454	2,454	2,454	2,454	2,454	2,454	2,454	2,454	2,454	667	667	667	667	667	61,111	2,037
	Local	24,523	24,517	24,576	24,484	24,504	24,484	24,569	24,569	24,471	23,610	22,927	21,930	21,930	21,923	855,797	28,527
	Total	26,977	26,971	27,030	26,938	26,958	26,938	27,023	27,023	26,925	24,277	23,594	22,597	22,597	22,590	916,908	30,564
TOTAL	Foreign	144,018	144,090	154,038	154,229	153,678	153,467	153,658	147,163	147,096	100,305	96,924	94,833	92,383	69,361	4,252,261	141,742
	Local	264,694	264,715	277,203	276,791	276,495	276,186	276,910	274,031	273,227	250,779	244,129	216,496	211,855	173,834	9,292,575	309,753
	Total	408,712	408,805	431,241	431,020	430,173	429,653	430,568	421,194	420,323	351,084	341,053	311,329	304,238	243,195	13,544,836	451,495
Credit Coal	Local	-	-	-	-	-	-	-	-	-	-	-	-	-	-	(160,114)	(5,338)
GRAND TOTAL	Foreign	144,018	144,090	154,038	154,229	153,678	153,467	153,658	147,163	147,096	100,305	96,924	94,833	92,383	69,361	4,252,261	141,742
	Local	264,694	264,715	277,203	276,791	276,495	276,186	276,910	274,031	273,227	250,779	244,129	216,496	211,855	173,834	9,132,461	304,415
	Total	408,712	408,805	431,241	431,020	430,173	429,653	430,568	421,194	420,323	351,084	341,053	311,329	304,238	243,195	13,384,722	446,157

Freight, taxes and duty included.
The estimates reflect 1980 June price levels.
No escalation.

TABLE 3-2

OPERATING COST

SUMMARY

(000's) RUPEES

Sheet 1

Description	Currency	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
Underground Mine	Foreign	13,233	16,241	13,493	13,327	15,233	12,971	11,972	11,027	11,254	13,995	14,880	13,324	10,449	10,774	10,450	10,127
	Local	26,750	30,039	28,895	28,992	29,929	28,803	28,719	28,482	28,103	29,241	29,700	29,021	27,285	27,537	27,591	27,335
	Total	39,988	46,280	42,388	42,319	45,162	41,774	40,691	39,509	39,357	43,236	44,580	42,345	37,734	38,311	38,041	37,462
Open Pits	Foreign	123,447	137,621	138,454	138,188	138,008	138,070	138,966	138,811	138,791	138,851	139,114	134,238	130,776	130,724	128,529	128,481
	Local	117,031	135,080	136,794	136,661	136,561	136,680	137,725	137,523	137,607	137,619	137,815	131,758	127,609	127,648	124,774	124,781
	Total	240,478	272,701	275,248	274,849	274,569	274,750	276,691	276,384	276,398	276,470	276,929	265,996	258,385	258,372	253,303	253,262
Surface Facilities	Foreign	890	890	890	890	890	890	890	890	890	890	890	890	890	890	890	890
	Local	6,856	7,824	8,196	8,196	8,196	8,196	8,196	8,196	8,196	8,196	8,196	8,196	8,196	8,196	8,196	8,196
	Total	7,746	8,714	9,086	9,086	9,086	9,086	9,086	9,086	9,086	9,086	9,086	9,086	9,086	9,086	9,086	9,086
Preparation Plant	Foreign	2,079	2,079	2,079	2,079	2,079	2,079	2,079	2,079	2,079	2,079	2,079	2,079	2,079	2,079	2,079	2,079
	Local	3,503	4,197	5,024	5,033	5,047	5,072	5,084	5,101	5,072	5,054	5,057	5,051	5,054	5,070	5,067	5,091
	Total	5,582	6,276	7,103	7,112	7,126	7,151	7,163	7,180	7,151	7,133	7,136	7,130	7,133	7,149	7,146	7,170
General Expense	Local	1,100	1,451	1,803	1,810	1,820	1,840	1,849	1,862	1,840	1,826	1,828	1,824	1,826	1,838	1,836	1,855
Sub-Total	Foreign	139,654	156,831	154,916	154,484	156,210	154,010	153,907	152,807	153,014	155,815	156,963	150,531	144,194	144,467	141,948	141,587
	Local	155,240	178,591	180,712	180,692	181,553	180,591	181,573	181,214	180,818	181,936	182,596	175,850	169,970	170,289	167,464	167,258
	Total	294,894	335,422	355,628	335,176	337,763	334,601	335,480	334,021	333,832	337,751	339,559	326,381	314,164	314,756	309,412	308,835
Head Office Over Head	Local	880	1,156	1,442	1,448	1,457	1,472	1,479	1,490	1,472	1,461	1,462	1,459	1,461	1,470	1,469	1,484
MINE TOTAL	Foreign	139,654	156,831	154,916	154,484	156,210	154,010	153,907	152,807	153,014	155,815	156,963	150,531	144,194	144,467	141,948	141,577
	Local	156,120	179,747	182,154	182,140	183,010	182,063	183,052	182,704	182,290	183,397	184,058	177,309	171,431	171,759	168,933	168,742
	Total	295,774	336,578	337,070	336,624	339,220	336,073	336,959	335,511	335,304	339,212	341,021	327,840	315,625	316,226	310,881	310,319
Railway	Foreign	667	1,560	1,561	2,454	2,454	2,454	2,454	2,454	2,454	2,454	2,454	2,454	2,454	2,454	2,454	2,454
	Local	7,015	10,275	18,034	18,446	18,481	18,546	18,576	18,616	18,546	18,496	18,506	18,491	18,496	18,536	18,531	18,596
	Total	7,682	11,835	19,595	20,900	20,935	21,000	21,030	21,070	21,000	20,950	20,960	20,945	20,950	20,990	20,985	21,050
GRAND TOTAL	Foreign	140,321	158,391	156,477	156,938	158,664	156,464	156,361	155,261	155,468	158,269	159,417	152,985	146,648	146,921	144,402	144,031
	Local	163,135	190,022	200,188	200,586	201,491	200,609	201,628	201,320	200,836	201,893	202,564	195,800	189,927	190,295	187,464	187,338
	Total	303,456	348,413	356,665	357,524	360,155	357,073	357,989	356,581	356,304	360,162	361,981	348,785	336,575	337,216	331,866	331,369

Freight, taxes and duty included.
The estimates reflect 1980 June price levels.
No escalation.

TABLE 3-2
OPERATING COST
SUMMARY
(000's) RUPEES

(Continued)

Description	Currency	Year 2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	Total	Average
Underground Mine	Foreign	10,128	10,130	10,130	10,128	10,129	9,982	10,127	3,653	3,650	3,408	2,180	-	-	-	286,400	9,547
	Local	27,354	27,355	27,322	27,260	27,267	27,126	27,300	24,431	24,323	22,245	20,685	-	-	-	739,090	24,636
	Total	37,482	37,485	37,452	37,388	37,396	37,108	37,427	28,084	27,973	25,653	22,865	-	-	-	1,025,490	34,183
Open Pits	Foreign	128,467	128,537	138,485	138,678	138,448	138,384	138,430	138,409	138,345	93,721	93,780	93,869	91,419	68,642	3,828,683	127,623
	Local	124,774	124,833	137,009	137,194	136,912	136,860	136,912	136,902	136,780	117,740	117,697	117,768	113,127	75,227	3,873,451	129,115
	Total	253,241	253,370	275,494	275,872	275,360	275,244	275,342	275,311	275,125	211,461	211,477	211,637	204,546	143,869	7,702,134	256,738
Surface Facilities	Foreign	890	890	890	890	890	890	890	890	890	752	297	297	297	52	23,945	798
	Local	8,195	8,195	8,195	8,195	8,195	8,195	8,195	8,195	8,195	8,135	7,896	6,785	6,785	6,675	239,455	7,982
	Total	9,085	9,085	9,085	9,085	9,085	9,085	9,085	9,085	9,085	8,887	8,193	7,082	7,082	6,727	263,400	8,780
Preparation Plant	Foreign	2,079	2,079	2,079	2,079	1,757	1,757	1,757	1,757	1,757	1,757	-	-	-	-	52,122	1,737
	Local	5,094	5,092	5,110	5,082	4,952	4,946	4,972	4,972	4,942	4,917	3,881	3,480	3,480	3,480	142,977	4,766
	Total	7,173	7,171	7,189	7,161	6,709	6,703	6,729	6,729	6,699	6,674	3,881	3,480	3,480	3,480	195,099	6,503
General Expense	Local	1,857	1,855	1,869	1,848	1,853	1,848	1,868	1,868	1,845	1,826	1,669	1,442	1,442	1,442	52,740	1,758
Sub-Total	Foreign	141,564	141,636	151,584	151,775	151,224	151,013	151,204	144,709	144,642	99,638	96,257	94,166	91,716	68,694	4,191,150	139,705
	Local	167,274	167,330	179,505	179,579	179,179	178,976	179,247	176,368	176,085	154,863	151,828	129,475	124,834	86,824	5,047,713	168,257
	Total	308,838	308,966	331,089	331,354	330,403	329,988	330,451	321,077	320,727	254,501	248,085	223,641	216,550	155,518	9,238,863	307,962
Head Office Over Head	Local	1,486	1,484	1,495	1,479	1,482	1,478	1,494	1,494	1,476	1,461	1,335	1,153	1,153	1,153	42,185	1,406
MINE TOTAL	Foreign	141,564	141,636	151,584	151,775	151,224	151,013	151,204	144,709	144,642	99,638	96,257	94,166	91,716	68,694	4,191,150	139,705
	Local	168,760	168,814	181,000	181,058	180,661	180,453	180,741	177,862	177,561	156,324	153,163	130,628	125,987	87,977	5,089,898	169,663
	Total	310,324	310,450	332,584	332,833	331,885	331,466	331,945	322,571	322,203	255,962	249,420	224,794	217,703	156,671	9,281,048	309,368
Railway	Foreign	2,454	2,454	2,454	2,454	2,454	2,454	2,454	2,454	2,454	667	667	667	667	667	61,111	2,037
	Local	18,601	18,596	18,641	18,571	18,586	18,571	18,636	18,636	18,561	17,720	172,000	16,440	16,440	16,440	527,826	17,594
	Total	21,055	21,050	21,095	21,025	21,040	21,025	21,090	21,090	21,015	18,387	17,867	17,107	17,107	17,107	588,937	19,631
GRAND TOTAL	Foreign	144,018	144,090	154,038	154,229	153,678	153,467	153 658	147,163	147,096	100,305	96,924	94,833	92,383	69,361	4,252,261	141,742
	Local	187,361	187,410	199,641	199,629	199,247	199,024	199,377	196,498	196,122	174,044	170,363	147,068	142,427	104,417	5,617,724	187,257
	Total	331,379	331,500	353,679	353,858	352,925	352,491	353,035	343,661	343,218	274,349	267,287	241,901	234,810	173,778	9,869,985	328,999

Freight, taxes and duty included.
The estimates reflect 1980 June price levels.
No escalation.

TABLE 3-3
OPERATING COST
SUMMARY OF MINE
(000's) RUPEES

Description	Currency	Year															
		1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
Wages	Local	8,513	10,393	10,902	10,902	10,902	10,902	10,902	10,902	10,902	10,902	10,902	10,902	10,630	10,630	10,630	10,630
Salaries	Local	3,719	4,034	4,077	4,077	4,077	4,077	4,077	4,077	4,077	4,077	4,077	4,077	4,035	4,035	4,035	4,035
Power	Local	5,599	6,149	6,300	6,338	6,323	6,304	6,422	6,432	6,367	6,358	6,466	6,365	6,251	6,269	6,247	6,288
Replacement & Improvement	Foreign	54,945	54,945	54,945	54,945	54,945	54,945	54,945	54,945	54,945	54,945	54,945	54,945	54,945	54,945	54,945	54,045
	Local	24,439	24,439	24,439	24,439	24,439	24,439	24,439	24,439	24,439	24,439	24,539	24,439	24,439	24,439	24,439	24,439
	Total	79,384	79,384	79,384	79,384	79,384	79,384	79,384	79,384	79,384	79,384	79,384	79,384	79,384	79,384	79,384	79,384
Material & Supplies	Foreign	51,481	63,030	60,518	60,157	61,937	59,675	59,126	58,181	58,391	61,171	62,215	57,624	52,569	52,867	51,196	50,834
	Local	95,652	114,568	115,330	115,277	116,151	115,173	115,955	115,585	115,275	116,409	116,935	110,661	105,473	105,767	103,136	102,872
	Total	147,133	177,598	175,848	175,434	178,088	174,848	175,171	173,766	173,666	177,580	179,150	168,285	158,042	158,634	154,332	153,706
Maintenance	Foreign	33,228	38,856	39,453	39,382	39,328	39,390	39,746	39,681	39,678	39,699	39,803	37,962	36,680	36,655	35,807	35,798
	Local	16,110	17,406	17,710	17,698	17,790	17,705	17,778	17,766	17,767	17,774	17,798	17,431	17,176	17,171	17,001	16,999
	Total	49,338	56,262	57,163	57,080	57,018	57,095	57,524	57,447	57,445	57,473	57,601	55,393	53,856	53,826	52,808	52,747
Others	Local	2,088	2,758	3,396	3,409	3,428	3,463	3,479	3,503	3,463	3,438	3,441	3,434	3,427	3,448	3,445	3,479
TOTAL	Foreign	139,654	156,831	154,916	154,484	156,210	154,010	153,907	152,807	153,014	155,815	156,963	150,531	144,194	144,467	141,948	141,577
	Local	156,120	179,747	182,154	182,140	183,010	182,063	183,052	182,704	182,290	183,397	184,058	177,309	171,431	171,759	168,933	168,742
	Total	295,774	336,578	337,070	336,624	339,220	336,073	336,959	335,511	335,304	339,212	341,021	327,840	315,625	316,226	310,881	310,319

Freight, taxes and duty included.
The estimates reflect 1980 June price levels.
No escalation.

TABLE 3-3
OPERATING COST
SUMMARY OF MINE
(000's) RUPEES

(Continued)

Description	Currency	Year 2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	Total	Average
Wages	Local	10,630	10,630	10,630	10,630	10,630	10,630	10,630	10,630	10,630	10,630	9,362	5,973	5,973	5,526	302,312	10,077
Salaries	Local	4,035	4,035	4,035	4,035	4,035	4,035	4,035	4,035	4,035	3,951	3,951	3,096	3,096	2,995	118,067	3,936
Power	Local	6,276	6,284	6,449	64,58	6,450	6,440	6,443	6,365	6,242	5,842	5,119	2,795	2,683	1,884	176,168	5,872
Replacement & Improvement	Foreign	54,945	54,945	54,945	54,945	54,623	64,623	54,623	50,348	50,348	50,348	50,348	50,348	50,348	50,326	1,615,183	53,839
	Local	24,438	24,438	24,438	24,438	24,301	24,301	24,301	22,467	22,467	22,467	22,467	22,467	22,467	22,430	718,911	23,964
	Total	79,383	79,383	79,383	79,383	78,924	78,924	78,924	72,815	72,815	72,815	72,815	72,815	72,815	72,815	2,334,094	77,803
Material & Supplies	Foreign	50,831	50,877	57,051	57,170	57,021	56,836	57,003	56,991	56,976	39,900	38,959	36,861	34,764	14,516	1,586,818	52,893
	Local	102,901	102,946	114,187	114,258	114,014	113,831	114,075	114,053	113,926	94,582	93,553	85,377	81,201	47,367	3,186,490	106,217
	Total	153,732	153,823	171,238	171,428	171,035	170,667	171,078	171,044	170,902	134,482	132,512	122,238	115,965	61,883	4,773,308	159,110
Maintenance	Foreign	35,788	35,814	39,588	39,660	39,580	39,554	39,578	37,370	37,318	9,390	6,950	6,957	6,604	3,852	989,149	32,973
	Local	16,997	17,002	17,757	17,772	17,756	17,750	17,755	16,810	16,800	16,744	15,618	8,325	7,972	5,220	489,258	16,307
	Total	52,785	52,816	57,345	57,432	57,336	57,304	57,333	54,180	54,118	26,134	22,568	15,282	14,576	9,072	1,478,407	49,280
Others	Local	3,433	3,479	3,504	3,467	3,475	3,466	3,502	3,502	3,461	3,376	3,093	2,595	2,595	2,595	98,692	3,290
TOTAL	Foreign	141,564	141,636	151,584	151,775	151,224	151,013	151,204	144,709	144,642	99,638	96,257	94,166	91,716	68,694	4,191,150	139,705
	Local	168,760	168,814	181,000	181,058	180,661	180,453	180,741	177,862	177,561	156,324	153,163	130,628	125,987	87,977	5,089,898	169,663
	Total	310,324	310,450	332,584	332,833	331,885	331,466	331,945	322,571	322,203	255,962	249,420	224,794	217,703	156,671	9,281,048	309,368

Freight, taxes and duty included.
The estimates reflect 1980 June price levels.
No. escalation.

TABLE 3-4
OPERATING COST
UNDERGROUND MINE
(000's) RUPEES

Sheet 1

Description	Currency	Year															
		1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
Wages	Local	2,986	4,055	4,055	4,055	4,055	4,055	4,055	4,055	4,055	4,055	4,055	4,055	3,783	3,783	3,783	3,783
Salaries	Local	689	773	773	773	773	773	773	773	773	773	773	773	731	731	731	731
Power	Local	3,144	3,264	3,328	3,401	3,408	3,391	3,473	3,491	3,443	3,433	3,515	3,519	3,493	3,534	3,534	3,580
Replacement & Improvement	Foreign	4,275	4,275	4,275	4,275	4,275	4,275	4,275	4,275	4,275	4,275	4,275	4,275	4,275	4,275	4,275	4,275
	Local	1,834	1,834	1,834	1,834	1,834	1,834	1,834	1,834	1,834	1,834	1,834	1,834	1,834	1,834	1,834	1,834
	Total	6,109	6,109	6,109	6,109	6,109	6,109	6,109	6,109	6,109	6,109	6,109	6,109	6,109	6,109	6,109	6,109
Materials & Supplies	Foreign	6,679	9,652	6,883	6,707	8,606	6,329	5,320	4,370	4,595	7,325	8,195	6,630	3,747	4,072	3,748	3,425
	Local	9,816	11,772	10,558	10,577	11,503	10,389	10,219	9,962	9,629	10,772	11,143	10,457	9,069	9,280	9,334	9,032
	Total	16,495	21,424	17,441	17,284	20,109	16,718	15,539	14,332	14,224	18,097	19,338	17,087	12,816	13,352	13,082	12,457
Maintenance	Foreign	2,284	2,314	2,335	2,345	2,352	2,367	2,377	2,382	2,384	2,395	2,410	2,419	2,427	2,427	2,427	2,427
	Local	8,173	8,190	8,196	8,201	8,205	8,210	8,214	8,216	8,218	8,223	8,229	8,232	8,235	8,235	8,235	8,235
	Total	10,457	10,504	10,531	10,546	10,557	10,577	10,591	10,598	10,602	10,618	10,639	10,651	10,662	10,662	10,662	10,662
Absenteeism	Local	108	151	151	151	151	151	151	151	151	151	151	151	140	140	140	140
TOTAL	Foreign	13,238	16,241	13,493	13,327	15,233	12,971	11,972	11,027	11,254	13,995	14,880	13,324	10,449	10,774	10,450	10,127
	Local	26,750	30,039	28,895	28,992	29,929	28,803	28,719	28,482	28,103	29,241	29,700	29,021	27,285	27,537	27,591	27,335
	Total	39,988	46,280	42,388	42,319	45,162	41,774	40,691	39,509	39,357	43,236	44,580	42,345	37,734	38,311	38,041	37,462

Freight, taxes and duty included.
The estimates reflect 1980 June price levels.
No escalation.

* Average (1) for 27 years
Average (2) for 30 years

TABLE 3-4
OPERATING COST
UNDERGROUND MINE
(000's) RUPEES

(Continued)

Description	Currency	Year 2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	Total	Average (1)	Average (2)
Wages	Local	3,783	3,783	3,783	3,783	3,783	3,783	3,783	3,783	3,783	2,515	2,515	-	-	-	101,800	3,771	3,393
Salaries	Local	731	731	731	731	731	731	731	731	731	647	647	-	-	-	19,989	740	666
Power	Local	3,573	3,573	3,490	3,490	3,482	3,482	3,475	3,401	3,284	2,882	2,238	-	-	-	91,321	3,382	3,044
Replacement & Improvement	Foreign	4,275	4,275	4,275	4,275	4,275	4,275	4,275	-	-	-	-	-	-	-	98,325	3,642	3,278
	Local	1,834	1,834	1,834	1,834	1,834	1,834	1,834	-	-	-	-	-	-	-	42,182	1,562	1,406
	Total	6,109	6,109	6,109	6,109	6,109	6,109	6,109	-	-	-	-	-	-	-	140,507	5,204	4,684
Materials & Supplies	Foreign	3,426	3,428	3,428	3,426	3,427	3,280	3,425	3,428	3,425	3,183	2,180	-	-	-	132,339	4,901	4,411
	Local	9,058	9,059	9,109	9,047	9,062	8,921	9,102	9,085	9,094	8,821	8,001	-	-	-	261,871	9,699	8,729
	Total	12,484	12,487	12,537	12,473	12,489	12,201	12,527	12,513	12,519	12,004	10,181	-	-	-	394,210	14,600	13,140
Maintenance	Foreign	2,427	2,427	2,427	2,427	2,427	2,427	2,427	225	225	225	-	-	-	-	55.736	2,064	1,858
	Local	8,235	8,235	8,235	8,235	8,235	8,235	8,235	7,291	7,291	7,291	7,195	-	-	-	218,160	8,080	7,272
	Total	10,662	10,662	10,662	10,662	10,662	10,662	10,662	7,516	7,516	7,516	7,195	-	-	-	273,896	10,144	9,130
Absenteeism	Local	140	140	140	140	140	140	140	140	140	89	89	-	-	-	3,767	140	126
TOTAL	Foreign	10,128	10,130	10,130	10,128	10,129	9,982	10,127	3,653	3,650	3,408	2,180	-	-	-	286,400	10,607	9,547
	Local	27,354	27,355	27,322	27,260	27,267	27,126	27,300	24,431	24,323	22,245	20,685	-	-	-	739,090	27,374	24,636
	Total	37,482	37,485	37,452	37,388	37,396	37,108	37,427	28,084	27,973	25,653	22,865	-	-	-	1,025,490	37,981	34,183

Freight, taxes and duty included.
The estimates reflect 1980 June price levels.
No escalation.

* Average (1) for 27 years
Average (2) for 30 years

TABLE 3-5
OPERATING COST
OPEN PITS
(000's) RUPEES

Sheet 1

Description	Currency	Year															
		1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
Wages	Local	2,492	2,538	2,538	2,538	2,538	2,538	2,538	2,538	2,538	2,538	2,538	2,538	2,538	2,538	2,538	2,538
Salaries	Local	936	936	936	936	936	936	936	936	936	936	936	936	936	936	936	936
Power	Local	1,723	1,992	1,971	1,934	1,909	1,901	1,934	1,912	1,912	1,917	1,942	1,839	1,750	1,723	1,702	1,692
Replacement & Improvement	Foreign	50,286	50,286	50,286	50,286	50,286	50,286	50,286	50,286	50,286	50,286	50,286	50,286	50,286	50,286	50,286	50,286
	Local	22,393	22,393	22,393	22,393	22,393	22,393	22,393	22,393	22,393	22,393	22,393	22,393	22,393	22,393	22,393	22,393
	Total	72,679	72,679	72,679	72,679	72,679	72,679	72,679	72,679	72,679	72,679	72,679	72,679	72,679	72,679	72,679	72,679
Material and Supplies	Foreign	44,567	53,143	53,400	53,215	53,096	53,111	53,661	53,576	53,561	53,611	53,785	50,759	48,587	48,560	47,213	47,174
	Local	83,692	100,306	101,925	101,846	101,783	101,900	102,843	102,717	102,762	102,767	102,920	97,336	93,534	93,605	90,922	90,941
	Total	128,259	153,449	155,325	155,061	154,879	155,011	156,504	156,293	156,323	156,378	156,705	148,095	142,121	142,165	138,135	138,115
Maintenance	Foreign	28,594	34,192	34,769	34,687	34,626	34,673	35,019	34,949	34,944	34,954	35,043	33,193	31,903	31,878	31,030	31,021
	Local	5,796	6,915	7,031	7,014	7,002	7,012	7,081	7,067	7,066	7,068	7,086	6,716	6,458	6,453	6,283	6,281
	Total	34,390	41,107	41,799	41,701	41,628	41,685	42,100	42,016	42,010	42,022	42,129	39,909	38,361	38,331	37,313	37,302
TOTAL	Foreign	123447	137,621	138,454	138,188	138,008	138,070	138,966	138,811	138,793	138,851	139,114	134,238	130,776	130,724	128,529	128,481
	Local	117,031	135,080	136,794	136,661	136,561	136,680	137,725	137,573	137,607	137,619	137,815	131,758	127,609	127,648	124,774	124,781
	Total	240,478	272,701	275,248	274,894	274,569	274,750	276,691	276,384	276,398	276,470	276,929	265,996	258,385	258,372	253,303	253,262

Freight, taxes and duty included.
The estimates reflect 1980 June price levels.
No escalation.

TABLE 3-5
OPERATING COST
OPEN PITS
(000's) RUPEES

(Continued)

Description	Currency	Year														Total	Average
		2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015		
Wages	Local	2,538	2,538	2,538	2,538	2,538	2,538	2,538	2,538	2,538	2,538	2,538	2,538	2,538	2,091	75,647	2,522
Salaries	Local	936	936	936	936	936	936	936	936	936	936	936	936	936	835	27,979	933
Power	Local	1,686	1,964	1,938	1,953	1,952	1,943	1,947	1,943	1,944	1,952	1,964	1,976	1,864	1,025	55,543	1,851
Replacement & Improvement	Foreign	50,286	20,286	50,286	50,286	50,286	50,286	50,286	50,286	50,286	50,286	50,286	50,286	50,286	50,274	1,508,568	50,286
	Local	22,393	22,393	22,393	22,393	22,393	22,393	22,393	22,393	22,393	22,393	22,393	22,393	22,393	22,366	671,763	22,392
	Total	72,679	72,679	72,679	72,679	72,679	72,679	72,679	72,679	72,679	72,679	72,679	72,679	72,679	72,640	2,180,331	72,678
Material and Supplies	Foreign	47,170	47,214	53,388	53,509	53,359	53,321	53,343	53,328	53,316	36,482	36,544	36,626	34,529	14,516	1,447,664	48,255
	Local	90,942	90,988	102,165	102,320	102,055	102,018	102,061	102,056	101,943	82,891	82,839	82,891	78,715	44,981	2,840,664	94,689
	Total	138,112	138,202	155,553	155,829	155,414	155,339	155,404	155,384	155,259	119,373	119,383	119,517	113,244	59,497	4,288,328	142,944
Maintenance	Foreign	31,011	31,037	34,811	34,883	34,803	34,777	34,801	34,795	34,743	6,953	6,950	6,957	6,604	3,852	872,451	29,082
	Local	6,279	6,284	7,039	7,054	7,038	7,032	7,037	7,036	7,026	7,030	7,027	7,034	6,681	3,929	201,855	6,728
	Total	37,290	37,321	41,850	41,937	41,841	41,809	41,838	41,831	41,769	13,983	13,977	13,991	13,285	7,781	1,074,306	35,810
TOTAL	Foreign	128,467	128,537	138,485	138,678	138,448	138,384	138,430	138,409	138,345	93,721	93,780	93,869	91,419	68,642	3,828,683	127,623
	Local	124,774	124,833	137,009	137,194	136,912	136,860	136,912	136,902	136,780	117,740	117,697	117,768	113,127	75,227	3,873,451	129,115
	Total	253,241	253,370	275,494	275,872	275,360	275,244	275,342	275,311	275,125	211,461	211,477	211,637	204,546	143,869	7,702,134	256,738

Freight, taxes and duty included.
The estimates reflet 1980 June price levels.
No escalation.

TABLE 3-6
OPERATING COST
SURFACE FACILITIES
(000's)RUPEES

Sheet 1

Description	Currency	Year															
		1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
Wages	Local	2,558	3,240	3,569	3,569	3,569	3,569	3,569	3,569	3,569	3,569	3,569	3,569	3,569	3,569	3,569	3,569
Salaries	Local	1,898	2,129	2,172	2,172	2,172	2,172	2,172	2,172	2,172	2,172	2,172	2,172	2,172	2,172	2,172	2,172
Power	Local	401	456	456	456	456	456	456	456	456	456	456	456	456	456	456	456
Replacement & Improvement	Foreign	62	62	62	62	62	62	62	62	62	62	62	62	62	62	62	62
	Local	75	75	75	75	75	75	75	75	75	75	75	75	75	75	75	75
	Total	137	137	137	137	137	137	137	137	137	137	137	137	137	137	137	137
Materials & Supplies	Foreign	235	235	235	235	235	235	235	235	235	235	235	235	235	235	235	235
	Local	1,044	1,044	1,044	1,044	1,044	1,044	1,044	1,044	1,044	1,044	1,044	1,044	1,044	1,044	1,044	1,044
	Total	1,279	1,279	1,279	1,279	1,279	1,279	1,279	1,279	1,279	1,279	1,279	1,279	1,279	1,279	1,279	1,279
Maintenance	Foreign	593	593	593	593	593	593	593	593	593	593	593	593	593	593	593	593
	Local	880	880	880	880	880	880	880	880	880	880	880	880	880	880	880	880
	Total	1,473	14,73	1,473	1,473	1,473	1,473	1,473	1,473	1,473	1,473	1,473	1,473	1,473	1,473	1,473	1,473
TOTAL	Foreign	890	890	890	890	890	890	890	890	890	890	890	890	890	890	890	890
	Local	6,856	7,824	8,196	8,196	8,196	8,196	8,196	8,196	8,196	8,196	8,196	8,196	8,196	8,196	8,196	8,196
	Total	7,746	8,714	9,086	9,086	9,086	9,086	9,086	9,086	9,086	9,086	9,086	9,086	9,086	9,086	9,086	9,086

Freight, taxes and duty included.
The estimates reflect 1980 June price levels.
No escalation.

TABLE 3-6
OPERATING COST
SURFACE FACILITIES
(000's) RUPEES

(Continued)

Description	Currency	Year														Total	Average
		2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015		
Wages	Local	3,569	3,569	3,569	3,569	3,569	3,569	3,569	3,569	3,569	3,569	3,569	2,695	2,695	2,695	103,108	3,437
Salaries	Local	2,172	2,172	2,172	2,172	2,172	2,172	2,172	2,172	2,172	2,172	2,172	1,964	1,964	1,964	64,219	2,141
Power	Local	456	456	456	456	456	456	456	456	456	456	412	383	383	383	13,362	445
Replacement & Improvement	Foreign	62	62	62	62	62	62	62	62	62	62	62	62	62	52	1,850	62
	Local	74	74	74	74	74	74	74	74	74	74	74	74	74	64	2,226	74
	Total	136	136	136	136	136	136	136	136	136	136	136	136	136	116	4,076	136
Material & Supplies	Foreign	235	235	235	235	235	235	235	235	235	235	235	235	235	-	6,815	227
	Local	1,044	1,044	1,044	1,044	1,044	1,044	1,044	1,044	1,044	1,044	1,044	1,044	1,044	944	31,220	1,041
	Total	1,279	1,279	1,279	1,279	1,279	1,279	1,279	1,279	1,279	1,279	1,279	1,279	1,279	944	38,035	1,268
Maintenance	Foreign	593	593	593	593	593	593	593	593	593	455	-	-	-	-	15,280	509
	Local	880	880	880	880	880	880	880	880	880	820	625	625	625	625	25,320	844
	Total	1,473	1,473	1,473	1,473	1,473	1,473	1,473	1,473	1,473	1,275	625	625	625	625	40,600	1,353
TOTAL	Foreign	890	890	890	890	890	890	890	890	890	752	297	297	297	52	23,945	798
	Local	8,195	8,195	8,195	8,195	8,195	8,195	8,195	8,195	8,195	8,135	7,896	6,785	6,785	6,675	239,455	7,982
	Total	9,085	9,085	9,085	9,085	9,085	9,085	9,085	9,085	8,085	8,887	8,193	7,082	7,082	6,727	263,400	8,780

Freight, taxes and duty included.
The estimates reflect 1980 June price levels.
No escalation.

TABLE 3-7
OPERATING COST
PREPARATION PLANT
(000's) RUPEES

Sheet 1

Description	Currency	Year															
		1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
Wages	Local	477	560	740	740	740	740	740	740	740	740	740	740	740	740	740	740
Salaries	Local	196	196	196	196	196	196	196	196	196	196	196	196	196	196	196	196
Power	Local	332	437	545	547	550	556	559	563	556	552	553	551	552	556	555	560
Replacement & Improvement	Foreign	322	322	322	322	322	322	322	322	322	322	322	322	322	322	322	322
	Local	137	137	137	137	137	137	137	137	138	137	137	137	137	137	137	137
	Total	459	459	457	457	457	457	457	457	457	457	457	457	457	457	457	457
Materials and Supplies	Local	1,100	1,446	1,803	1,810	1,821	1.840	1,849	1,862	1,840	1,826	1,828	1,824	1,826	1,838	1,836	1,855
Maintenance	Foreign	1,757	1,757	1,757	1,757	1,757	1,757	1,757	1,757	1,757	1,757	1,757	1,757	1,757	1,757	1,757	1,757
	Local	1,261	1,421	1,603	1,603	1,603	1,603	1,603	1,603	1,603	1,603	1,603	1,603	1,603	1,603	1,603	1,603
	Total	3,018	3,178	3,360	3,360	3,360	3,360	3,360	3,360	3,360	3,360	3,360	3,360	3,360	3,360	3,360	3,360
TOTAL	Foreign	2,079	2,079	2,079	2,079	2,079	2,079	2,079	2,079	2,079	2,079	2,079	2,079	2,079	2,079	2,079	2,079
	Local	3,503	4,197	5,024	5,033	5,047	5,072	5,084	5,101	5,072	5,054	5,507	5,051	5,054	5,070	5,067	5,091
	Total	5,582	6,276	7,103	7,112	7,126	7.151	7,163	7,180	7,151	7,133	7,136	7,130	7,133	7,149	7,146	7,170

Freight, taxes and duty included.
The estimates reflect 1980 June price levels.
No escalation.

TABLE 3-7
OPERATING COST
PREPARATION PLANT
(000's) RUPEES

(Continued)

Description	Currency	Year														Total	Average
		2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015		
Wages	Local	740	740	740	740	740	740	740	740	740	740	740	740	740	740	21,757	725
Salaries	Local	196	196	196	196	196	196	196	196	196	196	196	196	196	196	5,880	196
Power	Local	561	561	565	559	560	559	565	565	558	552	505	436	436	436	15,942	531
Replacement & Improvement	Foreign	322	322	322	322	-	-	-	-	-	-	-	-	-	-	6,440	214
	Local	137	137	137	137	-	-	-	-	-	-	-	-	-	-	2,740	92
	Total	457	457	457	457							-	-	-	-	9,180	206
Materials and Supples	Local	1,857	1,855	1,869	1,847	1,853	1,848	1,868	1,868	1,845	1,826	1,669	1,442	1,442	1,442	52,735	1,756
Maintenance	Foreign	1,757	1,757	1,757	1,757	1,757	1,757	1,757	1,757	1,757	1,757	-	-	-	-	45,682	1,523
	Local	1,603	1,603	1,603	1,603	1,603	1,603	1,603	1,603	1,603	1,603	771	666	666	666	43,923	1,464
	Total	3,360	3,360	3,360	3,360	3,360	3,360	3,360	3,360	3,360	3,360	771	666	666	666	89,605	2,987
TOTAL	Foreign	2,079	2,079	2,079	2,079	1,757	1,757	1,757	1,757	1,757	1,757	-	-	-	-	52,122	1,737
	Local	5,094	5,092	5,110	5,082	4,952	4,946	4,972	4,972	4,942	4,917	3,881	3,480	3,480	3,480	142,977	4,766
	Total	7,173	7,171	7,189	7,161	6,709	6.703	6,729	6,729	6,699	6,674	3,881	3,480	3,480	3,480	195,099	6,503

Freight, taxes and duty included.
The estimates reflect 1980 June price levels.
No. escalation.

TABLE 3-8
OPERATING COST
RAILWAY
(000's) RUPEES

Description	Currency	Year 1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
Wages	Local	64	127	382	382	382	382	382	382	382	382	382	382	382	382	382	382
Power	Local	35	70	176	176	176	176	176	176	176	176	176	176	176	176	176	176
Replacement & Improvement	Foreign	667	667	667	667	667	667	667	667	667	667	667	667	667	667	667	667
	Local	285	285	285	285	285	285	285	285	285	285	285	285	285	285	285	285
	Total	952	952	952	952	952	952	952	952	952	952	952	952	952	952	952	952
Material & Supplies	Local	1,620	3,240	8,100	8,100	8,100	8,100	8,100	8,100	8,100	8,100	8,100	8,100	8,100	8,100	8,100	8,100
Maintenance	Foreign	-	893	894	1,787	1,787	1,787	1,787	1,787	1,787	1,787	1,787	1,787	1,787	1,787	1,787	1,787
	Local	1,346	1,733	3,081	3,468	3,468	3,468	3,468	3,468	3,468	3,468	3,468	3,468	3,468	3,468	3,468	3,468
	Total	1,346	2,626	3,975	5,255	5,255	5,255	5,255	5,255	5,255	5,255	5,255	5,255	5,255	5,255	5,255	5,255
TOTAL	Foreign	667	1,560	1,561	2,454	2,454	2,454	2,454	2,454	2,454	2,454	2,454	2,454	2,454	2,454	2,454	2,454
	Local	3,350	5,455	12,024	12,411	12,411	12,411	12,411	12,411	12,411	12,411	12,411	12,411	12,411	12,411	12,411	12,411
	Total	4,017	7,015	13,585	14,865	14,865	14,865	14,865	14,865	14,865	14,865	14,865	14,865	14,865	14,865	14,865	14,865
Existing Railway	Local	3,665	4,820	6,010	6,035	6,070	6,135	6,165	6,205	6,135	6,085	6,095	6,080	6,085	6,125	6,120	6,185
GRAND TOTAL	Foreign	667	1,560	1,561	2,454	2,454	2,454	2,454	2,454	2,454	2,454	2,454	2,454	2,454	2,454	2,454	2,454
	Local	7,015	10,275	13,034	18,446	18,481	18,546	18,576	18,616	18,546	18,496	18,506	18,491	18,496	18,536	18,531	18,596
	Total	7,682	11,835	19,595	20,900	20,935	21,000	21,030	21,070	21,000	20,950	20,960	20,945	20,950	20,990	20,985	21,050

Freight, taxes and duty included.
The estimates reflect 1980 June price levels.
No escalation.

* Average (1) for 27 years
Average (2) for 30 years

TABLE 3-8

OPERATING COST

RAILWAY

(000's) RUPEES

(Continued)

Description	Currency	Year														Total	Average*
		2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015		
Wages	Local	382	382	382	382	382	382	382	382	382	382	382	382	382	382	10,887	363
Power	Local	176	176	176	176	176	176	176	176	176	176	176	176	176	176	5,033	168
Replacement & Improvement	Foreign	667	667	667	667	667	667	667	667	667	667	667	667	667	667	20,010	667
	Local	285	285	285	285	285	285	285	285	285	285	285	285	285	285	8,550	285
	Total	952	952	952	952	952	952	952	952	952	952	952	952	952	952	28,560	952
Materials & Supplies	Local	8,100	8,100	8,100	8,100	8,100	8,100	8,100	8,100	8,100	8,100	8,100	8,100	8,100	8,100	231,660	7,722
Maintenance	Foreign	1,787	1,787	1,787	1,787	1,787	1,787	1,787	1,787	1,787	-	-	-	-	-	41,101	1,370
	Local	3,468	3,468	3,468	3,468	3,468	3,468	3,468	3,468	3,468	2,692	2,692	2,692	2,692	2,692	195,916	3,197
	Total	5,255	5,255	5,255	5,255	5,255	5,255	5,255	5,255	5,255	2,692	2,692	2,692	2,692	2,692	137,017	4,567
TOTAL	Foreign	2,454	2,454	2,454	2,454	2,454	2,454	2,454	2,454	2,454	2,667	667	667	667	667	61,111	2,037
	Local	12,411	12,411	12,411	12,411	12,411	12,411	12,411	12.411	12,411	11,635	11,635	11,635	11,635	11,635	352,046	11,735
	Total	14,865	14,865	14,865	14,865	14,865	14,865	14,865	14,865	14,865	12,302	12,302	12,302	12,302	12,302	413,157	13,772
Existing Railway	Local	6,190	6,185	6,230	6,160	6,175	6,160	6,225	6,225	6,150	6,085	5,565	4,805	4,805	4,805	175,780	5,859
GRAND TOTAL	Foreign	2,454	2,454	2,454	2,454	2,454	2,454	2,454	2,454	2,454	667	667	667	667	667	61,111	2,037
	Local	18,601	18,596	18,641	18,571	18,586	18,571	18,636	18,636	18,561	17,720	17,200	16,440	16,440	16,440	527,826	17,594
	Total	21,055	21,050	21,095	21,025	21,040	21,025	21,090	21,090	21,015	18,387	17,867	17,107	17,107	17,107	588,937	19,631

Freight, taxes and duty included.
The estimates reflect 1980 June price levels.
No escalation.

TABLE 3-9
SUMMARY OF OPERATING COST
PER CLEAN COAL TONNE
(RUPEE)

Description	Currency	YEAR																														Average
		1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	
Mine	Foreign	190	163	129	128	128	126	125	123	125	128	129	124	118	118	116	115	115	115	122	123	123	123	122	116	118	82	86	98	95	71	119
	Local	213	186	151	151	151	148	148	147	148	151	151	146	141	140	138	136	136	136	145	147	146	146	145	143	144	128	138	136	131	92	145
	Total	403	349	280	279	279	274	273	270	273	279	280	270	259	258	254	251	251	251	267	270	269	269	267	259	262	210	224	234	226	163	264
Depreciation on Assets	Local	52	39	32	31	31	31	31	31	31	31	31	31	31	31	31	31	31	31	31	31	31	31	31	31	31	34	40	40	40	40	32
Amortization	Local	27	27	27	27	27	27	27	27	27	27	27	27	27	27	27	27	27	27	27	27	27	27	27	27	27	27	27	27	27	27	27
Interest on Loan	Local	312	214	152	133	113	93	74	55	37	19	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	36
Mine Sub-Total	Foreign	190	163	129	128	128	126	125	123	125	128	129	124	118	118	116	115	115	115	122	123	123	123	122	116	118	82	86	98	95	71	119
	Local	604	466	362	342	322	299	280	260	243	228	209	204	199	198	196	194	194	194	203	205	204	204	203	201	202	186	199	203	198	159	240
	Total	794	629	491	470	450	425	405	383	368	356	338	328	317	316	312	309	309	309	325	328	327	327	325	317	320	268	285	301	293	230	359
Rail	Foreign	1	1	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	1	1	1	1	1	2
	Local	9	11	16	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	17	17	17	15
	Total	10	12	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17	16	16	18	18	18	17
Depreciation on Assets	Local	5	4	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	4	4	4	4	3
Amortization	Local	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
Interest on Loan	Local	44	29	20	16	13	9	7	5	4	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	4
Railway Sub-Total	Foreign	1	1	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	1	1	1	1	1	2
	Local	60	46	41	36	33	29	27	25	24	22	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	21	23	23	23	24
	Total	61	47	42	38	35	31	29	27	26	24	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	21	22	24	24	24	26
TOTAL	Foreign	191	164	130	130	130	128	127	125	127	130	131	126	120	120	118	117	117	117	124	125	125	125	124	118	120	83	87	99	96	72	121
	Local	664	512	403	378	355	328	307	285	267	250	229	224	219	218	216	214	214	214	223	225	224	224	223	221	222	206	220	226	221	182	264
	Total	855	676	533	508	485	456	434	410	394	380	360	350	339	338	334	331	331	331	347	350	349	349	347	339	342	289	307	325	317	254	385
Credit Coal	Local	(218)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	(4)
GRAND TOTAL	Foreign	191	164	130	130	130	128	127	125	127	130	131	126	120	120	118	117	117	117	124	125	125	125	124	118	120	83	87	99	96	72	121
	Local	446	512	403	378	355	328	307	285	267	250	229	224	219	218	216	214	214	214	223	225	224	224	223	221	222	206	220	226	221	182	260
	Total	637	676	533	508	485	456	434	410	394	380	360	350	339	338	334	331	331	331	347	350	349	349	347	339	342	289	307	325	317	254	381

Freight, taxes and duty included.
The estimates reflect 1980 June price levels.
No escalation.

TABLE 3-10

OPERATING COST

SUMMARY

RUPEES PER CLEAN COAL TONNE

Description	Currency	Year																														Average
		1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	
Underground Mine	Foreign	18	17	11	11	11	10	10	8	9	11	12	11	8	9	8	8	8	8	8	8	8	8	8	3	3	3	2	-	-	-	8
	Local	36	31	24	24	26	24	23	23	23	24	25	24	23	22	23	22	22	22	22	22	22	22	22	20	20	18	19	-	-	-	21
	Total	54	48	35	35	37	34	33	31	32	35	37	35	31	31	31	30	30	30	30	30	30	30	30	23	23	21	21	-	-	-	29
Open Pits	Foreign	168	143	115	114	114	113	112	112	113	114	114	110	107	106	105	104	104	104	111	112	112	112	111	113	113	77	84	98	95	71	108
	Local	160	140	114	114	112	111	112	111	112	113	113	109	105	105	102	101	101	101	101	112	111	111	110	110	111	97	106	122	117	78	111
	Total	328	283	229	228	226	224	224	223	225	227	227	219	212	211	207	205	205	205	221	224	223	223	221	223	224	174	190	220	212	149	219
Surface Facilities	Foreign	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	-	-	-	-	1
	Local	9	8	6	6	6	6	6	6	6	7	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	7	7	7	7	6
	Total	10	9	7	7	7	7	7	7	7	8	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7
Preparation Plant	Foreign	3	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	1	1	1	-	-	-	-	2
	Local	5	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	3	4	4	4	4
	Total	8	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	5	5	5	3	4	4	4	6
General Expenses	Local	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
Sub-Total	Foreign	190	163	129	128	128	126	125	123	125	128	129	124	118	118	116	115	115	115	122	123	123	123	122	116	118	82	86	98	95	71	119
	Local	212	185	150	150	150	147	147	145	147	150	150	145	140	139	137	135	135	135	144	145	145	145	144	142	143	127	137	135	130	91	144
	Total	402	348	279	278	278	273	272	269	272	278	279	269	258	257	253	250	250	250	266	269	268	268	266	258	261	209	223	233	225	162	263
Head Office Overhead	Local	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
MINE TOTAL	Foreign	190	163	129	128	128	126	125	123	125	128	129	124	118	118	116	115	115	115	122	123	123	123	122	116	118	82	86	98	95	71	119
	Local	213	186	151	151	151	148	148	147	148	151	151	146	141	140	138	136	136	136	145	147	146	146	145	143	144	128	138	136	131	92	145
	Total	403	349	280	279	279	274	273	270	273	279	280	270	259	258	254	251	251	251	267	270	269	269	267	259	262	210	224	234	226	163	264
Railway	Foreign	1	1	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	1	1	1	1	1	2
	Local	9	11	16	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	17	17	17	15
	Total	10	12	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17	16	16	18	18	18	17
GRAND TOTAL	Foreign	191	164	130	130	130	128	127	125	127	130	131	126	120	120	118	117	117	117	124	125	125	125	124	118	120	83	87	99	96	72	121
	Local	222	197	167	166	166	163	163	162	163	166	166	161	156	155	153	151	151	151	160	162	161	161	160	158	159	143	153	153	148	109	160
	Total	413	361	297	295	296	291	290	287	290	296	297	287	276	275	271	268	268	268	284	287	286	286	284	276	279	226	240	252	244	181	281

Freight, taxes and duty included.
The estimates reflect 1980 June price levels.
No escalation.

TABLE 3-11
OPERATING COST
SUMMARY OF MINE
(RUPEES PER CLEAN COAL TONNE)

Description	Currency	Year																															
		1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	Average
Wages	Local	12	11	10	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	8	8	6	6	6	9
Salaries	Local	5	4	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	4	3	3	3	3
Power	Local	8	6	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	3	2	2	5
Replacement & Improvement	Foreign	75	57	46	45	45	45	45	44	45	45	45	45	45	45	45	45	45	45	44	45	45	45	44	40	41	41	45	53	52	52	46
	Local	33	25	19	20	20	20	20	20	20	20	20	20	20	20	20	20	19	19	20	20	20	20	19	18	18	18	20	23	23	24	20
	Total	108	82	65	66	65	65	65	64	65	65	65	65	65	65	65	65	64	64	64	65	65	65	63	58	59	59	65	76	75	76	66
Materials & Supplies	Foreign	70	66	50	43	51	43	43	47	43	50	51	43	43	43	42	41	41	41	45	46	46	46	46	46	46	33	35	38	36	15	45
	Local	130	119	96	96	96	94	94	93	94	96	96	91	87	86	84	83	83	83	91	93	92	92	92	92	93	77	84	89	85	43	91
	Total	200	185	146	146	147	143	142	140	142	146	147	139	130	129	126	124	124	124	137	139	138	138	138	138	139	110	119	127	121	64	136
Maintenance	Foreign	45	40	33	33	32	32	32	32	32	33	33	31	30	30	29	29	29	29	32	32	32	32	32	30	31	8	6	7	7	4	28
	Local	22	18	15	15	15	14	14	14	14	15	15	15	14	14	14	13	14	14	14	14	14	14	14	13	13	14	14	9	8	5	14
	Total	67	58	48	48	47	46	46	46	46	48	48	46	44	44	43	42	43	43	46	46	46	46	46	43	44	22	20	16	15	9	42
Others	Local	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
TOTAL	Foreign	190	163	129	128	128	126	125	123	125	128	129	124	118	118	116	115	115	115	122	123	123	123	122	116	118	82	86	98	95	71	119
	Local	213	185	151	151	151	148	148	147	148	151	151	145	141	140	138	135	136	136	145	147	145	115	145	143	144	128	133	136	131	92	145
	Total	403	349	280	279	279	274	273	270	273	279	280	270	259	258	254	251	251	251	267	270	269	269	267	259	262	210	224	234	226	163	264

Freight, taxes and duty included.
The estimates reflect 1990 June price levels.
No escalation.

TABLE 3-12

OPERATING COST

RUPEES PER CLEAN COAL TONNE

Description	Year																														Average*
	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	
UNDERGROUND MINE																															
Wages	23	18	18	17	17	17	17	15	16	16	16	16	16	15	14	14	14	14	14	15	15	15	15	15	15	10	16	-	-	-	16
Salaries	5	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	4	-	-	-	3
Power	24	14	14	14	14	14	14	13	13	14	14	14	14	14	14	13	13	13	13	14	14	14	14	13	13	12	15	-	-	-	14
Replacement & Improvement	45	26	26	26	25	26	25	22	24	24	24	25	25	24	23	23	23	23	23	24	24	25	24	-	-	-	-	-	-	-	21
Materials & Supplies	126	92	76	74	83	72	64	52	55	73	77	69	52	53	50	46	46	45	45	50	50	49	48	49	48	43	67	-	-	-	60
Maintenance	80	45	45	45	44	45	44	39	41	42	43	43	44	42	41	40	40	40	40	42	42	43	41	29	29	31	45	-	-	-	41
Absenteeism	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	-	-	-	1
TOTAL	305	199	183	180	187	178	168	145	153	173	178	171	155	152	146	140	140	140	140	149	149	150	146	110	109	106	149	-	-	-	156
OPEN PIT																															
Wages	4	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
Salaries	2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Power	3	3	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
Replacement & Improvement	121	99	75	75	74	73	73	75	75	75	75	75	75	75	75	75	75	75	74	74	74	74	74	73	74	75	75	75	75	75	76
Materials & Supplies	212	210	159	159	159	156	158	162	161	162	162	153	146	145	143	142	142	142	159	159	158	157	157	157	159	122	124	124	118	62	150
Maintenance	57	57	43	43	43	42	42	43	43	43	43	41	39	33	39	38	38	38	43	42	42	42	42	42	43	14	15	15	14	8	37
TOTAL	399	373	283	283	282	277	279	286	285	286	286	275	266	266	263	261	261	261	282	281	280	279	279	278	282	217	220	220	213	150	269

Freight, taxes and duty included.
The estimates reflect 1980 June price levels.
No escalation.

*27 Years for U/G

TABLE 3-13

DEPRECIATION SCHEDULE

(000'S) RUPEES

Mine

A. Depreciation

Description	Total Value
Land	293
Factory Buildings	42,246
Roads	71,118
Machinery & Equipments	1,137,762
Electrical Installation	61,621
Office Buildings, Warehouse, etc.	14,103
Furniture & Fixture	8,974
Transport Assets	2,289
Total	1,274,406

Total Value excluding land & Roads 1,266,995
Less Residual value @ 10% 126,700
Net Cost 1,140,295
Annual Depreciation 1,140,295 ÷ 30 years = 38,010

B. Development Expenditure

Description	Total Value
1. Preliminary Expenses	31,157
2. Construction & Development	433,257
3. Administration	54,000
4. Differed Revenue Expenses	24,148
5. Interest	339,000
6. Engineering Fee	67,000
Total	948,562

948,562 ÷ 35,156 = 26.98 Rs./Ton
* 35,156... Total production from 1986 to 2015.

Railway

A. Depreciation

Description	Total Value
Roads	111,053
Machinery & Equipments	116,696
Electrical Installation	13,957
Office Buildings Warehouse, etc.	2,372
Total	244,078

Total Value excluding roads 133,025
Less Residual value @10% 13,303
Net Cost 119,722
Annual Depreciation 119,722 ÷ 30 years = 3,991

B. Development Expenditue

Description	Total Value
1. Administration	8,000
2. Interest	37,000
3. Engineering fee	10,000
Total	55,000

55,000 ÷ 35,156 = 1.56 Rs./Ton
* 35,156 ... Total production from 1986 to 2015.

TABLE 3-14

SCHEDULE FOR REPAYMENT OF LOAN AND INTEREST

(000'S) RUPEES

Mine

Foreign Loan Rs. 1,306,000
Interest 8.75%

Year	Principal	Interest	Total Payment	Balance
1986	-	114,275	114,275	1,306,000
1987	-	114,275	114,275	1,306,000
1988	-	114,275	114,275	1,306,000
1989	-	114,275	114,275	1,306,000
1990	-	114,275	114,275	1,306,000
1991	261,200	114,275	375,475	1,044,800
1992	261,200	91,420	352,620	783,600
1993	261,200	68,565	329,765	522,400
1994	261,200	45,710	306,910	261,200
1995	261,200	22,855	284,055	-
Total	1,306,000	914,200	2,220,200	-

Local Loan Rs. 917,000
Interest 12.5%

Year	Principal	Interest	Total Payment	Balance
1986	183,400	114,625	298,025	733,600
1987	183,400	91,700	275,100	550,200
1988	183,400	68,775	252,175	366,800
1989	183,400	45,850	229,250	183,400
1990	183,400	22,925	206,325	-
Total	917,000	343,875	1,260,875	-

Railway

Foreign Loan Rs. 127,000
Interest 8.75%

Year	Principal	Interest	Total Payment	Balance
1986	-	11,113	11,113	127,000
1987	-	11,113	11,113	127,000
1988	-	11,113	11,113	127,000
1989	-	11,113	11,113	127,000
1990	-	11,113	11,113	127,000
1991	25,400	11,113	36,513	101,600
1992	25,300	8,890	34,290	76,200
1993	25,400	6,668	32,068	50,800
1994	25,400	4,445	29,845	25,400
1995	25,400	2,223	27,623	-
Total	127,000	88,904	215,904	-

Local Loan Rs. 172,000
Interest 12.5%

Year	Principal	Interest	Total Payment	Balance
1986	34,400	21,500	55,900	137,600
1987	34,400	17,200	51,600	103,200
1988	34,400	12,900	47,300	68,800
1989	34,400	8,600	43,000	34,400
1990	34,400	4,300	38,700	-
Total	172,000	64,500	236,500	-

TABLE 3-15

OPERATING COST
SALARIES AND WAGES SCALE
(000'S) RUPEES

(Local Currency)

Section	Description	Year 1983-1985	1986	1987	1988-1997	1998-2010	2011-2012	2013-2014	2015	Total	Average
Underground Mine	Officers	-	689	773	773	731	647	-	-	19,989	667
	Workers	-	2,986	4,055	4,055	3,783	2,515	-	-	101,800	3,394
	Sub-Total	-	3,675	4,828	4,828	4,514	3,162	-	-	121,789	4,061
Open Pit	Officers	-	936	936	936	936	936	936	835	27,979	935
	Workers	-	2,492	2,538	2,538	2,538	2,538	2,538	2,091	75,647	2,522
	Sub-Total	-	3,428	3,474	3,474	3,474	3,474	3,474	2,926	103,626	3,457
Administration	Officers	-	1,898	2,129	2,172	2,172	2,172	1,964	1,964	64,219	2,141
	Workers	-	2,558	3,240	3,569	3,569	3,569	2,695	2,695	103,108	3,438
	Sub-Total	-	4,456	5,369	5,741	5,741	5,741	4,659	4,659	167,327	5,579
Preparation Plant	Officers	-	196	196	196	196	196	196	196	5,880	196
	Workers	-	477	560	740	740	740	740	740	21,757	725
	Sub-Total	-	673	756	936	936	936	936	936	27,637	921
TOTAL	Officers	-	3,719	4,034	4,077	4,035	3,951	3,096	2,995	118,067	3,939
	Workers	-	8,513	10,393	10,902	10,630	9,362	5,973	5,526	302,312	10,079
	Sub-Total	-	12,232	14,427	14,979	14,665	13,313	9,069	8,521	420,379	14,018

The estimates reflect 1980 June price levels.

No escalation .

TABLE 3-16

OPERATING COST
SALARIES
(000'S) RUPEES

(Local Currency)

Sheet 1

Section	Description	Salary *	Year 1983-1985	1986	1987	1988-1997	1998-2010	2011-2012	2013-2014	2015	Total	Average
Underground Mine	Mine Manager	3,620	-	43	43	43	43	43	-	-	1,161	39
	Deputy Mine Manager	3,055	-	73	73	73	73	73	-	-	1,971	66
	Assistant Mining Engineer	2,545	-	92	92	92	92	92	-	-	2,484	83
	Longwall Face Foremen	1,155	-	83	167	167	167	83	-	-	4,257	142
	Pillar Splitting Foremen	1,155	-	-	-	-	42	42	-	-	630	21
	Road Heading Foremen	1,155	-	167	167	167	83	83	-	-	3,249	108
	Ventilation Foremen	1,155	-	14	14	14	14	14	-	-	378	13
	Road Maintenance Foremen	1,155	-	56	56	56	56	56	-	-	1,512	50
	Haulage Foremen	1,155	-	42	42	42	42	42	-	-	1,134	38
	Electrical & Mechanical Foremen	1,155	-	97	97	97	97	97	-	-	2,619	87
	Safetylamp Room Foremen	1,155	-	14	14	14	14	14	-	-	378	13
	Office Clerk	645	-	8	8	8	8	8	-	-	216	7
	Sub-Total		-	689	773	773	731	647	-	-	19,989	667
West Open Pit	Mine Manager	3,620	-	43	43	43	43	43	43	43	1,290	43
	Deputy Mine Manager	3,055	-	73	73	73	73	73	73	73	2,190	73
	Assistant Mining Engineer	2,545	-	92	92	92	92	92	92	61	2,729	91
	Stripping Foremen	1,155	-	42	42	42	42	42	42	28	1,246	42
	Bankshooting Foremen	1,155	-	28	28	28	28	28	28	14	826	28
	Parting & Coal Loading Foremen	1,155	-	28	28	28	28	28	28	28	840	28
	Haulage Foremen	1,155	-	42	42	42	42	42	42	28	1,246	42
	Road Grading Foremen	1,155	-	14	14	14	14	14	14	14	420	14
	Reclamation Foremen	1,155	-	14	14	14	14	14	14	14	420	14
	Electrical Foremen	1,155	-	42	42	42	42	42	42	28	1,246	42
	Mechanical Foremen	1,155	-	42	42	42	42	42	42	28	1,246	42
	Office Clerk	645	-	8	8	8	8	8	8	8	240	8
	Sub-Total		-	468	468	468	468	468	468	367	13,939	467
East Open Pit	Mine Manager	3,620	-	43	43	43	43	43	43	43	1,290	43
	Deputy Mine Manager	3,055	-	73	73	73	73	73	73	73	2,190	73
	Assistant Mining Engineer	2,545	-	92	92	92	92	92	92	92	2,760	92
	Stripping Foremen	1,155	-	42	42	42	42	42	42	42	1,260	42
	Bankshooting Foremen	1,155	-	28	28	28	28	28	28	28	840	28
	Parting & Coal Loading Foremen	1,155	-	28	28	28	28	28	28	28	840	28
	Haulage Foremen	1,155	-	42	42	42	42	42	42	42	1,260	42
	Road Grading Foremen	1,155	-	14	14	14	14	14	14	14	420	14
	Reclamation Foremen	1,155	-	14	14	14	14	14	14	14	420	14
	Mechanical Foremen	1,155	-	42	42	42	42	42	42	42	1,260	42
	Electrical Foremen	1,155	-	42	42	42	42	42	42	42	1,260	42
	Office Clerk	645	-	8	8	8	8	8	8	8	240	8
	Sub-Total		-	468	468	468	468	468	468	468	14,040	468
	Total		-	936	936	936	936	936	936	835	27,979	935

* Rs/man/month

The estimates reflect 1980 price levels.
No escalation.

TABLE 3-16

OPERATING COST
SALARIES
(000'S) RUPEES

(Continued)

Section	Description	Salary*	Year 1983-1985	1986	1987	1988-1997	1998-2010	2011-2012	2013-2014	2015	Total	Average
Management	General Manager	5,650	-	68	68	68	68	68	68	68	2,040	68
	Deputy General Manager	5,090	-	122	122	122	122	122	122	122	3,660	122
	Clerks/Typist	645	-	23	23	23	23	23	23	23	690	23
	Sub-Total		-	213	213	213	213	213	213	213	6,390	213
General Affairs	Manager	3,620	-	43	43	43	43	43	43	43	1,290	43
	Deputy Manager	2,715	-	33	33	33	33	33	33	33	990	33
	Clerks/Typists	590	-	14	21	28	28	28	14	14	777	26
	Deputy Manager, Security	2,715	-	33	33	33	33	33	33	33	990	33
	Security Inspectors	1,130	-	41	41	41	41	41	41	41	1,230	41
	Clerk	565	-	7	7	7	7	7	7	7	210	7
	Pesh Imams	645	-	15	23	31	31	31	15	15	858	29
	Sub-Total		-	186	201	216	216	216	186	186	6,345	212
Accounting	Accountant	3,055	-	37	37	37	37	37	37	37	1,110	37
	Assistant Accountant	1,630	-	20	20	20	20	20	20	20	600	20
	Account Assistans	1,155	-	56	70	70	70	70	56	56	2,044	68
	Cashier	1,155	-	14	14	14	14	14	14	14	420	14
	Clerks	565	-	14	14	14	14	14	14	14	420	14
	Deputy Manager Store	2,545	-	31	31	31	31	31	31	31	930	31
	Store Keepers	1,155	-	42	70	70	70	70	42	42	1,988	66
	Sub-Total		-	214	256	256	256	256	214	214	7,512	250
Labour & Social Welfare	Manager	3,620	-	43	43	43	43	43	43	43	1,290	43
	Deputy Manager	2,715	-	33	33	33	33	33	33	33	990	33
	Supervisors Employ	930	-	11	11	11	11	11	11	11	330	11
	Supervisors, Control	930	-	34	34	34	34	34	34	34	1,020	34
	Deputy Manager, Fairprice Shop	1,630	-	20	20	20	20	20	20	20	600	20
	Sales Supervisors	860	-	10	21	21	21	21	10	10	586	20
	Account Assistant	860	-	10	10	10	10	10	10	10	300	10
	Clerk/Cashier	590	-	7	7	7	7	7	7	7	210	7
	Office Clerk	565	-	7	7	7	7	7	7	7	210	7
	Sub-Total		-	175	186	186	186	186	175	175	5,536	185
Civil & Water Supply	Manager	3,620	-	43	43	43	43	43	43	43	1,290	43
	Assistant Civil Engineer	2,715	-	33	33	33	33	33	33	33	990	33
	Overseer, Civil	1,630	-	20	20	20	20	20	20	20	600	20
	Assistant Surveyor	1,155	-	14	14	14	14	14	14	14	420	14
	Deputy Manager Water Supply	2,715	-	33	33	33	33	33	33	33	990	33
	Water Supply Foremen	1,155	-	56	56	56	56	56	56	56	1,680	56
	Office Clerk	565	-	7	7	7	7	7	7	7	210	7
	Sub-Total		-	206	206	206	206	206	206	206	6,180	206
Electrical & Mechanical	Manager	3,620	-	43	43	43	43	43	43	43	1,290	43
	Assistant Engineers	2,715	-	66	66	66	66	66	66	66	1,980	66
	General Foreman, Work Shop	2,715	-	33	33	33	33	33	33	33	990	33
	Electrical & Mechanical Foreman	1,115	-	56	56	56	56	56	56	56	1,680	56
	Clerk Shop Foremen	1,155	-	28	28	56	56	56	28	28	1,540	51
	Office Clerk	565	-	7	7	7	7	7	7	7	210	7
	Sub-Total		-	233	261	261	261	261	233	233	7,690	256

* Rs/man/month

The estimates reflect 1980 June price levels.
No escalation.

TABLE 3-16

OPERATING COST
SALARIES
(000'S) RUPEES

(Continued)

Sheet 3

Section	Description	Salary*	Year 1983-1985	1986	1987	1988-1997	1998-2010	2011-2012	2013-2014	2015	Total	Average
System	Manager	3,620	-	43	43	43	43	43	43	43	1,290	43
	Analyst/Clerk	645	-	8	8	8	8	8	8	8	240	8
	Sub-Total		-	51	51	51	51	51	51	51	1,530	51
Training	Manager	3,620	-	43	43	43	43	43	43	43	1,290	43
	Trainer	1,155	-	83	83	83	83	83	28	28	2,325	78
	Office Clerk	565	-	7	7	7	7	7	7	7	210	7
	Sub-Total		-	133	133	133	133	133	78	78	3,825	128
Planning	Manager	3,620	-	43	43	43	43	43	43	43	1,290	43
	Assistant Engineer	2,715	-	65	65	65	65	65	65	65	1,950	65
	Junior Engineer	1,155	-	42	42	42	42	42	42	42	1,260	42
	Explosive Foreman	1,155	-	14	14	14	14	14	14	14	420	14
	Geologist	3,055	-	37	37	37	37	37	37	37	1,110	37
	Assistant Geologists	1,155	-	28	28	28	28	28	28	28	840	28
	Drilling Foremen	1,155	-	28	28	28	28	28	28	28	840	28
	Surveyor	2,545	-	31	31	31	31	31	31	31	930	31
	Assistant Surveyor	1,155	-	42	42	42	42	42	42	42	1,260	42
	Office Clerk	565	-	7	7	7	7	7	7	7	210	7
	Sub-Total		-	337	337	337	337	337	337	337	10,110	337
Safety	Manager	3,620	-	43	43	43	43	43	43	43	1,290	43
	Safety Crew	1,155	-	14	56	56	56	56	14	14	1,512	50
	Office Clerk	565	-	7	7	7	7	7	7	7	210	7
	Sub-Total		-	64	106	106	106	106	64	64	3,012	100
Medical	Medical Officer	3,645	-	44	44	44	44	44	44	44	1,320	44
	Assistant Medical Officers	2,840	-	34	68	68	68	68	68	68	2,006	67
	Lady Assistant Medical Officers	3,645	-	-	87	87	87	87	87	87	2,523	84
	Office Clerk	645	-	8	8	8	8	8	8	8	240	8
	Sub-Total		-	86	207	207	207	207	207	207	6,089	203
	Total		-	1,898	2,129	2,172	2,172	2,172	1,964	1,964	64,219	2,141
Coal Preparation & Transport	Manager	3,620	-	43	43	43	43	43	43	43	1,290	43
	General Foreman Plant	2,545	-	31	31	31	31	31	31	31	930	31
	Plant Foremen	1,155	-	42	42	42	42	42	42	42	1,260	42
	Deputy Manager, Transport	2,545	-	31	31	31	31	31	31	31	930	31
	Transport Foreman	1,155	-	42	42	42	42	42	42	42	1,260	42
	Office Clerk	565	-	7	7	7	7	7	7	7	210	7
	Total		-	196	196	196	196	196	196	196	5,880	196
	Grand Total		-	3,719	4,034	4,077	4,035	3,951	3,096	2,995	118,067	3,939

The estimates reflect 1980 June price levels.
No escalation.

*Rs/man/month

TABLE 3-17

OPERATING COST
WAGES
(000'S) RUPEES

(Local Currnecy)

Sheet 1

Section	Description	Wage	Year 1983-1985	1986	1987	1988-1997	1998-2010	2011-2012	2013-2014	2015	Total	Average
Underground Mine	Longwall Face Workers	*	-	843	1,685	1,685	1,551	843	-	-	41,227	1,374
	Pillar Splitting Workers	*	-	-	-	135	135	135	-	-	2,025	68
	Road Heading Workers	*	-	547	547	547	274	274	-	-	10,674	356
	Ventilation Workers	*	-	109	128	128	128	83	-	-	3,347	112
	Maintenance Workers	*	-	423	423	423	423	212	-	-	10,999	367
	Haulage Workers	*	-	418	607	607	607	418	-	-	15,822	527
	Electrical & Mechanical Foremen	*	-	210	210	210	210	114	-	-	5,478	182
	Machine Operators	*	-	153	172	172	172	153	-	-	4,587	153
	Safetylamp Room Workers	*	-	70	70	70	70	70	-	-	1,890	63
	Electrical & Mechanical Store Workers	*	-	53	53	53	53	53	-	-	1,431	48
	Office Workers	*	-	160	160	160	160	160	-	-	4,320	144
	Total		-	2,986	4,055	4,055	3,783	2,515	-	-	101,800	3,394
West Open Pit	Stripping Workers	*	-	173	173	173	173	173	173	86	5,103	170
	Bankshooting Workers	*	-	145	145	145	145	145	145	75	4,280	143
	Parting & Coal Loading Workers	*	-	128	128	128	128	128	128	128	3,840	128
	Haulage Workers	*	-	417	417	417	417	417	417	278	12,371	412
	Road Grading Workers	*	-	70	70	70	70	70	70	70	2,100	70
	Reclamation Workers	*	-	73	73	73	73	73	73	73	2,190	73
	Electrical Workers	*	-	42	42	42	42	42	42	28	1,246	42
	Mechanical Workers	*	-	42	42	42	42	42	42	28	1,246	42
	Office Workers	*	-	207	207	207	207	207	207	130	6,133	204
	Sub-Total		-	1,297	1,297	1,297	1,297	1,297	1,297	896	38,509	1,284
East Open Pit	Stripping Workers	*	-	173	173	173	173	173	173	173	5,190	173
	Bankshooting Workers	*	-	145	145	145	145	145	145	145	4,350	145
	Parting & Coal Loading Workers	*	-	115	115	115	115	115	115	115	3,450	115
	Haulage Workers	*	-	340	386	386	386	386	386	340	11,488	383
	Road Grading Workers	*	-	64	64	64	64	64	64	64	1,920	64
	Reclamation Workers	*	-	67	67	67	67	67	67	67	2,010	67
	Electrical Workers	*	-	42	42	42	42	42	42	42	1,260	42
	Mechanical Workers	*	-	42	42	42	42	42	42	42	1,260	42
	Office Workers	*	-	207	207	207	207	207	207	207	6,210	207
	Sub-Total	*	-	1,195	1,241	1,241	1,241	1,241	1,241	1,195	37,138	1,238
	Total	*	-	2,492	2,538	2,538	2,538	2,538	2,538	2,091	75,647	2,522

* Shown in Tables 3-18 to 3-20.

The estimates reflect 1980 June price levels.
No escalation.

TABLE 3-17

OPERATING COST
WAGES
(000 SL RUPEES

(Continued)

Sheet 2

Section	Description	Wage *	Year							Total	Average
			1983-1985	1986	1987	1988-1997	1998-2010	2011-2012	2013-2014	2015		
Management	Office Attendants	530	-	19	19	19	19	19	19	19	570	19
General Affairs	Head Telephone Operator	645	-	8	8	8	8	8	8	8	240	8
	Telephone Operators	590	-	21	21	21	21	21	21	21	630	21
	Cooks	545	-	7	13	13	13	13	13	13	384	13
	Vehicle Drivers	645	-	154	154	154	154	154	154	154	4,620	154
	Security Guards	530	-	38	38	38	38	38	38	38	1,140	38
	Armed Guards	530	-	58	58	58	58	58	58	58	1,740	58
	Junior Clerks	590	-	43	57	57	57	57	50	50	1,675	56
	Watchmen	545	-	137	273	273	273	273	46	46	7,373	246
	Office Attendants	530	-	70	83	83	83	83	70	70	2,438	81
	Sub-Total		-	536	705	705	705	705	458	458	20,240	675
Accounting	Junior Clerks	590	-	107	178	178	178	178	142	142	5,161	172
	Office Attendants	530	-	13	13	13	13	13	13	13	390	13
	General Workers	530	-	26	32	32	32	32	19	19	915	31
	Sub-Total		-	146	223	223	223	223	174	174	6,466	216
Labour & Social Welfare	Junior Clerks	590	-	43	50	50	50	50	43	43	1,472	49
	Salesmen	545	-	13	26	26	26	26	13	13	728	24
	Cooks	545	-	7	13	13	13	13	7	7	366	12
	Office Attendants	530	-	32	32	32	32	32	32	32	960	32
	General Workers	530	-	19	38	38	38	38	19	19	1,064	35
	Sub-Total		-	114	159	159	159	159	114	114	4,590	152
Civil & Water Supply	Draftmen/Surveyor/Assistants	860	-	21	21	21	21	21	21	21	630	21
	Civil Workers	590	-	28	57	57	57	57	28	28	1,594	53
	Carpenter Shop Workers	590	-	21	21	43	43	43	21	21	1,180	39
	Pump Station Workers	590	-	128	128	128	128	128	128	128	3,840	128
	Plumbers	590	-	14	14	14	14	14	14	14	420	14
	Sewage Station Workers	590	-	-	64	64	64	64	64	64	1,856	62
	Junior Clerks	590	-	14	14	21	21	21	14	14	595	20
	Office Attendants	530	-	26	26	26	26	26	26	26	780	26
	General Workers	530	-	115	115	128	128	128	102	102	3,736	125
	Sub-Total		-	367	460	502	502	502	418	418	14,631	488
Electrical & Mechanical	Electrical Workers	645	-	31	54	77	77	77	54	54	2,172	72
	Mechanical Workers	645	-	31	62	92	92	92	62	62	2,579	86
	Substation Workers	590	-	42	42	42	42	42	42	42	1,260	42
	Power House Workers	590	-	42	42	42	42	42	42	42	1,260	42
	Work Shop Workers	590	-	426	497	724	724	724	497	497	20,514	684
	Junior Clerk	530	-	13	19	26	26	26	19	19	739	25
	Office Attendants	530	-	32	32	32	32	32	32	32	960	32
	Sub-Total		-	617	748	1,035	1,035	1,035	748	748	29,484	983
System	Key Punchers	590	-	14	21	21	21	21	21	21	623	21
	Junior Clerk	530	-	6	6	6	6	6	6	6	180	6
	Office Attendants	530	-	6	13	13	13	13	13	13	383	13
	Sub-Total		-	26	40	40	40	40	40	40	1,186	40

* Rs/man/month

The estimates reflect 1980 June price levels.
No escalation.

TABLE 3-17

OPERATING COST
WAGES
(000'S) RUPEES

(Continued)

Sheet 3

Section	Description	Wage *	Year 1985-1985	1986	1987	1988-1998	1998-2010	2011-2012	2013-2014	2015	Total	Average
Training	Training Assistants	590	-	85	85	85	85	85	28	28	2,379	79
	Junior Clerks	530	-	13	13	13	13	13	13	13	390	13
	Office Attendants	530	-	19	19	19	19	19	19	19	570	19
	Sub-Total		-	117	117	117	117	117	60	60	3,339	111
Planning	Explosive Carriers	530	-	58	58	58	58	58	58	58	1,740	58
	Explosive Truck Drivers	645	-	23	23	23	23	23	23	23	690	23
	Drillers	565	-	27	27	27	27	27	20	20	789	26
	Draftmen	790	-	29	29	29	29	29	29	29	870	29
	Junior Clerks	530	-	26	26	26	26	26	26	26	780	26
	Drilling Helpers	530	-	77	77	77	77	77	38	38	2,193	73
	Survey Helpers	530	-	77	77	77	77	77	38	38	2,193	73
	Office Attendants	530	-	32	32	32	32	32	32	32	960	32
	Sub-Total		-	349	349	349	349	349	264	264	10,215	340
Safety	Safety Assistants	530	-	13	26	26	26	26	13	13	728	24
	Junior Clerks	530	-	6	13	13	13	13	6	6	362	12
	Office Attendants	530	-	19	19	19	19	19	19	19	570	19
	Sub-Total		-	38	58	58	58	58	38	38	1,660	55
Medical	Head Nurse	645	-	8	8	8	8	8	8	8	240	8
	Nurses	530	-	38	64	64	64	64	64	64	1,894	63
	Health Visitor	600	-	-	7	7	7	7	7	7	203	7
	Midwives	530	-	-	13	13	13	13	13	13	377	13
	Head Compounder	645	-	8	8	8	8	8	8	8	240	8
	Compounders	645	-	15	23	23	23	23	23	23	682	23
	Sanitary Inspectors	645	-	-	15	15	15	15	15	15	435	15
	Junior Clerks	530	-	13	13	13	13	13	13	13	390	13
	First Aid Attendants	645	-	23	23	23	23	23	23	23	690	23
	Ambulance Privor	645	-	8	8	8	8	8	8	8	240	8
	Sweepers	530	-	64	128	128	128	128	128	128	3,776	126
	First Aid Helpers	545	-	39	39	39	39	39	39	39	1,170	39
	Cook	545	-	13	13	13	13	13	13	13	390	13
	Sub-Total		-	229	362	362	362	362	362	362	10,727	359
	Total		-	2,558	3,240	3,569	3,569	3,569	2,695	2,695	103,108	3,438
Coal Preparation & Transport	Patrols	530	-	13	13	13	13	13	13	13	390	13
	Central Control Men	645	-	15	15	15	15	15	15	15	450	15
	Other Plant Workers	590	-	128	128	128	128	128	128	128	3,840	128
	Transport Workers	590	-	21	21	21	21	21	21	21	630	21
	Junior Clerks	530	-	51	51	51	51	51	51	51	1,530	51
	Office Attendants	530	-	38	38	64	64	64	64	64	1,868	62
	Hand Pickers	530	-	77	102	256	256	256	256	256	7,347	245
	General Workers	530	-	134	192	192	192	192	192	192	5,702	190
	Total		-	477	560	740	740	740	740	740	21,757	725
	Grand Total			8,513	10,393	10,902	10,630	9,362	5,973	5,526	302,312	10,079

The estimates reflect 1980 June price levels.

* Rs/man/month

No escalation ,

TABLE 3-18

OPERATING COST UNDERGROUND
WAGES
(000'S) RUPEES

(Local Currency)

Sheet 1

Description	Wage*	Year 1983-1985	1986	1987	1988-1997	1998-2010	2011-2012	2013-2014	2015	Total	Average
Longwall Face Workers											
Chief Workers	645	-	15	31	31	31	15	-	-	789	26
Miners	530	-	499	998	998	883	499	-	-	23,954	798
Prop Drawers	590	-	85	170	170	170	85	-	-	4,335	145
Stablemen	590	-	57	114	114	114	57	-	-	2,907	97
Prop Checkers	530	-	13	26	26	26	13	-	-	663	22
Packers	530	-	51	102	102	102	51	-	-	1,302	87
Pullbackmen	530	-	26	51	51	51	26	-	-	1,302	43
Face Maintenancemen	530	-	64	128	128	128	64	-	-	3,264	109
Shot Firers	545	-	33	65	65	46	33	-	-	1,412	47
Sub-Total		-	843	1,685	1,685	1,551	843	-	-	41,227	1,374
Pillar Splitting Workers											
Miners	530	-	-	-	-	115	115	-	-	1,725	58
Shot Firers	545	-	-	-	-	20	20	-	-	300	10
Sub-Total		-	-	-	-	135	135	-	-	2,025	68
Road Heading Workers											
Miners	530	-	384	384	384	192	192	-	-	7,488	250
Loaders	590	-	85	85	85	43	43	-	-	1,665	56
Shot Firers	545	-	78	78	78	39	39	-	-	1,521	50
Sub-Total		-	547	547	547	274	274	-	-	10,674	356
Ventilation Workers											
Bratticemen	530	-	64	64	64	64	38	-	-	1,676	56
Flyash Packer	530	-	26	26	26	26	26	-	-	702	23
Gas Patrol	530	-	19	38	38	38	19	-	-	969	33
Sub-Total		-	109	128	128	128	83	-	-	3,347	112
Entry Maintenance Workers											
Panel Maintenance	530	-	38	38	38	38	19	-	-	988	33
Track Maintenance	530	-	64	64	64	64	64	-	-	1,728	58
Gate Maintenance	530	-	282	282	282	282	109	-	-	7,268	242
(include rock-duster) Shot Firers	545	-	39	39	39	39	20	-	-	1,015	34
Sub-Total		-	423	423	423	423	212	-	-	10,999	367

*Rs/man/month

The estimates reflect 1980 June price levels.
No escalation.

TABLE 3-18

OPERATING COST UNDERGROUND
WAGES
(000'S) RUPEES

(Continued)

Sheet 2

Description	Wage *	Year 1983-1985	1986	1987	1988-1997	1998-2010	2011-2012	2013-2014	2015	Total	Average
Haulage Workers											
Surface Workers											
Diesel Locomotive Driver	590	-	36	36	36	36	36	-	-	972	32
Shunters	545	-	33	33	33	33	33	-	-	891	30
Tippler men	590	-	14	14	14	14	14	-	-	378	13
Tippler Helpers	530	-	38	38	38	38	38	-	-	1,026	34
Underground Workers											
Battery Locomotive Drivers	590	-	107	192	192	192	107	-	-	4,929	164
Shunter Battery Locomotive	545	-	98	176	176	176	98	-	-	4,518	151
Shunter Pit Mouth	545	-	33	33	33	33	33	-	-	891	30
Shunter Pit Bottom	545	-	33	33	33	33	33	-	-	891	30
Shunter Junction & Each Panel	530	-	26	52	52	52	26	-	-	1,326	43
Sub-Total		-	418	607	607	607	418	-	-	15,822	527
Electrical Mechanical Workers											
Electricians	645	-	54	54	54	54	31	-	-	1,412	47
Electricians Apprentices	530	-	51	51	51	51	26	-	-	1,327	44
Mechanics	645	-	54	54	54	54	31	-	-	1,412	47
Mechanics Apprentices	530	-	51	51	51	51	26	-	-	1,327	44
Sub-Total		-	210	210	210	210	114	-	-	5,478	182
Machine Operators											
Surface Workers											
Air Compressor Operators	590	-	21	21	21	21	21	-	-	567	19
Air Compressor Helpers	530	-	19	38	38	38	19	-	-	969	32
Main Slop Hoist Operators	590	-	21	21	21	21	21	-	-	567	19
Main Slop Hoist Helpers	530	-	19	19	19	19	19	-	-	513	17
Underground Workers											
Chain Conveyor Operators	590	-	14	14	14	14	14	-	-	378	13
B.L. Battery Charger	590	-	21	21	21	21	21	-	-	567	19
B.L. Battery Charger Assistant	530	-	38	38	38	38	38	-	-	1,026	34
Sub-Total		-	153	172	172	172	153	-	-	4,587	153
Safetylamp Room Workers											
Safetylamp Issuers	530	-	19	19	19	19	19	-	-	513	17
Safetylamp Workers	530	-	19	19	19	19	19	-	-	513	17
Gas Detector Supervisor	903	-	11	11	11	11	11	-	-	297	10
Gas Detector Repair Men	590	-	21	21	21	21	21	-	-	567	19
Sub-Total		-	70	70	70	70	70	-	-	1,890	63

The estimates reflect 1980 June price levels.
No escalation.
* Rs/man/month

TABLE 3-18

OPERATING COST UNDERGROUND
WAGES
(000'S) RUPEES

(Continued)

Sheet 3

Description	Wage *	Year 1983-1985	1986	1987	1988-1997	1998-2010	2011-2012	2013-2014	2015	Total	Average
Electrical & Mechanical Store Workers											
Issuers	530	-	19	19	19	19	19	-	-	513	17
Supervisors	930	-	34	34	34	34	34	-	-	918	31
Sub-Total		-	53	53	53	53	53	-	-	1,431	48
Office Workers											
Junior Clerks	530	-	58	58	58	58	58	-	-	1,566	52
Office Attendants/Oilermen	530	-	64	64	64	64	64	-	-	1,728	58
Checkmen	530	-	38	38	38	38	38	-	-	1,026	34
Sub-Total		-	160	160	160	160	160	-	-	4,320	144
Total		-	2,986	4,055	4,055	3,783	2,515	-	-	101,800	3,394

The estimates reflect 1980 June price levels.
No escalation.

* Rs/man/month

TABLE 3-19

OPERATING COST WEST OPEN PIT
WAGES
(000'S) RUPEES

Sheet 1

(Local Currency)

Description	Wage*	Year 1983-1985	1986	1987	1988-1997	1998-2010	2011-2012	2013-2014	2015	Total	Average
Stripping											
Shovel Operator	645	-	46	46	46	46	46	46	46	1,357	45
Helpers	530	-	38	38	38	38	38	38	19	1,121	37
Oilers	590	-	43	43	43	43	43	43	21	1,268	43
Groundmen	645	-	46	46	46	46	46	46	23	1,357	45
Sub-Total		-	173	173	173	173	173	173	86	5,103	170
Bankshooting											
Drillers	645	-	31	31	31	31	31	31	15	914	30
Helpers	530	-	51	51	51	51	51	51	26	1,505	51
Dozer Operators	645	-	31	31	31	31	31	31	15	914	30
Shooters	530	-	32	32	32	32	32	32	19	947	32
Sub-Total		-	145	145	145	145	145	145	75	4,280	143
Parting Coal Loading											
Drillers	645	-	15	15	15	15	15	15	15	450	15
Helpers	530	-	26	26	26	26	26	26	25	780	26
Dozer Operators	645	-	15	15	15	15	15	15	15	450	15
Scraper Operators	645	-	31	31	31	31	31	31	31	930	31
Hydraulic Excavator Operators	645	-	15	15	15	15	15	15	15	450	15
Shooters	530	-	26	26	26	26	26	26	26	780	26
Sub-Total		-	128	128	128	128	128	128	128	3,840	128
Haulage											
Truck Drivers 120 t	645	-	231	231	231	231	231	231	92	6,791	226
Truck Drivers 46 t	645	-	77	77	77	77	77	77	77	2,310	77
Greasemen	530	-	32	32	32	32	32	32	32	960	32
Machinist & Welders Helper	530	-	26	26	26	26	26	26	26	780	26
Crossing Watchmen	530	-	38	38	38	38	38	38	38	1,140	38
Motor Patrols	530	-	13	13	13	13	13	13	13	390	13
Sub-Total		-	417	417	417	417	417	417	278	12,371	412
Road Grading											
Grader Operators	645	-	15	15	15	15	15	15	15	450	15
Dozer Operators	645	-	15	15	15	15	15	15	15	450	15
Sprinkler	645	-	8	8	8	8	8	8	8	240	8
General Workers	530	-	32	32	32	32	32	32	32	960	32
Sub-Total		-	70	70	70	70	70	70	70	2,100	70

* Rs/man/month

The estimates reflect 1980 June price levels.
No escalation.

TABLE 3-19

OPERATING COST WEST OPEN PIT

WAGES

(000'S) RUPEES

Sheet 2

(Continued)

Description	Wage *	Year							Total	Average
		1983-1985	1986	1987	1988-1997	1998-2010	2011-2012	2013-2014	2015		
Reclamation											
Dozer Operators	645	-	15	15	15	15	15	15	15	450	15
Scraper Operators	645	-	8	8	8	8	8	8	8	240	8
Crush Operators	645	-	15	15	15	15	15	15	15	450	15
Front End Loaders	645	-	8	8	8	8	8	8	8	240	8
Trucks 46 t	645	-	8	8	8	8	8	8	8	240	8
General Workers	530	-	19	19	19	19	19	19	19	570	19
Sub-Total		-	73	73	73	73	73	73	73	2,190	73
Electrical Workers											
Electricians	645	-	23	23	23	23	23	23	15	682	23
Helpers	530	-	19	19	19	19	19	19	13	564	19
Sub-Total		-	42	42	42	42	42	42	28	1,246	42
Mechanical Workers											
Mechanics	645	-	23	23	23	23	23	23	15	682	23
Helpers	530	-	19	19	19	19	19	19	13	564	19
Sub-Total		-	42	42	42	42	42	42	28	1,246	42
Office Clerk											
Junior Clerks	530	-	83	83	83	83	83	83	83	2,490	83
Attendants	530	-	26	26	26	26	26	26	26	780	26
Time Keepers	590	-	21	21	21	21	21	21	21	630	21
Apprentics	530	-	77	77	77	77	77	77	-	2,233	74
Sub-Total		-	207	207	207	207	207	207	130	6,133	204
Total		-	1,297	1,297	1,297	1,297	1,297	1,297	896	38,509	1,284

The estimates reflect 1980 June price levels.

No escalation.

*Rs/man/month

TABLE 3-20

OPERATING COST EAST OPEN PIT

WAGES

(000"S) RUPEES

(Local Currency)

Sheet 1

Description	Wage*	Year 1983-1985	1986	1987	1988-1997	1998-2010	2011-2012	2013-2014	2015	Total	Average
Stripping											
Shovel Operator	645	-	46	46	46	46	46	46	46	1,380	46
Helpers	530	-	38	38	38	38	38	38	38	1,140	38
Oilers	590	-	43	43	43	43	43	43	43	1,290	43
Groundmen	645	-	46	46	46	46	46	46	46	1,380	46
Sub-Total		-	173	173	173	173	173	173	173	5,190	173
Bankshooting											
Drillers	645	-	31	31	31	31	31	31	31	930	31
Helpers	530	-	51	51	51	51	51	51	51	1,530	51
Dozer Operators	645	-	31	31	31	31	31	31	31	930	31
Shooters	530	-	32	32	32	32	32	32	32	960	32
Sub-Total		-	145	145	145	145	145	145	145	4,350	145
Parting Coal Loading											
Drillers	645	-	15	15	15	15	15	15	15	450	15
Helpers	530	-	13	13	13	13	13	13	13	260	13
Dozer Operators	645	-	15	15	15	15	15	15	15	450	15
Scraper Operators	645	-	31	31	31	31	31	31	31	930	31
Hydraulic Excavator Operators	645	-	15	15	15	15	15	15	15	450	15
Shooters	530	-	26	26	26	26	26	26	26	780	26
Sub-Total		-	115	115	115	115	115	115	115	3,450	115
Haulage											
Track Drivers 120 t	645	-	185	231	231	231	231	231	185	6,838	228
Truck Drivers 46 t	645	-	46	46	46	46	46	46	46	1,380	46
Greasemen	530	-	32	32	32	32	32	32	32	960	32
Machinist & Welders Helpers	530	-	26	26	26	26	26	26	26	780	26
Crossing Watchmen	530	-	38	38	38	38	38	38	38	1,140	38
Motor Patrols	530	-	13	13	13	13	13	13	13	390	13
Sub-Total		-	340	386	386	386	386	386	340	11,488	383

* Rs/man/month

The estimates reflect 1980 June price levels.
No escalation.

TABLE 3-20

OPERATING COST EAST OPEN PIT
WAGES
(000'S) RUPEES

(Continued)

Sheet 2

Description	Wage*	Year 1983-1985	1986	1987	1988-1998	1998-2010	2011-2012	2013-2014	2015	Total	Average
Road Grading											
Grader Operators	645	-	15	15	15	15	15	15	15	450	15
Dozer Operators	645	-	15	15	15	15	15	15	15	450	15
Sprinkler	645	-	8	8	8	8	8	8	8	240	8
General Workers	530	-	26	26	26	26	26	26	26	780	26
Sub-Total		-	64	64	64	64	64	64	64	1,920	64
Reclamation											
Dozer Operators	645	-	15	15	15	15	15	15	15	450	15
Scraper Operators	645	-	8	8	8	8	8	8	8	240	8
Crush Operators	645	-	15	15	15	15	15	15	15	450	15
Front End Loaders	645	-	8	8	8	8	8	8	8	240	8
Trucks 46 t	645	-	8	8	8	8	8	8	8	240	8
General Workers	530	-	13	13	13	13	13	13	13	390	13
Sub-Total		-	67	67	67	67	67	67	67	2,010	67
Electrical Workers											
Electricians	645	-	23	23	23	23	23	23	23	690	23
Helpers	530	-	19	19	19	19	19	19	19	570	19
Sub-Total		-	42	42	42	42	42	42	42	1,260	42
Mechanical Workers											
Mechanics	645	-	23	23	23	23	23	23	23	690	23
Helpers	530	-	19	19	19	19	19	19	19	570	19
Sub-Total		-	42	42	42	42	42	42	42	1,260	42
Office Clerk											
Junior Clerks	530	-	83	83	83	83	83	83	83	2,490	83
Attendants	530	-	26	26	26	26	26	26	26	780	26
Time Keepers	590	-	21	21	21	21	21	21	21	630	21
Apprentics	530	-	77	77	77	77	77	77	77	2,310	77
Sub-Total		-	207	207	207	207	207	207	207	6,210	207
Total		-	1,195	1,241	1,241	1,241	1,241	1,241	1,195	37,138	1,238

The estimates reflect 1980 June price levels.
No escalation.
* Rs/man/month

TABLE 3-21 COST PER UNIT SOLD

Items	Remarks		
1. Installed Capacity	300 MW		
2. Plant Factor (%)	70	60	50
3. Unit Generated (GWh)	1,839.6	1,576.8	1,314
4. Unit Consumed in Auxiliaries (90%)	165.6	141.9	118.3
5. Unit Sent Out (GWh)	1,674	1,434.9	1,195.7
6. Cost of Coal (Million Rs) (381 Rs/ton as received	426.4	365.5	304.6
7. Interest			
F.C (8.75 %) (Million Rs)	328.5	328.5	328.5
L.C (12.5 %) (Million Rs)	405	405	405
8. Depreciation (Million Rs) (3.5 %)	217.9	217.9	217.9
9. Operation and Maintenance Cost (3 %)	186.8	186.8	186.8
Total Cost (Million Rs) (6 to 9)	1,564.6	1,503.7	1,442.8
Cost/Unit Sold (Paisas)	93.5	104.8	120.7

Exclude escalation
Price of June, 1980

CHAPTER 4 ECONOMIC ANALYSIS

4-1 Summary

Development of Lakhra Coal Mine was planned with the purpose of supplying its entire coal production as fuel for Lakhra Coal-fired Thermal Power Station. That is, the construction costs and the operation and maintenance costs of the coal mine and the railway transportation facilities are to be calculated in fuel costs of Lakhra Coal-fired Thermal Power Station. The analyses which follow were made keeping this point in mind, and on the assumption that the plant factor of the power station is 50 to 70%. At a discount rate of 10%, the economic viability of the project is summarized below.

(1) If a heavy oil-fired thermal power station is considered as the alternative to Lakhra Thermal Power Station, the former will not be able to compete with the latter unless the price rise of crude oil is held at a low level of an annual average of 4.5 to 5.5%.

(2) Even though the future price rise of crude oil is held down to a level equal to the escalation rate of wholesale prices of manufactured products in major industrial countries (average of roughly 8% in each country), the "benefit-cost ratio" of the Lakhra Coal-fired Thermal Power Station Project will be a high rate of 1.39 to 1.62%.

(3) By implementation of the Lakhra Coal Mining and Coal-Fired Thermal Power Station Project, it will be possible to conserve approximately 380 to 530 million m^3 of natural gas every year, and this gas can be diverted to chemical industries which produce value intensive products.

4-2 Preconditions

4-2-1 Commodity Price Escalation Rate

The period from 1950 to 1958, that is, the period after the social and economic confusion immediately following World War II and before the world entered a period of high economic growth, the world economy had been the most stable, but even at that time, prices of construction materials in the U.S.A. had been showing an escalation rate averaging 5% annually.

Subsequently, the rapid increase in demand for petroleum, natural gas and other finite energy resources has caused a continual rise of commodity prices in countries of the world.

In making economic comparisons of individual projects having different weights of price factors or items, an accurate conclusion cannot be drawn unless the future trend in prices of the various items are taken into consideration. In the study of this chapter, future commodity price increases are estimated to be as described below.

(1) Construction Cost

A report was published in 1975 by the World Bank regarding prediction of future construction commodity prices. According to this report, the annual average escalation rate of equipment prices was predicted to be 8% for 1977 through 1979, and 7% for 1980 through 1987, while that of civil works costs and engineering fees was predicted to be 12% for 1977 through 1979, and 10% for 1980 through 1987.

In contrast to the above predictions, power station construction in Japan from 1970 until the present recorded an annual average price escalation rate of approximately 7% for turbines and generators and 5 to 6% for transformers, circuit breakers, etc., while civil construction costs showed a slightly higher escalation rate than these equipment prices. As for wholesale price indices of industrial products in the U.S.A., West Germany, France, Japan, etc. during the same period, they have indicated an annual escalation rate of approximately 7% for these countries as a whole.

Using the price trend up to now described above as the basis, and taking into account the recent trend in various countries to control commodity prices by fiscal policy, commodity price escalation rates slightly lower than that predicted by the World Bank are estimated as follows:

Foreign currency portion construction cost escalation rate	..... 7% annually
Domestic currency portion construction cost escalation rate	..... 9% annually

(2) Operation and Maintenance Cost

Statistically, the operation and maintenance costs of thermal power stations, coal mines and railways are approximately 20% for wages and approximately 80% for materials.

In the case of Pakistan, it is thought that one half of the required materials can be procured domestically. If it is assumed for the sake of simplicity that the proportions of the foreign and domestic currency portions in the operation and maintenance costs are equal, the annual average escalation rate for this cost item will be the median between 7% and 9%, or 8%.

(3) Fuel Cost

The fuel cost of Lakhra Coal-fired Thermal Power Station, as described above, may be taken as the construction cost and the operation and maintenance cost of Lakhra Coal Mine and the railway transportation facilities.

With regard to heavy oil a comparable source to coal of Lakhra, the crude oil price per barrel rose from US$11.65 to US$32 between the Tehran Conference of OPEC at the beginning of 1974 and the Alger Conference in June 1980. This corresponds to a price hike of 17% annually, and even if the relative decrease in the purchasing power of the dollar is taken into

consideration, it is a high price rise in excess of a real annual rate of 12%.

At the Bali Conference of OPEC held in December, 1980 the price per barrel of crude was raised to US$36 (Gulf countries). There will be a time lag of several months before this price hike will reflect on the cost of electricity. Therefore, for the purpose of this study, a price of US$32 per barrel was used.

The prediction of future prices of crude oil is very difficult. Consequently, a number of different price hike rates are assumed, and the "benefit-cost ratio" of Lakhra Coal-fired Thermal Power Station is calculated for the respective cases.

4-2-2 Alternative Power Station

As indicated at the beginning, for the purpose of economic analysis a heavy oil-fired thermal power station will be used as the alternative to this Project. The reasons for this are explained below.

(1) Domestic natural gas, which is extremely cheap at approximately 1/6 of the price per unit calorific value of heavy oil, is being used at thermal power stations in Pakistan. The total installed capacity of thermal power stations of WAPDA about the time immediately before start of operation of Lakhra Thermal Power Station is planned to be approximately 2,160 MW. If these thermal power stations were to be operated at an average plant factor of 40% and an average fuel consumption rate of 0.34 m^3/kWh, the annual gas consumption will be as much as 2.6 billion m^3. This is almost half of the present annual gas production in Pakistan. In regard to utilization of natural gas, the Pakistani Government has the following long-range policy. As a precious domestic energy resource, conservation of natural gas is to be promoted to maintain the supply of gas for as long a period as possible, and instead of burning it simply as primary energy, emphasis is to switch the use of gas as raw material for chemical industry to obtain value intensive products. Consequently, it naturally can be forecasted that a time will come in the near future when domestic production of natural gas cannot completely satisfy the fuel demand for power generation. In such case, the cost of fuel used at power stations will be that of the alternative fuel, namely, heavy oil.

(2) It is not appropriate to consider a gas turbine or diesel power station as the alternative power station. This is because the former can demonstrate advantages only in supplying peak loads for short duration and the role to be played differs essentially from Lakhra Theramal Power Station which will be for supplying base load. As for the latter, since diesel oil which cost considerably more than heavy oil and coal, the fuel cost will be higher than that of a steam power station. In addition the service life of the equipment would be half of that of a steam power plant, so the total capital cost including equipment replacement cost will be higher than that of a steam power station.

4-2-3 Method of Economic Comparison

(1) Conversion of Total Cost to Present Value

The method of economic analysis is to compare the "benefit-cost ratio" of the Lakhra Coal Mining and Coal-Fired Thermal Power Station Project by converting to present value, as at the beginning of the year construction is started (1981), the total cost (construction costs and operation and maintenance costs of the power station, coal mine and railway facilities) of the Lakhra Coal Mining and Coal-Fired Thermal Power Station Project taking into account escalation in commodity prices, and the total cost (construction cost, operation and maintenance cost, and fuel cost) of the alternative power station. In such case, since it is difficult to forecast the rate of price rise of heavy oil, a range of 4% to 10% is tentatively assumed, and the corresponding "benefit-cost ratios" are respectively calculated, and based on the price hike range, the rate of price rise of heavy oil at which a heavy oil-fired thermal power station can compete with Lakhra Coal-Fired Thermal Power Station is inversely calculated.

(2) Discount Rate

In economic analysis of a project such as a power station which requires many years for capital recovery, it is appropriate to determine the discount rate based on long-term loan interest rates of international financing institutions or the long-term loan interest rates of government financing agencies of the country involved. At present, the World Bank is charging interest rates of 8.25 to 8.75%, while in Pakista, government financing agencies are charging an interest rate of 12.50% for project financing.

In the case of the Lakhra Coal Mining and Coal-Fired Thermal Power Station Project, the ratio of foreign and domestic currency requirements in the construction cost will be 56% to 44%, therefore the weighted average of the above-mentioned interest rates which is 10%, is applied as the discount rate. Beside this, for the purpose of including sensitivity analysis, a discount rate of 13% which is slightly higher than the long-term domestic interest rate of 12.50% is also used for the sake of reference.

(3) Cumulative Present Value Conversion Rate for Annual Cost considering Commodity Price Escalation

Regarding operation and maintenance costs and fuel costs which continue to climb year after year, if the cost in the first year is A, the commodity price escalation rate e%, and discount rate i%, the cumulative amount converted to present value S_e in n years can be obtained by the formula below.

$$S_e = \frac{A\,(1+e/2)}{(1+i/2)} \times \frac{(1+i)\,[(1+i)^n-(1+e)^n]}{(1+i)^n(i-e)}$$

Explanation:

It is appropriate to consider items such as operation and maintenance cost and fuel cost as at the middle of the year. The cumulative amount converted to present value of A in the n-th year will be the following:

$$\frac{A}{(1+i/2)(1+i)^{n-1}}$$

If A were to escalate at a rate of e% every year, the value of A in the n-th year will be as follows:

$$\frac{A(1+e/2)(1+e)^{n-1}}{(1+i/2)(1+i)^{n-1}}$$

Therefore, the cumulative present value S_e of A in the n-th year will be as follows:

$$S_e = \frac{A(1+e/2)}{(1+i/2)} + \frac{A(1+e/2)(1+e)}{(1+i/2)(1+i)} + \frac{A(1+e/2)(1+e)^2}{(1+i/2)(1+i)^2}$$
$$\cdots\cdots + \frac{A(1+e/2)(1+e)^{n-1}}{(1+i/2)(1+i)^{n-1}}$$
$$= \frac{A(1+e/2)}{(1+i/2)} \times \frac{(1+i)\{(1+i)^n - (1+e)^n\}}{(1+i)^n(i-e)}$$

(4) Plant Factor

In the electric power system of WAPDA where the weight of hydroelectric power generation is large; the utility factor of steam power stations at present is about 50%. In contrast, in accordance with the aim of reducing consumption of natural gas, it is expected that Lakhra Coal-fired Thermal Power Station will be operated at a higher plant factor. The coal from Lakhra Coal Mine with reserves of 29,538,000 tons, annual average coal production of 984,600 tons for 30 years, and calorific-value of 4,613 kcal/kg, even if completely utilized for power generation, will not raise the plant factors of Lakhra Thermal Power Station (thermal efficiency 37%) above an annual average of 74%.

In consideration of the above, plant factors of 50%, 60% and 70% will be assumed for this study.

4-3 Present Value of Total Cost

4-3-1 Lakhra Coal Mining and Coal-Fired Thermal Power Station Project

(1) Construction Cost

The construction cost (not including interest during construction) of this Project at 1980 values is estimated to be 7,023 million Rs. consisting of 4,877 million Rs. for the power station, and 2,146 million Rs. for the coal mine and railway facilities. But affected by commodity price increases, it is thought that the actual cost of the former will be 7,088 million Rs. and the latter 2,870 Rs. for a total of 9,958 million Rs. When this total amount is converted to present value as of the beginning of 1981, it will be 6,441 million Rs. at a

discount rate of 10% and 5,708 million Rs.at a discount rate of 13% as indicated in Table 4-1.

(2) Operation and Maintenance Cost

Statistically, the operation and maintenance cost of a coal-fired thermal power station with flue gas desulphurization is approximately 4.4% of the net construction cost. Therefore, it is estimated to be 7,088 x 0.044 = 312 million Rs.at the time of start of operation.

In contrast, the operation and maintenance cost of the coal mine and the coal transportation component is estimated to be 8,452 million Rs.at 1980 prices for the planned total coal production of 29,538,000 tons through the entire period of operation. Consequently, the operation and maintenance cost at 1980 prices per ton of supply will be 8,452 millions Rs.÷ 29,538,000 tons = 286 Rs, and when price escalation at an annual rate of 8% is taken into account, the cost will be 490 Rs.at the time of start of operation of the power station. Therefore, the estimated annual operation and maintenance costs at that time for plant factors of 50%, 60% and 70% will be 324 million Rs.,389 million Rs. and 454 million Rs.,respectively.

Based on the above 1987 values and estimating total cost for a period of 30 years with annual price escalation of 8%, the operation and maintenance cost in 1987 when Lakhra Thermal Power Station will start operation converted into present value at the beginning of 1987 and also at the beginning of 1981 at discount rates of 10% and 13% will be as shown in Table 4-2.

4-3-2 Alternative Heavy Oil-fired Thermal Power Station

(1) Construction Cost

With installed capacity of the same scale, the construction cost of a heavy oil-fired thermal power station is ordinarily approximately 75% of that of a coal-fired thermal power station. The rate of consumption for station service of energy generated is about 6.7% in case of a heavy oil-fired thermal power station and 9% in case of a coal-fired thermal power station. Accordingly, the installed capacity of a heavy oil-fired thermal power station which can supply electric energy equal to a coal-fired thermal power station of installed capacity of 300 MW will be 300 x (1 − 0.09) ÷ (1 − 0.067) = 292.6 MW. Therefore, the construction cost of the alternative heavy oil-fired thermal power station will be about 75% x 292.6 ÷ 300 = 73% of that of Lakhra Coal-fired Thermal Power Station.

On the basis of the above price ratio, the estimated construction cost of the alternative thermal power station taking into account commodity price escalation and the said amount converted into present value use given in Table 4-3, the former will be 5,174 million Rs.while the latter will be 3,248 million Rs.at a discount rate of 10%, and 2,854 million Rs.at a discount rate of 13%.

(2) Operation and Maintenance Cost

The ratio of operation and maintenance cost to construction cost is 4.4% in case of a coal-fired thermal and about 2.5% in case of a heavy oil-fired thermal. Accordingly, the operation and

maintenance cost of the heavy oil-fired thermal power station, based on the price at the time of start of operation, will be 5,174 x 0.025 = 129 million Rs. With this figure as the basis, the total cost during a period of 30 years at a price escalation rate of 8% converted to present value as of the beginning of 1981, as indicated in Table 4-4, will be 1,680 million Rs.at a discount rate of 10% and 1,016 million Rs.at a discount rate of 13%.

(3) Fuel Cost

As previously stated, the basic crude oil price of US$32 per barrel (= 159 liter = 136 kg) is applied in this study. Therefore, at an average heat value of 10,000 kcal/kg, the fuel cost per kWh at a thermal power station of thermal efficiency of 37% will be US$0.0546 or 0.54 Rs. (For identical calorific values, the price of bunker C oil is roughly equal to the price of crude oil.)

With the above price as the basis, the estimated annual fuel costs of the alternative heavy oil-fired thermal power station at price rise of 4% to 10% annually will be as indicated in Table 4-5.

4-4 Benefit-cost Ratio

On the basis of the total costs of the Lakhra Coal Mining and Coal-Fired Thermal Power Station Project and the alternative heavy oil-fired thermal power station, the benefit-cost ratio of the project are indicated in Table 4-6, Fig. 4-1 (a) and Fig. 4-1 (b), and the following conclusions may be drawn.

4-5 Conclusions

The lignite of Lakhra Coal Mine is a coal which has no other use than as a fuel for power generation, but by developing this lignite and utilizing it as a fuel for power generation, 380 to 530 million m^3 of natural gas would be converted annually, and this gas can be utilized as raw material for fertilizer industry and other chemical industries. Besides the advantage of conservation of resources, this coal-fired thermal power generation component will have the following economic benefit compared with a heavy oil-fired thermal power station offering equivalent service.

(1) In order for the heavy oil-fired thermal power station to be able to compete with the Lakhra Coal-fired Thermal Power Generation component, the rate of crude oil price rise must be held in the range of 4.5 to 5.5% at a discount rate of 10% and in the range of 4.9 to 6.1% at a discount rate of 13%. This low price hike of crude oil is inconceivable as a matter of reality.

(2) Even if the price hike of crude oil were to be held to about 8% annually, a level equal to escalation of commodity prices in general, the Lakhra Thermal Power Generation component will still show a high benefit-cost ratio of 1.39 to 1.62 at a discount rate of 10% and 1.24 to 1.45 at a discount rate of 13%.

The Lakhra Coal Mining and Coal-Fired Thermal Power Station Project will require an investment which is 1.9 times more than a heavy oil-fired thermal, but if the above-mentioned economic benefits are considered, it will be desirable to promote the implementation of the Project as soon as possible.

Table 4-1 Present Value of Construction Cost of Lakhra Project as of the beginning of 1981

(Million Rupee)

Item	Total	1981	1982	1983	1984	1985	1986	1987	Remarks
At 1980 Values									
Coal-fired Thermal Power Station									
Foreign exchange component	2,673	30	44	270	515	1,164	392	258	
Domestic currency component	2,204	13	25	227	512	866	351	210	
Sub-total	4,877	43	69	497	1,027	2,030	743	468	
Mine and Railway Facilities									
Foreign exchange component	1,245	11	11	569	315	339			
Domestic currency component	901	7	9	358	279	248			
Sub-total	2,146	18	20	927	594	587			
Total	7,023	61	89	1,424	1,621	2,617	743	468	
Value at Time of Investment									
Coal-fired Thermal Power Station									Price escalation rate:
Foreign exchange component	3,722	32	50	331	675	1,632	588	414	7%
Domestic currency component	3,366	14	30	294	723	1,332	589	384	9%
Sub-total	7,088	46	80	625	1,398	2,964	1,177	798	
Mine and Railway Facilities									Price escalation rate:
Foreign exchange component	1,611	12	13	697	413	476			7%
Domestic currency component	1,259	8	11	464	394	382			9%
Sub-total	2,870	20	24	1,161	807	858			
Total (A)	9,958	66	104	1,786	2,205	3,822	1,177	798	
Present Values as of the beginning of 1981									
At discount rate of 10%	6,441	60	86	1,342	1,506	2,373	664	410	Present values of investment (A)
At discount rate of 13%	5,708	58	82	1,238	1,352	2,074	565	339	Present values of investments (A)

Table 4-2 Present Value of Operation and Maintenance Cost of Lakhra Project as of the beginning of 1981

(Million Rupees)

Item	Plant factor	Annual cost at 1988 values	Price escalation: 8% per annum Discount rate : 10%			Price escalation: 8% per annum Discount rate : 13%		
			Cumulative present value conversion rate for 30 years (1987–2016)	$(1+0.10)^{-6}$	Present value as of the beginning of 1981	Cumulative present value conversion rate for 30 years (1987–2016)	$(1+0.13)^{-6}$	Present value as of the beginning of 1981
Coal-fired Thermal Power Station	50	312	23.06	0.5647	4,063	16.39	0.4803	2,456
	60	312	23.06	0.5647	4,063	16.39	0.4803	2,456
	70	312	23.06	0.5647	4,063	16.39	0.4803	2,456
Mine and Railway Facilities	50	(Note) 324	23.06	0.5647	4,219	16.39	0.4803	2,550
	60	389	23.06	0.5647	5,066	16.39	0.4803	3,062
	70	454	23.06	0.5647	5,912	16.39	0.4803	3,574
Total	50	636	23.06	0.5647	8,282	16.39	0.4803	5,006
	60	701	23.06	0.5647	9,129	16.39	0.4803	5,518
	70	766	23.06	0.5647	9,975	16.39	0.4803	6,030

(Note)

Plant Factor (%)	Fuel Consumption (ton/year)	Operation and Maintenance Cost per ton of lignite supplied (Cost at 1987 values: Rs./ton)	Annual Operation and Maintenance Cost (Million Rs.)
50	662,000	490	324
60	794,400	490	389
70	926,800	490	454

Table 4-3 Present Value of Construction Cost of Alternative Heavy Oil-fired Thermal Power Station as of the beginning of 1981

(Million Rupees)

Item	Total	1981	1982	1983	1984	1985	1986	1987	Remarks
At 1980 Values									
Foreign exchange component	1,951	22	32	197	376	850	286	188	
Domestic currency component	1,609	10	18	166	374	632	256	153	
Total	3,560	32	50	363	750	1,482	542	341	
Value at the Time of Investment									Price escalation rate:
Foreign exchange component	2,719	24	37	242	493	1,192	429	302	7%
Domestic currency component	2,458	11	22	214	527	972	429	280	9%
Total (A)	5,174	35	59	456	1,020	2,164	858	582	
Present Values of the beginning of 1981									
At discount rate of 10%	3,248	32	49	343	697	1,344	484	299	Present value of investment (A)
At discount rate of 13%	2,854	31	46	316	626	1,175	412	248	Present value of investment (A)

Table 4-4 Present Value of Operation and Maintenance Cost of Alternative Thermal Power Station as of the beginning of 1981

(Million Rupees)

Plant factor (%)	Annual cost at 1987 values	Price escalation: 8% per annum Discount rate : 10%			Price escalation: 8% per annum Discount rate 13%		
		Cumulative present value conversion rate for 30 years (1987–2016)	$(1+0.10)^{-6}$	Present value as of the beginning of 1981	Cumulative present value conversion rate for 30 years (1987–2016)	$(1+0.10)^{-6}$	Present value as of the beginning of 1981
50	129	23.06	0.5647	1,680	16.39	0.4803	1,016
60	129	23.06	0.5647	1,680	16.39	0.4803	1,016
70	129	23.06	0.5647	1,680	16.39	0.4803	1,016

Table 4-5 Present Value of Fuel Cost of the Alternative Heavy Oil-fired Thermal Power Station as of the beginning of 1981

(Million Rupees)

Price rice of fuel oil (%)	Fuel price at 1987 value (Rs/kWh)	Plant factor (%)	Annual generation – 292.6MW – (GWh)	Annual fuel cost at 1987 value (Million Rs,)	Discount rate: 10%			Discount rate: 13%		
					Cumulative present value conversion rate for 30 years (1987–2016)	$(1+0.10)^{-6}$	Present value as of the begining of 1981	Cumulative present value conversion rate for 30 years (1987–2016)	$(1+0.13)^{-6}$	Present value as of the beginning of 1981
4	0.71	50	1,281.6	910	14.50	0.5647	7,451	11.03	0.4803	4,821
		60	1,537.9	1,092			8,941			5,785
		70	1,794.2	1,274			10,431			6,749
5	0.76	50	1,281.6	974	16.16	0.5647	8,888	12.09	0.4803	5,655
		60	1,537.9	1,168			10,666			6,782
		70	1,794.2	1,364			12,443			7,920
6	0.81	50	1,281.6	1,038	18.10	0.5647	10,610	13.32	0.4803	6,641
		60	1,537.9	1,246			12,732			7,971
		70	1,794.2	1,453			14,854			9,296
7	0.87	50	1,281.6	1,115	20.38	0.5647	12,832	14.78	0.4803	7,915
		60	1,537.9	1,338			15,398			9,498
		70	1,794.2	1,561			17,964			11,081
8	0.93	50	1,281.6	1,192	23.06	0.5647	15,521	16.39	0.4803	9,384
		60	1,537.9	1,430			18,625			11,257
		70	1,794.2	1,669			21,729			13,139
9	0.99	50	1,281.6	1,268	26.24	0.5647	18,800	18.32	0.4803	11,157
		60	1,537.9	1,523			22,560			13,401
		70	1,794.2	1,776			26,320			15,627
10	1.05	50	1,281.6	1,346	30.0	0.5647	22,797	20.57	0.4803	13,298
		60	1,537.9	1,615			27,356			15,956
		70	1,794.2	1,884			31,915			18,613

Table 4-6 Benefit-cost Ratio

Rise of crude oil price (%)	Discount rate: 10%			Discount rate: 13%		
	Plant factor			Plant factor		
	50%	60%	70%	50%	60%	70%
4	12,379/14,723 = 0.84	13,869/15,570 = 0.89	15,359/16,416 = 0.94	8,691/10,714 = 0.81	9,655/11,226 = 0.86	10,619/11,738 = 0.90
5	13,816/14,273 = 0.94	15,594/15,103 = 1.0	17,371/15,932 = 1.06	9,525/10,321 = 0.89	10,652/10,808 = 0.95	11,790/11,296 = 0.99
6	15,538/14,273 = 1.06	17,660/15,103 = 1.13	19,782/15,932 = 1.21	10,511/10,321 = 0.98	11,841/10,808 = 1.05	13,166/11,296 = 1.12
7	17,760/14,273 = 1.21	20,326/15,103 = 1.31	22,892/15,932 = 1.39	11,785/10,321 = 1.10	13,368/10,808 = 1.19	14,951/11,296 = 1.27
8	20,449/14,273 = 1.39	23,553/15,103 = 1.51	26,657/15,932 = 1.62	13,254/10,321 = 1.24	15,127/10,808 = 1.35	17,009/11,296 = 1.45
9	23,728/14,273 = 1.61	27,488/15,103 = 1.77	31,248/15,932 = 1.90	15,027/10,321 = 1.40	17,271/10,808 = 1.54	19,497/11,296 = 1.66
10	27,725/14,273 = 1.88	32,284/15,103 = 2.07	36,843/15,932 = 2.24	17,168/10,321 = 1.60	19,826/10,808 = 1.77	22,483/11,296 = 1.92

Table 4-1(a) Correlation between Benefit-Cost ratio and Rise of crude oil price
(Discount rate : 10%)

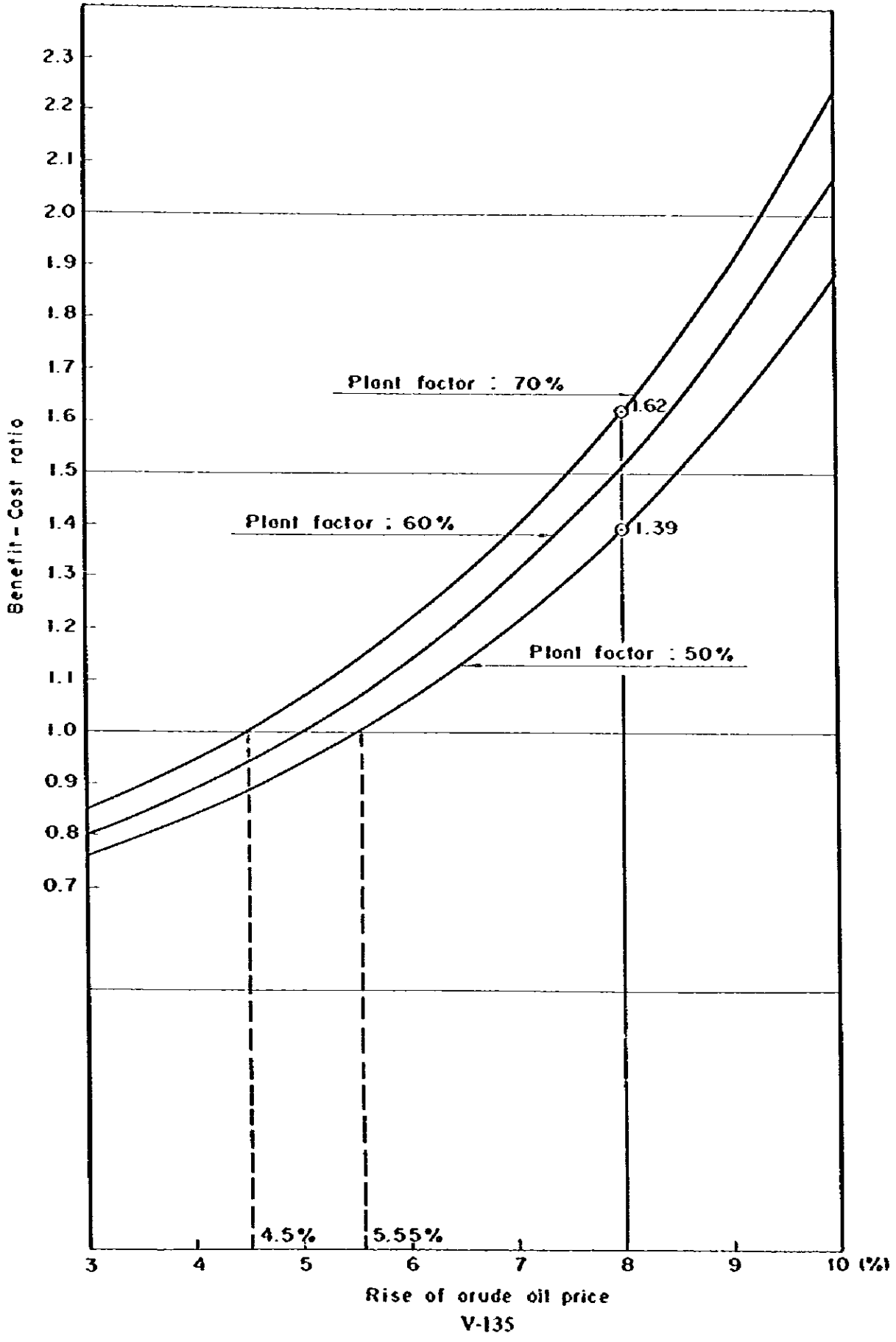
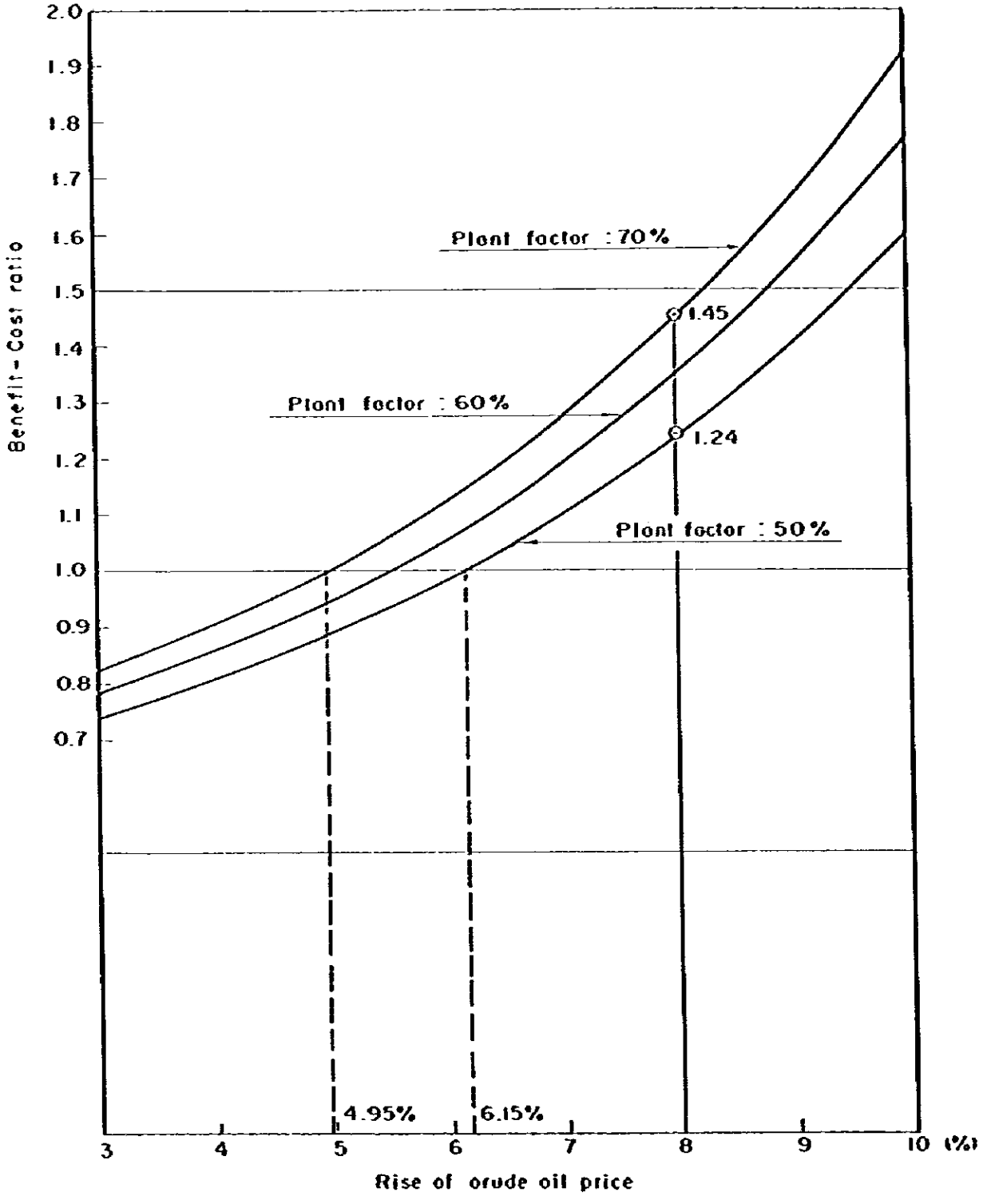


Table 4 - 1 (b) Correlation between Benefit - Cost ratio and Rise of crude oil price (Discount rate : 13%)



CHAPTER 5 FINANCIAL ANALYSIS

5-1 Summary

The financial analysis, differing from the economic analysis based on a comparison with an alternative project, must be made in accordance with the actual flow of income and expenditure of an enterprise so that the so-called concept of conversion to present worth is not involved. On the other hand, predictions of price escalations must be incorporated in connection with estimates of future expenses and setting of corresponding electricity charge rates.

In carrying out the Project, in this case, whereas Lakhra Thermal Power Station will be operated by WAPDA, operation of the coal mine and railway facilities will be under PMDC, so that the Project must be divided into two portions with a tangible supply price calculated for the lignite to be developed with regard to the coal mine and railway facilities plans, while for the thermal power generation plan, the fuel cost must be calculated based on this unit supply cost.

The results of analysis may be summarized as follows:

(1) For the components of coal mining and railway facilities the unit cost of supplying coal for 1987/88 is calculated as 983 Rs./ton (0.50 Rs./kWh). With the subsequent price excalation rates forecast to be an annual 4.7% for the first 20 years, 6.8% for the following 5 years, and 7.7% for the final 5 years. If the coal is to be supplied at cost without taking into account profit of the enterprise, the cumulative cash flow will show a deficit from 2003/04, but if the unit supply prices up to that time are to be increased by 1.7%, the cash flow will not result in a deficit. The internal rate of return in this case will be 11.9%.

(2) With regard to the coal-fired thermal power generation component, the supply costs per kWh in 1987/88 are calculated to be 1.44 Rs.at the sending end and 1.90 Rs. at the ultimate consumer's end, while the subsequent cost escalation rate will successively increase every 5 years at annual rates of 1.6%, 2.0%, 2.6%, 3.4%, 5.6% and 7.3%. Since the present electricity charge level is not high enough for future development projects to be financed from the standpoint of the electric power sector alone, profit and loss calculations and cash flow analyses were omitted.

5-2 Preconditions

The preconditions applied in the subsequent analyses are the following:

(1) Commodity Price Escalation Rate

Foreign currency portion construction cost	7% per annum	Same as conditions applied in Economic Analysis
Domestic currency portion construction cost	9% per annum	
Operation and maintenance cost	8% per annum	

(2) Power Plant Factor 70%

(3) Construction Funds Procurement Conditions

Foreign currency portion ..... Interest rate 8.75%,
25-year equal-installment principal and interest repayment

Domestic currency portion ..... Interest rate 12.50%,
20-year equal-installment principal and interest repayment

(4) Depreciation

30-year depreciation by straight line method for residual value of 10%

5-3 Construction Funds Required

The construction cost of the Lakhra Coal Mining and Coal-Fired Thermal Power Station Project in terms of 1980 value is estimated to be 4,877 million Rs.for the thermal power station and 2,146 million Rs for the coal mine and railway facilities, a total of 7,023 million Rs., while the actual fund requirement until completion of the Project will need to take into account interest during the construction period along with future price escalations. The actual total construction cost, thus, including interest during construction, is estimated to be 12,008 million Rs as indicated in the table below.

(Million Rs.)

Item	Thermal Power Station	Coal Mine, Railway Facilities	Total
1980 Value			
Foreign currency portion	2,673	1,245	3,918
Domestic currency portion	2,204	901	3,105
Total	4,877	2,146	7,024
Commissioning Year Value			
Foreign currency portion	3,722	1,611	5,333
Domestic currency portion	3,366	1,259	4,625
Total	7,088	2,870	9,958
Interest During Construction			
Foreign currency portion	(494)	(237)	(731)
Local currency portion			
(F.C.)	494	237	731
(L.C.)	1,066	253	1,319
Total	1,560	490	2,050
Total Construction Cost			
Foreign currency portion	3,722 (4,216)	1,611 (1,848)	5,333 (6,064)
Local currency portion			
(F.C.)	4,926	1,749	6,675
(L.C.)	(4,432)	(1,512)	(5,944)
Total	8,648	3,360	12,008

( ) : The interest during construction is included in the foreign currency portion.

5-4 Components of Coal Mine and Railway Facilities

5-4-1 Loan Repayment Plan

The coal mine and the railway facilities components will go into operation from 1985, but it will be 1987 when the thermal power station will be commissioned. Consequently, there will be a time lag of 2 years, and regarding the income and expenditure of the coal mine and railway facilities components during this time, for the sake of simplification of calculations, the system of successively transferring the incomes and expenditures to those in 1987 and subsequent years was adopted, while the loan repayment plan of Table 5-1 was made to match that of the thermal power generation component and 1987 taken to be the starting point. (Likewise for Tables 5-2 and 5-3 also.)

The repayment amounts of principal plus interest in equal installments are as indicated below.

Foreign Currency portion:
1,848 x 0.099755 = 184.3 million Rs. (25 Yr.)

Domestic currency portion:
1,512 x 0.138116 = 208.8 million Rs. (20 Yr.)

5-4-2 Operation Costs

(1) Operation and Maintenance Cost

The operation and maintenance cost in the event the planned coal production of 29,538,000 tons from start of operation to closing of the mine is completely consumed is estimated to be 8,452 million Rs.in terms of 1980 value, so that with a price escalation rate of 8% annually, the operation and maintenance cost per ton in 1987 will be (8,452,000,000 Rs. ÷ 29,538,000 t) x $(1 + 0.08)^7$ = 490 Rs.

(2) Depreciation Cost

When the assets amounting to 3,360 million Rs. at the time of start of operation are depreciated by the straight line method in 30 years with the residual value as 10%, the annual depreciation amount will be 106 million Rs.

(3,360 − 336) x 0.035 = 106 million Rs.

5-4-3 Financial Costs

The interest payments on borrowings indicated in Table 5-1 correspond to the financial costs.

5-4-4 Operating Income and Unit Supply Price of Coal

When it is assumed that profit of the enterprise is not considered (net profit = 0), that is, lignite is supplied at cost, the operating cost, or the income from sales of lignite must be equal to the sum of the operating costs and financial costs.

(1) Coal Sales Quantity

The calorific value of Lakhra coal is 4,613 kcal/kg. Consequently, in case Lakhra Thermal Power Station of thermal efficiency of 37% (2,324 kcal/kWh) is operated at a plant factor of 70%, the annual coal consumption will be 926,800 tons.

$$(300{,}000\ \text{kW} \times 8{,}760\ \text{hr} \times 0.7 \times 2{,}324\ \text{kcal}) \div 4{,}613\ \text{kcal/kg} = 926{,}800\ \text{tons}$$

(2) Unit Coal Supply Coast

The above required operating income divided by the annual consumption of coal results in the unit supply cost. As indicated in Table 5-2, the supply cost per ton will be the following:

Year	Unit Supply Cost (Rs./t)	Annual Average Cost Escalation Rate
1987/88	983	4.7%
2006/07	2,331	6.8%
2011/12	3,233	7.7%
2016/17	4,675	

5-4-5 Cash Flow and Internal Rate of Return

The above are the results of calculations from the standpoint of a cost valuation basis, and in such case, as indicated in Table 5-3, the cumulative deficit in cash flow from 2003/04 to 2011/12 will be 710 million Rs. In contrast, the cumulative income up to 2011/12 will be 41,241.5 million Rs.

Consequently, in order not to produce a deficit in the cash balance, it will be necessary to increase the sales income (accordingly, unit coal sales price) from start of operation to 2011/12 by at least 1.7%.

$$710.0 \div 41{,}241.5 = 0.017$$

In this case the internal rate of return will be 11.9%.

$$(5,423.5 + 710.0) \div 51.510 = 0.119$$

5-5 Coal-Fired Thermal Power Generation Project Component

5-5-1 Loan Repayment Plan

Similarly to the coal mine and railway facilities components, the annual repayment amounts of loans may be calculated as follows:

Foreign currency portion:
4,216 x 0.099755 = 420.6 million Rs.
Domestic currency portion:
4,432 x 0.138116 = 612.1 million Rs.

5-5-2 Operating Costs

(1) Operation and Maintenance Cost

In case of a coal-fired thermal power station not possessing a desulfurization facility, the operation and maintenance cost statistically corresponds to approximately 3% of the construction cost without interest during construction, but in case there is a desulfurization apparatus, the operation and maintenance cost of the apparatus will be added to this cost. The construction cost (without interest during construction) of Lakhra Thermal Power Station will be 4,877 million Rs. including 264 million Rs. for desulfurization apparatus in terms of 1980 values, and the operation and maintenance cost of the apparatus will be 75 million Rs. in terms of 1980 value. Therefore, the operation and maintenance cost for the whole will correspond to 4.4% of the entire construction cost without interest during construction.

$$[(4,877 - 264) \times 0.03 + 75] \div 4,877 = 0.044$$

When price escalation is taken into account, it is thought 7,088 million Rs.will be required as the construction cost (without interest during construction) of Lakhra Thermal Power Station, and the operation and maintenance cost in 1987 will be 7,088 x 0.044 = 312 Rs.

(2) Fuel Costs

The fuel cost of Lakhra Thermal Power Station is made up by the operating income from coal sales (Table 5-2) of the coal mine and railway facilities component.

(3) Depreciation Cost

When the assets amounting to 8,648 million Rs. at the time of start of operation are depreciated by the straight line method in 30 years with the residual value as 10%, the annual depreciation amount will be 272 million Rs.

$$(8,648 - 865) \times 0.035 = 272 \text{ million Rs.}$$

5-5-3 Financial Cost

The interest payments on borrowings indicated in Table 5-4 correspond to the financial costs.

5-5-4 Electric Energy Supplied and Unit Energy Supply Price

(1) Electric Energy Supplied

If Lakhra Thermal Power Station is operated at a plant factor of 70%, since the station service ratio is 9%, the electric energy supplied at the transmitting end will be 1,674 GWh.

$$300{,}000\ \text{kW} \times 8{,}760\ \text{hr} \times 0.7 \times 0.91 = 1{,}674\ \text{GWh}$$

The transmission and distribution loss rate will be lowered to 24% in 1987, and with improvements subsequently made until in the year 2000, it will be lowered to about 20% following which it is thought more or less constant conditions will continue.

Based on the above assumptions, the energy supplied at the ultimate consumer's end will be the following:

Year	Loss Rate (%)	Energy Sales (GWh)
1987/88	24.0	1,272
1990/91	23.0	1,289
1995/96	21.4	1,316
2000 and after	20.0	1,339

(2) Unit Energy Supply Price

By comparing the total amount of operation and maintenance cost, fuel cost, depreciation cost, and interest payment with the energy supplied, the supply cost per kWh of Lakhra Thermal Power Station is obtained as indicated in Table 5-5. The supply cost and cost escalation rate every five years after start of operation are as shown below.

Year	Supply Cost per kWh (Rs/kWh)		Cost Escalation Rate (%)
	Transmitting End	Distributing End	
1987/88	1.44	1.90	
1991/92	1.56	2.02	1.6
1996/97	1.76	2.23	2.0
2001/02	2.04	2.54	2.6
2006/07	2.40	3.00	3.4
2011/12	3.16	3.94	5.6
2016/17	4.49	5.60	7.3

Table 5-1 Repayment Schedule for Coal Mine and Railway Facilities Plans

(Million Rupee)

No.	Year	Foreign Currency Portion					Domestic Currency Portion					Remarks
		Funds Borrowed (including the Interest during Construction)	Redemption			Outstanding Balance	Funds Borrowed (including the Interest during Construction)	Redemption			Outstanding Balance	
			Principal	Interest	Total			Principal	Interest	Total		
	1981	13				13	9				9	o Repayment Terms:
	82	15				28	13				22	Foreign Currency
	83	730				758	495				517	Portion:
	84	494				1,252	479				996	Interest rate 8.75%,
	85	596				1,848	516				1,512	repayment period
	86											25 yrs., principal and
												interest in equal
												installments
1	1987/88		22.6	161.7	184.3	1,825.4		19.8	189.0	208.8	1,492.2	Domestic Currency
2	88/89		24.6	159.7	184.3	1,800.8		22.3	186.5	208.8	1,469.9	Portion:
3	89/90		26.7	157.6	184.3	1,774.1		25.1	183.7	208.8	1,444.8	Interest rate 12.5%,
4	1990/91		29.1	155.2	184.3	1,745.0		28.2	180.6	208.8	1,416.6	repayment period 20
5	91/92		31.6	152.7	184.3	1,713.4		31.7	177.1	208.8	1,384.9	yrs., principal and
6	92/93		34.4	149.9	184.3	1,679.0		35.7	173.1	208.8	1,349.2	interest in equal
7	93/94		37.4	146.9	184.3	1,641.6		40.1	168.7	208.8	1,309.1	installments
8	94/95		40.7	143.6	184.3	1,600.9		45.2	163.6	208.8	1,263.9	
9	95/96		44.2	140.1	184.3	1,556.7		50.8	158.0	208.8	1,213.1	o Repayment assumed
10	96/97		48.1	136.2	184.3	1,508.6		57.2	151.6	208.8	1,155.9	to be commenced
11	97/98		52.3	132.0	184.3	1,456.3		64.3	144.5	208.8	1,091.6	half-year after start
12	98/99		56.9	127.4	184.3	1,399.4		72.3	136.5	208.8	1,019.3	of operation of
13	99/2000		61.9	122.4	184.3	1,337.5		81.4	127.4	208.8	937.9	Lakhra Thermal
14	2000/1		67.3	117.0	184.3	1,270.2		91.6	117.2	208.8	846.3	Power Station
15	1/2		73.2	111.1	184.3	1,197.0		103.0	105.8	208.8	743.3	
16	2/3		79.6	104.7	184.3	1,117.4		115.9	92.9	208.8	627.4	
17	3/4		86.5	97.8	184.3	1,030.9		130.4	78.4	208.8	497.0	
18	4/5		94.1	90.2	184.3	936.8		146.7	62.1	208.8	350.3	
19	5/6		102.3	82.0	184.3	834.5		165.0	43.8	208.8	185.3	
20	6/7		111.3	73.0	184.3	723.2		185.3	23.5	208.8	0	
21	7/8		121.0	63.3	184.3	602.2						
22	8/9		131.6	52.7	184.3	470.6						
23	9/10		143.1	41.2	184.3	327.5						
24	2010/11		155.6	28.7	184.3	171.9						
25	11/12		171.9	12.4	184.3	0						
Total		1,848	1,848.0	2,759.5	4,607.5		1,512	1,512.0	2,664.0	4,176.0		

Table 5-2 Statement of Income for Coal Mine and Railway Facilities Plans

(Million Rupee)

No.	Year	Revenue			Operating Expenses			Financial Expenses			Total Expenses (D)=(B)+(C)	Net Income (E)=(A)-(C)	Outstanding Balance of Assets in Operation	Remarks
		Sales of Lignite (ton)	Unit Price (Rs./ton)	Total (A)=(D)	O & M Expenses	Depreciation	Sub-total (B)	Interest: Foreign Currency	Interest: Domestic Currency	Sub-total (C)				
1	1987/88	926,800	983	910.7	454	106	560	161.7	189.0	350.7	910.7	0	3,254	o Table prepared assuming expense and income accompanying coal production from 1955 successively transferred into income and expenditures for 1987 and after.
2	88/89	926,800	1,017	942.2	490	106	596	159.7	186.5	346.2	942.2	0	3,148	
3	89/90	926,800	1,053	476.3	529	106	635	157.6	183.7	341.3	976.3	0	3,042	
4	1990/91	926,800	1,093	1,012.8	571	106	677	155.2	180.6	335.8	1,012.8	0	2,936	
5	91/92	926,800	1,136	1,052.8	617	106	723	152.7	177.1	329.8	1,052.8	0	2,830	
6	92/93	926,800	1,182	1,095.0	666	106	772	149.9	173.1	323.0	1,095.0	0	2,724	
7	93/94	926,800	1,232	1,141.6	720	106	826	146.9	168.7	315.6	1,141.6	0	2,618	
8	94/95	926,800	1,284	1,190.2	777	106	883	143.6	163.6	307.2	1,190.2	0	2,512	o Lignite Supply Unit Price Escalation Rate:
9	95/96	926,800	1,342	1,244.1	840	106	946	140.1	158.0	298.1	1,244.1	0	2,406	
10	96/97	926,800	1,403	1,300.8	907	106	1,013	136.2	151.6	287.8	1,300.8	0	2,300	·Initial
11	97/98	926,800	1,470	1,362.5	980	106	1,086	132.0	144.5	276.5	1,362.5	0	2,194	20 years: 4.7% annually
12	98/99	926,800	1,541	1,427.9	1,058	106	1,164	127.4	136.5	263.9	1,427.9	0	2,088	·Next
13	99/2000	926,800	1,616	1,497.8	1,142	106	1,248	122.4	127.4	249.8	1,497.8	0	1,982	5 years: 6.8% annually
14	2000/1	926,800	1,699	1,574.2	1,234	106	1,340	117.0	117.2	234.2	1,574.2	0	1,876	·Last
15	1/2	926,800	1,787	1,655.9	1,333	106	1,439	111.1	105.8	216.9	1,655.9	0	1,770	5 years: 7.7% annually
16	2/3	926,800	1,880	1,742.6	1,439	106	1,545	104.7	92.9	197.6	1,742.6	0	1,664	
17	3/4	926,800	1,981	1,836.2	1,554	106	1,660	97.8	78.4	176.2	1,836.2	0	1,558	
18	4/5	926,800	2,090	1,937.3	1,679	106	1,785	90.2	62.1	152.3	1,937.3	0	1,452	
19	5/6	926,800	2,206	2,044.8	1,813	106	1,919	82.0	43.8	125.8	2,044.8	0	1,346	
20	6/7	926,800	2,331	2,160.5	1,958	106	2,064	73.0	23.5	96.5	2,160.5	0	1,240	
21	7/8	926,800	2,465	2,284.3	2,115	106	2,221	63.3		63.3	2,284.3	0	1,134	
22	8/9	926,800	2,636	2,442.7	2,284	106	2,390	52.7		52.7	2,442.7	0	1,028	
23	9/10	926,800	2,821	2,614.2	2,467	106	2,573	41.2		41.2	2,614.2	0	922	
24	2010/11	926,800	3,020	2,798.7	2,664	106	2,770	28.7		28.7	2,798.7	0	816	
25	11/12	926,800	3,232	2,995.4	2,877	106	2,983	12.4		12.4	2,995.4	0	710	
26	12/13	926,800	3,467	3,213.0	3,107	106	3,213				3,213.0	0	604	
27	13/14	926,800	3,735	3,462.0	3,356	106	3,462				3,462.0	0	498	
28	14/15	926,800	4,025	3,730.0	3,624	106	3,730				3,730.0	0	392	
29	15/16	926,800	4,338	4,020.0	3,914	106	4,020				4,020.0	0	286	
30	2016/17	926,800	4,675	4,333.0	4,227	106	4,333				4,333.0	0	180	
Total		27,804,000		59,999.5	51,395	3,180	54,576	2,759.5	2,664.0	5,423.5	59,999.5	0	51,510	

Table 5-3 Statement of Cashflow for Coal Mine and Railway Facilities Plans

(Million Rupee)

No.	Year	Cash Inflow					Cash Outflow				Cash Balance		
		Cash from Income		Proceed from Finance		Total	Capital Expenditure (Construction Costs)	Repayment of Borrowings		Total	Yearly	Accumulated Total	
		Net Income	Depreciation	Foreign Loan	Domestic Loan			Foreign Loan	Domestic Loan				
	1981			13	9	22	22			22	0	0	
	82			15	13	28	28			28	0	0	
	83			730	495	1,225	1,225			1,225	0	0	
	84			494	479	973	973			973	0	0	
	85			596	516	1,112	1,112			1,112	0	0	
	86												
1	1987/88	0	106			106		22.6	19.8	42.4	63.6	63.6	
2	88/89	0	106			106		24.6	22.3	46.9	59.1	122.7	
3	89/90	0	106			106		26.7	25.1	51.8	54.2	176.9	
4	1990/91	0	106			106		29.1	28.2	57.3	48.7	225.6	
5	91/92	0	106			106		31.6	31.7	63.3	42.7	268.3	
6	92/93	0	106			106		34.4	35.7	70.1	35.9	304.2	
7	93/94	0	106			106		37.4	40.1	77.5	28.5	332.7	
8	94/95	0	106			106		40.7	45.2	85.9	20.1	352.8	
9	95/96	0	106			106		44.2	50.8	95.0	11.0	363.8	
10	96/97	0	106			106		48.1	57.2	105.3	0.7	364.5	
11	97/98	0	106			106		52.3	64.3	116.6	-10.6	353.9	
12	98/99	0	106			106		56.9	72.3	129.2	-23.2	330.7	
13	99/2000	0	106			106		61.9	81.4	143.3	-37.3	293.4	
14	2000/1	0	106			106		67.3	91.6	158.9	-52.9	240.5	
15	1/2	0	106			106		73.2	103.0	176.2	-70.2	170.3	
16	2/3	0	106			106		79.6	115.9	195.5	-89.5	80.8	
17	3/4	0	106			106		86.5	130.4	216.9	-110.9	-30.1	
18	4/5	0	106			106		94.1	146.7	240.8	-134.8	-164.9	
19	5/6	0	106			106		102.3	165.0	267.3	-161.3	-326.2	
20	6/7	0	106			106		111.3	185.3	296.6	-190.6	-516.8	
21	7/8	0	106			106		121.0		121.0	-15.0	-531.8	
22	8/9	0	106			106		131.6		131.6	-25.6	-557.4	
23	9/10	0	106			106		143.1		143.1	-37.1	-594.5	
24	2010/11	0	106			106		155.6		155.6	-49.6	-644.1	
25	11/12	0	106			106		171.9		171.9	-65.9	-710.0	
26	12/13	0	106			106					106.0	-604.0	
27	13/14	0	106			106					106.0	-498.0	
28	14/15	0	106			106					106.0	-392.2	
29	15/16	0	106			106					106.0	-286.0	
30	2016/17	0	106			106					106.0	-180.0	Residual value
Total		0	3,180	1,848	1,512	6,540	3,360	1,848	1,512	6,720			

Table 5-4 Repayment Schedule for Thermal Power Generation Plan

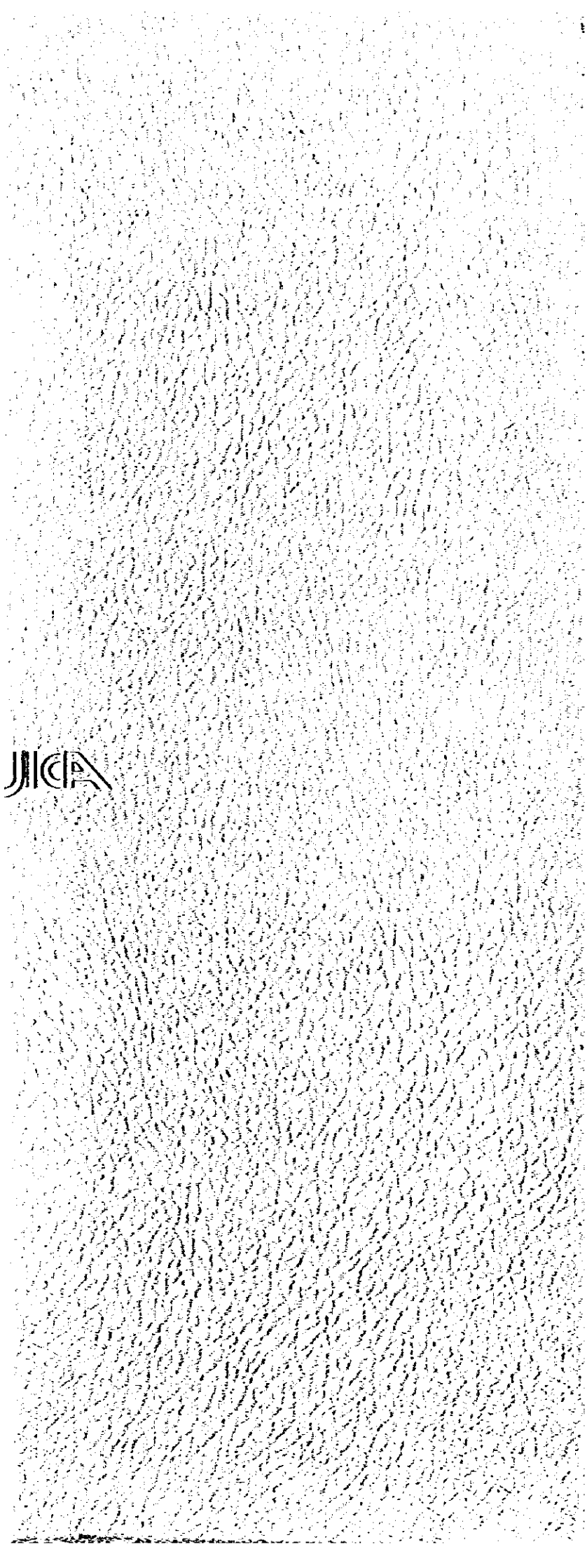
(Million Rupee)

No.	Year	Foreign Currency Portion					Domestic Currency Portion					Remarks
		Funds Borrowed (including the Interest during Construction)	Redemption			Outstanding Balance	Funds Borrowed (including the Interest during Construction)	Redemption			Outstanding Balance	
			Principal	Interest	Total			Principal	Interest	Total		
	1981	33				33	15				15	o Repayment Terms:
	82	55				88	34				49	Foreign Currency
	83	353				441	318				367	Portion:
	84	723				1,164	811				1,178	Interest rate 8.75%,
	85	1,720				2,884	1,548				2,726	repayment period 25
	86	731				3,615	925				3,651	yrs., principal and
	87	601				4,216	781				4,432	interest in equal
1	1987/88		51.7	368.9	420.6	4,164.3		58.1	554.0	612.1	4,373.9	installments
2	88/89		56.2	364.4	420.6	4,108.1		65.4	546.7	612.1	4,308.5	Domestic Currency
3	89/90		61.1	359.5	420.6	4,047.0		73.5	538.6	612.1	4,235.0	Portion:
4	1990/91		66.5	354.1	420.6	3,980.5		82.7	529.4	612.1	4,152.3	Interest rate 12.50%,
5	91/92		72.3	348.3	420.6	3,908.2		93.1	519.0	612.1	4,059.2	repayment period 20
6	92/93		78.6	342.0	420.6	3,829.6		104.7	507.4	612.1	3,954.5	yrs., principal and
7	93/94		85.5	335.1	420.6	3,744.1		117.8	494.3	612.1	3,836.7	interest in equal
8	94/95		93.0	327.6	420.6	3,651.1		132.5	479.6	612.1	3,704.2	installments
9	95/96		101.1	319.5	420.6	3,550.0		149.1	463.0	612.1	3,555.1	
10	96/97		110.0	310.6	420.6	3,440.0		167.7	444.4	612.1	3,387.4	o Repayment assumed to
11	97/98		119.6	301.0	420.6	3,320.4		188.7	423.4	612.1	3,198.7	be commenced half-
12	98/99		130.1	290.5	420.6	3,190.3		212.3	399.8	612.1	2,986.4	year after start of ope-
13	99/2000		141.4	279.2	420.6	3,048.9		238.8	373.3	612.1	2,747.6	ration of Lakhra Ther-
14	2000/1		153,8	266.8	420.6	2,895.1		268.6	343.5	612.1	2,479.0	mal Power Station.
15	1/2		167.3	253.3	420.6	2,727.8		302.2	309.9	612.1	2,176.8	
16	2/3		181.9	238.7	420.6	2,545.9		340.0	272.1	612.1	1,836.8	
17	3/4		197.8	222.8	420.6	2,348.1		382.5	229.6	612.1	1,454.3	
18	4/5		215.1	205.5	420.6	2,133.0		430.3	181.8	612.1	1,024.0	
19	5/6		234.0	186.6	420.6	1,899.0		484.1	128.0	612.1	539.9	
20	6/7		254.4	166.2	420.6	1,644.6		539.9	72.2	612.1	0	
21	7/8		276.7	143.9	420.6	1,367.9						
22	8/9		300.9	119.7	420.6	1,067.0						
23	9/10		327.2	93.4	420.6	739.8						
24	2010/11		355.9	64.7	420.6	383.9						
25	11/12		383.9	36.7	420.6	0						
Total		4,216	4,216.0	6,299.0	10,515.0		4,432	4,432.0	7,810.0	12,242.0		

Table 5-5 Supply Cost per kWh

(Million Rupee)

No.	Year	Operation and Maintenance Expenses				Financial Expenses			Total Costs	Energy Supplied -Sending End =1,674 GWh		Supply Cost per kWh		
		O & M Expenses	Fuel Costs	Depreciation Cost	Sub-total	Interest		Sub-total		Loss	Energy	Sending End	Ultimate Consumer's End	Annual Cost Escalation
						Foreign	Domestic							
										(%)	(GWh)	(Rs./kWh)	(Rs./kWh)	(%)
1	1987/88	312	910.7	272	1,494.5	368.9	554.0	922.9	2,417.6	24.0	1,272	1.44	1.90	0
2	88/89	337	942.2	272	1,551.2	364.4	546.7	911.1	2,462.3	23.7	1,277			
3	89/90	364	976.3	272	1,612.3	359.5	538.6	898.1	2,510.4	23.4	1,284			1.6
4	1990/91	393	1,012.8	272	1,677.8	354.1	529.4	883.5	2,561.3	23.0	1,289			
5	91/92	424	1,052.8	272	1,748.8	348.3	519.0	867.3	2,616.1	22.7	1,294	1.56	2.02	0
6	92/93	458	1,095.0	272	1,825.0	342.0	507.4	849.4	2,674.4	22.4	1,299			
7	93/94	495	1,141.6	272	1,908.6	335.1	494.3	829.4	2,738.0	22.0	1,306			2.0
8	94/95	534	1,190.2	272	1,996.2	327.6	479.6	807.2	2,803.4	21.7	1,311			
9	95/96	577	1,244.1	272	2,093.1	319.5	463.0	782.5	2,875.6	21.4	1,316			
10	96/97	624	1,300.8	272	2,196.8	310.6	444.4	755.0	2,951.8	21.0	1,322	1.76	2.23	0
11	97/98	674	1,362.5	272	2,308.5	301.0	423.4	724.4	3,032.9	20.7	1,328			
12	98/99	727	1,427.9	272	2,426.9	290.5	399.8	690.3	3,117.2	20.4	1,333			2.6
13	99/2000	786	1,497.8	272	2,555.8	279.2	373.3	652.5	3,208.3	20.0	1,339			
14	2000/1	848	1,574.2	272	2,694.2	266.8	343.5	610.3	3,304.5	20.0	1,339			
15	1/2	916	1,655.9	272	2,843.9	253.3	309.9	563.2	3,407.1	20.0	1,339	2.04	2.54	0
16	2/3	990	1,742.6	272	3,004.6	238.7	272.1	510.8	3,515.4	20.0	1,339			
17	3/4	1,069	1,836.2	272	3,177.2	222.8	229.6	452.4	3,629.6	20.0	1,339			3.4
18	4/5	1,154	1,937.3	272	3,363.3	205.5	181.8	387.3	3,750.6	20.0	1,339			
19	5/6	1,247	2,044.8	272	3,563.8	186.6	128.0	314.6	3,878.4	20.0	1,339			
20	6/7	1,346	2,160.5	272	3,778.5	166.2	72.2	238.4	4,016.9	20.0	1,339	2.40	3.0	
21	7/8	1,454	2,284.3	272	4,010.3	143.9		143.9	4,154.2	20.0	1,339			
22	8/9	1,570	2,442.7	272	4,284.7	119.7		1119.7	4,404.4	20.0	1,339			5.6
23	9/10	1,696	2,614.2	272	4,582.2	93.4		93.4	4,675.6	20.0	1,339			
24	2010/11	1,832	2,798.7	272	4,902.7	64.7		64.7	4,967.4	20.0	1,339			
25	11/12	1,978	2,995.4	272	5,245.4	36.7		36.7	5,282.1	20.0	1,339	3.16	3.94	0
26	12/13	2,137	3,213.0	272	5,622.0				5,622.0	20.0	1,339			
27	13/14	2,308	3,462.0	272	6,042.0				6,042.0	20.0	1,339			7.3
28	14/15	2,492	3,730.0	272	6,494.0				6,494.0	20.0	1,339			
29	15/16	2,692	4,020.0	272	6,984.0				6,984.0	20.0	1,339			
30	16/17	2,906	4,333.0	272	7,511.0				7,511.0	20.0	1,339	4.49	5.60	0
Total		35,340	59,999.5	8,160	103,499.5	6,299.0	7,810.0	14,109.0	117,608.5					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