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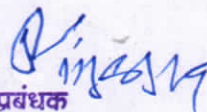

PROJECT REPORT
FOR
KUSMUNDA OC EXPANSION (15-50 MTY)

OF
SOUTH EASTERN COALFIELDS LIMITED
(A Mini Ratna Company)
(KUSMUNDA AREA)

DECEMBER 2011

(UPDATED MAY 2013)

REGIONAL INSTITUTE - V
CENTRAL MINE PLANNING & DESIGN INSTITUTE LIMITED
A Mini Ratna & An ISO 9001 Company
(A Subsidiary of Coal India Limited)
SECL COMPLEX, SEEPAT ROAD
BILASPUR - (C.G.) 495006


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SECL-Kusmunda Area


PROJECT REPORT FOR KUSMUNDA OPENCAST EXPANSION (15-50 Mty)**SUMMARISED DATA**

Sl. No.	Particulars	Unit	Value		
A. GENERAL					
1	Name of Project		Kusmunda OC Expn. (15 – 50 Mty)		
2	Name of Area / Company / State		Kusmunda Area/SECL/C.G.		
3	Nearest Railway Station from project	Name km	Gevra Road Railway Station 1.5 Km		
4	Nearest National / State Highway / Approach road	Name km	Bilaspur-Ambikapur 25		
B. GEOLOGICAL					
1	Name of geological blocks considered	Name	Jatraj, Resdi & Sonpuri		
2	Area of the geological blocks(part area)	sq. km	16.03		
3	Borehole Density within blocks	BHs / sq.km	15.03		
4	Description of all coal seams within block				
Stratigraphic Sequence	Thickness (m)		No. of borehole intersections	Geological Reserves (Mt)	Remarks
	Min.	Max.			
Seam E	1.45	9.05	27		
Parting	0.70	4.67			
Seam F	0.80	3.17	37		
Seam E&F	6.40	14.79	20	42.24	
Parting	56.85	88.85			
UK Seam	20.03	34.41	97	359.28	
Parting	34.20	91.00			
LK Top	31.50	42.38	83	437.44	
Parting	3.00	19.83			
LK Bottom	2.86	16.65	56	706.18	
LK Composite Seam	48.06	64.40	53		
C. TECHNICAL					
1	Area of the proposed mine boundary	Ha			1603
2	Borehole density within mine area	BHs/sq. km			15.03
3	Mine parameters (Quarry-wise)				
	Extent along strike (min. – max.)	Km			4.40-6.50
	Extent along dip (min.-max.)	Km			2.60-3.20

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Name of seam	Thickness minimum	Thickness maximum	Av. gradient (in degrees)	Mineable Reserves (Mt)	Volume of OB (Mcum)
4	Description of coal seams proposed to be worked along with the parting details			As on 1.4.2011	
Top OB	10.00	104.00	1 in 10		561.95
E&F	6.40	14.79		32.26	
Parting	56.84	88.85			184.47*
UK	20.03	30.73		234.70	
Parting	34.20	91.00			523.39*
LK Top	31.50	42.38		225.80	
Parting	3.00	19.83			72.64*
LK B/Comb	50.92	81.05		512.64	
Total Coal/OB				1005.40	1342.45
5	Av. Stripping Ratio			cum/t	1.34
6	Method of Mining				Shovel – Dumper
7	Target Output				
	Nominal production capacity (at 100%)			Mt	50.0
	Peak production capacity (at 125%)			Mt	62.50
	Production capacity (at 85%)			Mt	42.50
8	Year of achieving Target Production (from zero date)				8 th year
9	Year of start of Internal Dumping				1 st year
10	Production Phasing (from zero date upto target year)			Year	8

	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8
Coal, Mt	15.00	15.00	15.00	22.00	30.00	37.00	44.00	50.00
OB, Mcum	20.73	20.73	20.73	31.86	42.49	42.59	52.29	67.65

* Inclusive of bands

11	Total Mine Life (at Normative Prodn. capacity)	Years	24
	Pre-construction period	Years	-
	Construction period	Years	3
	Production build-up period	Years	5
	Production period	Years	15
	Tapering / mine closure period	Years	1

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12	Major HEMM Deployed for Coal	FEL Surface Miner Dozer Drill Dumper Diesel Hyd. Backhoe	10 cum 5 Mt 410 HP 160 mm 45 T 5 Cum	20 10 10 4 169 3
13	Major HEMM Deployed for OB	Shovel Shovel Dumper Dumper Drill Dozer / Wheel Dozer	42cum 10 cum 240T 100T 250 mm 850/410 HP	5 12 52 115 22 23
14	Total Manpower	Nos.		4130
15	Overall Output per manshift (OMS)	Tonnes		43.16
16	Seam-wise weighted average grade of coal (non-coking LF)		F (Equivalent GCV- 4497 Kcal/kg) GCV Band-10	
17	Presence of Major Surface Constraints.(nallas, road, power line, etc.)	(type)		Forest land & village
18	Coal Transport within the mine.(In-pit belt conveying system or by Truck)			By In pit Belt Conveyor
19	Surface Coal Transport to Siding/ Despatch Point and Mode of Despatch			By Belt Conveyor
20	Any Railway Siding and distance			Gevra Siding, 5 km
21	Name of any Specific Customer/Industry			Miscellaneous Power sector

D.	ENVIRONMENTAL & OTHERS		
1	<u>Civil Construction</u> Residential houses Existing Additional	Nos. Nos. Nos.	2851 2035 816
2	<u>Water Demand</u> Colony Industrial	MLD MLD	0.603 3.33
3	<u>Total Land to be acquired</u> Government land Tenancy land Forest land (type of forest)	Ha Ha. Ha Ha	2365.76 225.17 1950.24 190.35
4	<u>Land to be acquired within minetake area (excavation area)</u> Government land Tenancy land Forest land (type of forest)	Ha Ha Ha Ha	550.00
5	Land to be acquired outside minetake area (Beyond Excavation Area, such as Approach Road, Infrastructure, Colony, etc.)	Ha	1815.76

6	Land to be acquired for external dumping	Ha	Nil
7	Net Present Value of Forest Land	₹ Lakhs/Ha	10.00
	Total Area	Ha	190.36
	Total Value	₹ Lakhs	1903.56
8	Habitation & Rehabilitation		
	No. of villages within mine boundary		10 villages
	No. of land pustees		3390
	No. of PAFs to be rehabilitated		8200
	Cost of land & Rehabilitation	Nos.	
9	Total Cost R&R only	₹ crores	949.20
		₹ crores	508.28
10	Total EMP Capital	₹ crores	575.33
11	Average annual rainfall	mm	1265
12	Make of Water	Cum/day	2515200
13	Total installed pumping capacity	lps	8725
14	Drainage of the Area	Southernly-flowing Hasdeo River	
15	Any proposed diversion of road or power line	Diversion of west bank Canal	

E. FINANCIAL			
1	Total Capital Investment	Existing Additional Total	₹ Crores
			700.10
			6912.22
			7612.32
2	Specific Investment		₹/ tonne
			1522.46
			₹/cum
			784.25
3	Total Capital Investment on P&M	Existing Additional	₹ Crores
			615.95
4	Specific Investment on P&M	Total Additional	₹/ tonne
			1119.19
5	Capital requirement upto target year		₹ crores
			995.99
			5712.95
6	Earnings per manshift (EMS)		₹
			2839.32
7	Estimated Cost of Production		₹/ tonne
	At 100% production level		445.88
	At 85% production level		506.31
8	Estimated average selling price (at 95% sales realization)		₹/ tonne
			898.00
9	Estimated Profit		₹/ tonne
	At 100% production level		452.12
	At 85% production level		391.69
10	Financial Internal rate of return (FIRR)		%
	At 100% production level		91.77
	At 85% production level		56.86
11	Break-even point	Production Production level	Mty %
			21.55
			43.10
12	Cost of Outsourcing (average)	In Seam Band Coal	₹/cum ₹/tonne
			NA
13	Mine Closure Cost (for corpus fund)		₹/tonne
			3.80

EXECUTIVE SUMMARY**1.0 INTRODUCTION**

A Feasibility Report for Kusmunda-I OCP in the Eastern Section of Jatraj Block was prepared in June 1973, and was approved by the Government in December 1974 for a targetted capacity of 1.50 Mty at a capital expenditure of Rs.17.13 crores.

The Feasibility Report for Kusmunda Expansion Project for a targetted capacity of 6.0 Mty was prepared by CMPDI in March 1978, and was sanctioned by the Government in October 1978, the estimated capital investment as per the RCE 1985 was Rs.168.44 crores including the area and the then existing capital of the mine opened against the Feasibility Report sanctioned in December 1974. The project was completed on 31.03.1987 at a completion cost of Rs.162.34 crores.

The Project Report for Kusmunda Expansion Project for a targetted capacity of 10.0 Mty was prepared by CMPDI in Aug-2005, which has been approved by Govt. of India. The estimated incremental capital investment as per the PR (6 to 10 Mty) was Rs.360.25 crores. The project exceeded the production level of 10.0 Mty in 2008-09.

Working group/X Plan document on updated production of May 2005 indicated the demand of non coking coal for the XI plan as 622 Mt and indigenous supply of non coking coal from CIL as 508 Mt. Projection of total indigenous supply of non coking coal as 562.32 Mt leaves a gap of 59.68 Mt for which Emergency Coal Production Plan of CIL was formulated. Kusmunda Opencast was identified as one of the project in the Emergency Coal Production Plan of CIL to augment production from a level of 10 Mty to 15Mty.

Accordingly, Project Report for Kusmunda OC Expansion (10 to 15 Mty) was formulated and approved for an incremental capacity of 5 Mty for an additional capital investment of Rs. 450.66 crores with mine boundary extending further on dip side mostly covering Sonpuri Geological Block beyond which the area is under exploration.

On western side, Resdi geological Block was left intact for second phase of expansion after the existing mine comes to a proper shape having optimum space available for internal dumping.

Liberalisation of power sector has resulted in a sharp increase in demand for power grade coal. Expansion of Kusmunda Opencast is, again therefore, proposed with a view to fulfill the growth in demand. In this context, this project named Kusmunda OC Expansion Project (15 to 50 Mty) has been conceived.

1.1.1 SALIENT FEATURES OF LAST APPROVED REPORT

Date of sanction	13.06.2008
Mineable reserves	: 499.13 Mt as on 1.4.2006
Total OBR	: 707.66 Mcum
Stripping Ratio	: 1.42 cum/t
Targeted production	: 15 Mty
Incremental Production	: 5 Mty
Life of the projects	: 35 years
Seams to be worked	: Lower Kusmunda, Upper Kusmunda & E&F
Average grade of coal	: "F"
Maximum depth	: 235 m
Capital outlay	: Rs.901.33 crores
Incremental Capital	: Rs.450.66 Crores
Manpower	: 220
OMS	: 86.09 t

1.2 PERFORMANCE OF KUSMUNDA EXPANSION OCP

The performance of the mine for the last five years has been summarised in the following table:-

Particulars	08-09	09-10	10-11	11-12	12-13
Production (Mt)	10.56	11.20	14.56	15.00	15.00
OMS (t)	13.96	14.88	24.02	23.67	20.85
Selling price (Rs./t)	575.50	599.24	570.91	820.41	1042.17
Cost of production (Rs./t)	302.40	344.04	371.99	398.93	417.36
Profit/loss (Rs./t)	273.10	255.20	198.92	421.47	624.81

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1.3 NEED FOR KUSMUNDA OCP EXPANSION PROJECT REPORT (15-50 MTY)

- i) The basic infrastructure is available at Kusbunda OC mine and the expansion can be planned with short gestation period.
- ii) Sufficient coal reserves at a favourable stripping ratio are available in Kusbunda OC and its surrounding (dip side) Blocks, viz., Sonpuri, Resdi, for planning the expansion.
- iii) The expansion of nearby Gevra OC and Dipka OCP has already been planned for a targeted capacity of 35 Mty and 25 Mty respectively. And after the study of the data available from the Geological Report on Resdi Block, Kusbunda OC has been identified as the next suitable block where such large expansion can be planned.

In Draft Project Report, two main variants i.e. Variant-I, with 56 cum ERS(Elect. Rope Shovel) with 440T RD(Rear Dumper) and Variant-II, with 42 cum Elect. Rope Shovels with 240T RD were proposed. A joint high level meeting comprising of CMDs & Directors of both CMPDI and SECL was convened to finalise the major HEMM for the Project. Based on the recommendation of joint high level meeting (refer to Annexure-I), two Options were worked out. Both the variants were to be worked by departmental equipment for coal and OB as well. OB was to be extracted by the combination of 53 & 10 cum and 400T & 100T RD in both Options. For extraction of coal, surface Miner with a combination of 10 cum FEL & 60T RD coal body dumper / truck was to be used in Option-I and same combination as in OB was proposed for Option-II.

No outsourcing operation was to be carried out in both the Options.

Later on, as per requirement of Technical Sub-Committee of SECL, **Option-III**, OB departmental with the combination of 53 & 10 cum Elect. Rope Shovels and 400T & 100T RD and coal outsourcing by surface miner was submitted with comparative economics of departmental and outsourced method.

As per directives of D(T),CIL, **Option-IV**, OBR Departmental by 42 & 10cum ERS with 240 & 100 T rear dumpers & coal departmental by surface miner with it's techno-economics was submitted.

As per TSC held on 14.8.12, **Option-V**, OBR departmental by 42 & 10cum ERS with 240 & 100 T rear dumpers & coal contractual by surface miner was worked out.

All the Options were presented before SECL Board. The Board after detailed deliberations accorded in principle approval of the Expansion Project Report of Kasmunda Opencast Expansion (15 – 50 Mty) with Option-IV for the purpose of stage-I clearance. Accordingly, Updated Cost Estimates of Option-IV is prepared and submitted.

The project will produce coal of Power Grade. ROM coal is proposed to be washed in the pit head washery before it is dispatched to the customer and the washery rejects will be utilized in a FBC plant for power generation.

The flexibility in the implementation stage may be exercised within the approved cost estimates to respond to improvements in technology and equipment which would result in improved profitability and productivity measures. Following points may be considered under the flexibility: -

- a) Re-alignment of project boundaries for better working layout / dump etc.
- b) To procure state-of-the-art safety equipment, whenever they are introduced, even if the same is not provided in approved Project Report.
- c) Relocation of site for infrastructure facilities depending upon techno-economic reasons and availability of land / forest area etc.
- d) Hiring of equipment for loading, transportation etc., at a competitive price, so as to cater to the needs of increased demand of coal and subsequent removal of higher OB and for augmentation of coal production.
- e) For upgradation of new technology in mining method for improving performance and reduction in manpower, at a subsequent date before and after project completion.
- f) In case of backlog of OB due to delay in procurement of major HEMM, the quantity of OB backlog may be outsourced.

Sometimes with favorable geological conditions and improved productivity of the HEMM with better mining conditions project may produce upto 1.25 times

of the planned capacity. So, EMP should be prepared for 62.50 Mty and accordingly approval from the Competent Authority is to be sought.

2.0 MARKETABILITY

Liberalisation of power sector by Government of India has generated wide spread interests for private and public sector investments in power generation. As such, there is an appreciable increase in the number of upcoming new thermal power projects in both private and public sectors. This has resulted in a sharp increase in demand for power grade coal. Expansion of Kusbunda Opencast is, therefore, proposed with a view to fulfill the above indicated growth in demand.

The on-going Kusbunda Opencast Expansion was sanctioned for a targeted coal production of 15 Mty. Presently, Kusbunda Opencast Expansion has reached the production level of 15 Mty. The expansion of this project has been planned to a targeted capacity of 50 Mty. The additional production has been linked to various Thermal Power Stations. As such, there will not be any problem to market the coal from this project.

3.0 PROJECT SITE INFORMATION

3.1 LOCATION

Kusbunda OCP Expansion, a part of Eastern Sector of Jatraj, Resdi and Sonpuri Blocks, is located in the south-central part of Korba Coalfield in Korba district of Chhattisgarh. These blocks cover an area of 16.03 sq.km. and are bounded by latitudes 15°18' to 22°21'30" and longitudes 82°38'39" to 82°42' 8" (ref. Plate No.I) and included in Survey of India Toposheet No. 64J/11.

3.2 CLIMATE

The climate of the area is dry to moist tropical with well defined summer from April to June, rainy season from July to September and winter from November to February. The temperature rises to a maximum of about 48°C in May and drops to a minimum of about 6°C in January.

3.3 PHYSIOGRAPHY

The general topography is flat terrain with minor undulations. The general elevations ranging from 280 m to 300 m above Mean Sea Level. The drainage is by southerly flowing Hasdeo River which lies to the east of the block.

4.0 GEOLOGY

4.1 A mining block covering an area of 16.03 sq.km. has been considered in the Kasmunda Opencast Expansion Project (50 Mty). The boundaries of the mining blocks are given below:-

North : Geological Block Boundary of Resdi & Jatraj Block

South : Geological Block Boundary Resdi & Sonpuri Block

East : West bank canal of Hasdeo river.

West : Geological Block Boundary Resdi Block

4.2 STRATIGRAPHIC SUCCESSION

The entire block is capped with thick soil cover. There is no rock exposure in the block. The boreholes drilled in the block were closed after the Lower Kasmunda seam. The geological succession is, therefore, based on the borehole data drilled within the block.

4.3 SEQUENCE OF COAL SEAMS

The sequence of coal seams and partings in the block is summarized as follows:-

Sequence of coal seam

Coal seam Name/ parting	Nomen- clature	Thickness range(m)		Generalised thickness (m)	No.of boreholes inter- section (Full thickness)	Area (sq km)	Seam wise BH density (no. per sq km)	No.of samples actually tested for proximate Analysis (determined /calculated)
Seam	E	1.45 (CMKL-123)	7.30 (CMKS-7)	5-7	27			
Parting		0.70	2.81					
Seam	F	1.30 (CMKR-12)	3.17 (CKKS-14)	1.5-2	37			
	E&F	6.40 (CMKR-5)	11.10 (CMKR-3)	8-10	20	0.72	27.78	7

Coal seam Name/parting	Nomenclature	Thickness range(m)		Generalised thickness (m)	No. of boreholes intersection (Full thickness)	Area (sq km)	Seam wise BH density (no. per sq km)	No. of samples actually tested for proximate Analysis (determined /calculated)
Parting		58.59	79.40					
	Upper Kusbunda	20.03 (CMKS-13)	30.73 (CMKL-101)	24-28	97	5.85	16.58	54
Parting		45.25	81.85					
Seam	Lower Kusbunda Composite	49.20 (CMKL-109)	60.83 (CMKL-56)	50-60	32	1.86	17.20	95
Seam	Lower Kusbunda Top	31.50 (CMKR-49)	42.38 (CMKR-27)	38-40	83	5.85	14.19	
Parting		3.00	19.83					
Seam	Lower Kusbunda Bottom	2.86 (CMKR-21)	16.65 (NCKK-28)	8-10	56	7.2	7.78	

4.4 DESCRIPTION OF COAL SEAMS

4.4.1 GENERAL

The existence of three well defined coal seams has been proved in the project area. These seams are named as Lower Kusbunda, Upper Kusbunda and E&F in ascending order. The Lower Kusbunda seam is composite in the western part of the mining block and it splits into mainly two sections in the eastern part. There is a grey shale/sandy shale band at 30-40m from the roof of the seam that has a tendency of increasing in thickness from west to east. In the area where the thickness of the band becomes 3m and above, the Lower Kusbunda seam has been considered to split up in to 2 sections, Lower Kusbunda Top and Lower Kusbunda Bottom.

The Upper Kusbunda, a composite seam has tendency to increase in thickness from north to south.

Three sections on the basis of seam composition can be clearly identified as top shaly coal section, middle interbanded section and bottom coaly section.

Seam E&F, which is the top most horizons in the block has also splitting tendency in the bottom part with the development of a carb.shale band. However, the thickness of this band is less than 3m in the project area and hence E&F seam has been considered as a single horizon.

Altogether 23 faults have been deciphered in the block. Out of these, two faults F2-F2 and F10-F10 having throw of 10-75m & 5-95m are the major faults. However, presence of a few minor faults cannot be ruled out.

4.5 LOWER KUSMUNDA SEAM

The Lower Kasmunda seam is the most important seam in the block, both from the point of view of quality and thickness. The seam is composite in the western part except in small a patch where it splits into 2 sections viz. Lower Kasmunda Bottom and Lower Kasmunda Top in the eastern part.

4.5.1 LOWER KUSMUNDA COMPOSITE SEAM

GENERAL

Lower Kasmunda composite seam has been encountered in 32 borehole. The thickness of the composite seam varies from 49.20 m to 60.83m. The Lower Kasmunda Seam incrops in a small patch in the north eastern part of the block.

The parting between Upper Kasmunda & Lower Kasmunda seams are composed of mostly sandstone and occasionally alternate bands of shale and sandstone. The parting between Lower Kasmunda composite seam and overlying Upper Kasmunda seam has wide variation in thickness varying from 45.25 m to 81.85 m.

4.5.2 LOWER KUSMUNDA BOTTOM SEAM

GENERAL

The thickness of the Lower Kasmunda Bottom Seam varies from 2.86m (CMKR-21) to 16.65m (NCKK-28). The seam does not show any splitting behaviour but its thickness is reduced gradually due to increasing parting with the overlying seam. The seam incrops in the north-eastern part of the block.

ROOF & FLOOR

The immediate roof of the seam is mostly carb.shale. The immediate floor of the seam is composed of grey shale and 1m below the floor of the seam is mostly of sandstone and shale.

4.5.3 LOWER KUSMUNDA TOP SEAM

GENERAL

The top of Lower Kasmunda seam incrops in the north eastern part of the block. The parting with the underlying Lower Kasmunda bottom seam varies from 3.00m to 19.83m. The thickness of the Top split including all bands varies from 31.50m to 42.38m.

4.5.4 UPPER KUSMUNDA SEAM

GENERAL

The Upper Kasmunda seam overlies the Lower Kasmunda seam at a parting varying from 45.25 m to 81.85 m and the parting with the overlying E&F seam varies from 58.59 to 79.40 m. The thickness of Upper Kasmunda seam varies from 20.03m to 30.73 m. The Upper Kasmunda seam occurs as a composite seam in the northern Jatraj block and in most of the western part of the area (Resdi block). However it exhibits a tendency of splitting into 2 sections viz. UK(Top) and UK(Bot.) in the eastern part of Resdi Block.

4.5.5 SEAM E&F

GENERAL

The seam overlies the Upper Kasmunda Seam after a parting range of 58.59m to 79.40m. The thickness of the seam varies from 6.40m to 11.10m (CMKR-3). The seam incrops in the central part of the property.

5.1 MINE BOUNDARIES

The proposed mine is an extension of the earlier sanctioned opencast mine of 15 Mty. Only the southern & western boundary has been pushed towards the dip side covering total. The quarry boundaries have been fixed in the following manner:-

North - Fault F1 (>300 m throw).

East - 60 m surface barrier from Hasdeo west bank canal.

West - Western boundary of Resdi Geological Block. Further west exploration is yet to be completed.

South - Southern boundary of Resdi and Sonpuri Geological Block. Further south exploration is yet to be completed.

5.2 MINEABLE RESERVES

The estimation of reserves is based on a minimum mineable seam thickness of 1 m. A geological loss of 10% and a mining loss of 5% have been considered in the estimation of mineable reserves.

The mineable reserves & volume of OBR as on 1.4.2011 have been given in the following table:-

S.N.	Seams/Partings	Unit	Total
A.	Mineable Reserves		
1	E&F Seam	Mt	32.26
2	Upper Kusbunda seam	Mt	234.70
3	Lower Kusbunda (Top) seams	Mt	225.80
4	Lower Kusbunda (Bot) + Lower Kusbunda (Comb) seams	Mt	512.64
	Total Reserves	Mt	1005.40
B.	Vol. of OB/Parting		
1	Top O.B.R.	Mcum	561.95
2	In seam band of E&F seam	Mcum	5.18
3	Parting between E&F & UK	Mcum	179.29
4	In seam band of U/K seam	Mcum	26.67
5	Parting between U/K & LK (Top)	Mcum	496.72
6	In seam band of LK (Top)seam	Mcum	10.8
7	Part. bet. L/K(B) & L/K(T)	Mcum	34.05
8	In seam band of LK (Bot)/LK(Comb.)seam	Mcum	27.79
	Total vol. of OB/Parting	Mcum	1342.45
C	Stripping Ratio	Mcum/t	1.34

Note:- Coal of 15 Mty with corresponding OB of 16.89 Mcum in 2011-12 and 15 Mty of coal with consequent OB of 20.92 Mcum in 2012-13 have been extracted.

5.3 TARGET OUTPUT & MINE LIFE

The mine is proposed for peak coal production of 50.0 Mty and peak OB removal of 69.25 mcum.

Mine Life

The mine life for nominal production is 24 years. The break-up is as under:

- Construction period - 3 Year
- Production build-up period - 5 years
- Production period - 15 years
- Tapering period - 1 year
- Total period - 24 years

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6.1 METHOD OF MINING

The selection of mining method for Kusbunda Opencast Expansion Project (50Mty) has been based on the following factors:-

- (i) Kusbunda Opencast Project is being worked by opencast methods deploying shovel dumper combination.
- (ii) Present depth of workings are about 150 m against an ultimate planned depth of 235 m (as per 15Mty PR). Kusbunda Expansion Opencast Project (50 Mty) has been planned upto a maximum depth of 300 m.
- (iii) The coal deposit mainly constitutes of three thick coal seams occurring at shallow to moderate depth at favourable stripping ratio considering the grade.

6.2 GEOLOGICAL AND MINING CHARACTERISTICS OF THE QUARRY

The geological and mining characteristics of the quarry has been summarised in the following table:-

Geological and Mining Characteristics (Within quarry area only)

Sl.No.	Particulars	Unit	Value
I:	COAL SEAMS		
1.	Thickness : (In-bands) :		
	E&F	Metre	6.40 – 14.79
	Upper Kusbunda	Metre	20.03 – 30.73
	Lower Kusbunda (Top)	Metre	31.50 – 42.38
	Lower Kusbunda (Combined)	Metre	48.06 – 64.40
	Lower Kusbunda (Bottom)	Metre	2.86-16.65
2.	Dip	Degree	4° - 10°
3.	Specific Gravity		1.67
4.	Excavation category of coal	Assumed	III
II:	OVERBURDEN / PARTINGS		
1.	Thickness :		
	Top O.B.	Metre	10.00 – 104.00
	Between E&F and UK	Metre	56.84 – 88.85
	Between UK and LK (T) / LK (C)	Metre	34.20 – 91.00
	Between LK (T) and LK (B)	Metre	3.00 - 19.83
2.	Specific Gravity	Assumed	2.40
3.	Excavation Category	Assumed	50% III + 50% IV
I:	COAL SEAMS		
1.	Thickness : (In-bands) :		
	E&F	Metre	6.40 – 14.79
	Upper Kusbunda	Metre	20.03 – 30.73
	Lower Kusbunda (Top)	Metre	31.50 – 42.38
	Lower Kusbunda (Combined)	Metre	48.06 – 64.40

Geological and Mining Characteristics (Within quarry area only)

Sl.No.	Particulars	Unit	Value
2.	Lower Kusbunda (Bottom)	Metre	2.86-16.65
3.	Dip	Degree	4° - 10°
4.	Specific Gravity		1.67
II:	Excavation category of coal	Assumed	III
1.	OVERBURDEN / PARTINGS		
	Thickness :		
	Top O.B.	Metre	10.00 – 104.00
	Between E&F and UK	Metre	56.84 – 88.85
	Between UK and LK (T) / LK (C)	Metre	34.20 – 91.00
	Between LK (T) and LK (B)	Metre	3.00 - 19.83
2.	Specific Gravity	Assumed	2.40
3.	Excavation Category	Assumed	50% III + 50% IV

6.3 EQUIPMENT SELECTION

Mine will be worked by departmental equipment for coal and OB as well. OB will be extracted by the combination of 42 & 10 cum Elect. Rope Shovels and 240T & 100T RD. For extraction of coal, surface Miner with a combination of 10 cum FEL & 45T RD coal body dumper / truck will be used. No outsourcing operation will be carried out.

7.1 CONSTRAINTS ON MINE DEVELOPMENT

- 1) At present, north of fault F2F2, Quarry No. 2 in Lower Kusbunda Seam, is being worked. The quarry surface on the south-eastern side of Quarry No. 2 has reached upto the acquired boundary on the edge of Jatraj village. The benches on this site have become steep.
- 2) At present, haul road along the floor of Lower Kusbunda Bottom Seam is being developed in the patch north of fault F2F2
- 3) At present, mine geometry is getting into a proper shape. The profile / geometry of the quarry is to be brought into a proper shape, to avoid acute crisis of OB dumping in future.

7.2 MINING STRATEGY / MINING SEQUENCE

Efforts must be made to advance Quarry No. 2 towards west to develop its full strike length and create space for internal dumping. As the quarry is advanced towards west, a new haul road 'A' as shown in the Final Stage Quarry Plan (refer Drg. No.-1) must be developed with a loop along the quarry batter to reach upto the floor of Lower Kusbunda Bottom Seam. This road will serve the mine till it reaches fault F2F2.

But at the same time, before the mine reaches fault F2F2, two more roads 'B' & 'C' will be developed beside main haul road as shown in the Final Stage Quarry Plan. Road 'B' will be developed through batter with such gradient that it will cater the mine beyond fault F2F2. On the floor of the mine, filling will be done to such an extent that it will join the batter portion of the road 'B' with a gradient 1 in 16 from upthrown side of the fault F2F2 upto surface.

Another road 'C' will be made ready for laying belt conveyor for the property beyond fault F2F2. When road 'C' will be used for coal transportation, road B will be exercised for general utilities. Road 'B' & 'C' will cater coal transportation of Lower Kusbunda Seam (Top/Bottom).

Similarly, while working between fault F2 and F10, main haul road will be maintained along the floor of Lower Kusbunda (Bottom/ Combined) Seam which will be utilized for all purposes including coal transport. A secondary channel will be developed subsequently to in one level of 180m to cater the property beyond fault F10. The moment the mine crosses fault F10, secondary channel will be brought into use for all purpose and that portion of haul road which lies between F2 & F10 along LK Bottom seam will be cut off.

Beyond fault F10, single central haul road will be maintained along the floor of LK Bottom seam and that will be used for all purpose for the entire life of the mine. After fault F2, sizer with hopper will be put along the face which will feed the main conveyor placed in the main haul road.

As the average parting between floor of LK Bottom and UK seam is 120m, coal of UK seam can not be brought down to main haul road lying on the floor of LK Bottom seam. It is proposed to evacuate coal of UK seam through another belt conveyor which will be developed along the northern batter. But this will be effective as long as UK seam is at shallow depth upto 80m. When the mine goes dipper beyond 100m, northern batter is required to be flushed with internal dump which will obviate the use of belt conveyor along northern batter.

It is proposed to re-examine the mode of transport of coal of UK seam after 10-12 years of mine operation and the best feasible technology like high angle belt conveyor or any other similar technology available at that time may be considered. It is essential that the land of Jatraj village is acquired as soon as possible.

7.3 DUMPING STRATEGY

By adopting the proposed sequence of mining, as the quarry advances, the amount of external dump will decrease and that of internal dump will increase as more space for the economic dumping is created. From the year 2014-15 onwards after reaching the western boundary developing the full strike length, all dumps will be accommodated internally.

The total volume of overburden has been estimated as 1342.50 Mcum, out of this, 20.80 Mcum will be placed in the external dumps located on the present site of external dumping (north of the bridge). The balance 1321.70 Mcum will be accommodated in the internal dump.

The following design criteria have been considered for waste dumps.

- (i) OB in external dumps will be stacked in 30 m high benches.
- (ii) OB in internal dumps will also be stacked in 30 m high benches.
- (iii) A berm width of 30 m has been provided for transport etc.
- (iv) Dump slope for each deck to be at natural repose (37°).
- (v) Dozers to be deployed for shaping the dumps overall slope is 28° .
- (vi) Final reclamation will be achieved using the equipment provided for the purpose.

8.1 DESIGN CRITERIA

The mine has been planned for 330 days of working. Three shift working will be practiced.

Duration of shift hours will be eight. Excavation category assumed

- i) Coal - III
- ii) Alluvial OB - Cat. I/II : Assumed
- iii) Hard OB - 50% cat. III + 50% cat. IV

Insitu volume weight t/cum

- i) Coal - 1.67 t/cum
- ii) Overburden - 2.40 t / cum

8.2 ANNUAL PRODUCTIVITY OF HEMM PROPOSED IN TABULAR FORM AND WITH DIFFERENT LEAD DISTANCE FOR DUMPERS

The lead for OB & Coal has been calculated as 3.5 Km & 2.5 km respectively on weighted averages, which have been used for calculating the no. of dumpers.

The annual productivity of shovels and dumpers combination as per the prevalent norms is given in the following Tables. The productivity has been calculated as per the design criteria mentioned in para 8.4.

Annual Productivity of shovels considering 330 working days

S.N.	Particulars of HEMM	Unit	Productivity / cum
I	For OBR		
1	10 m ³ Elect. Rope Shovel + 100 T Rear Dumper	Mcum.	2.04
2	42m ³ Elect. Rope Shovel + 240 T Rear Dumper (EWD)	Mcum.	8.06
	For Coal		
1	Surface Miner	MT	5
2	10m ³ FEL + 45 T Rear Dumper (coal body dumper / truck)	MT	2.93

8.3 CALENDAR PROGRAMME OF EXCAVATION

The summarised calendar programme of excavation is given in following table. The mine will be advanced towards dip direction exposing the floor of LK (Bottom/Combined) Seam along the sectors shown in the final stage quarry plan.

The targeted level of the production will be achieved in the 8th year. First three years have been taken as the construction period during which coal production will be restricted to 15 Mty. From 4th year onwards coal production will be increased till 8th year to meet the targeted production of 50 Mty. The peak natural volume of OB at targeted level of production has been estimated as 79.12 Mcum/year. It will be brought down to 69.25 Mcum/year by advance stripping of Top OB for smooth production of 50.0 Mty of coal/year. Considering the average width of quarry and annual advance of quarry floor, the calendar programme has been prepared and: -

8.4 EQUIPMENT SCHEDULE

HEMM have been provided as per the work load of coal and OBR in different horizons indicated in calendar programme of excavation. The project is an expansion of existing Kusmunda OC of which PR for 10 Mty and then PR for 15 Mty (incremental 5 Mty) have been approved. Therefore this PR for 50 Mty is being prepared over existing, incorporating maximum provisions of approved 10 Mty & 15 Mty PR as far as possible.

As the quantum of annual OB removal is very high, it is proposed to maximize the use of higher size equipment i.e. combination of 42 cum capacity Rope shovels & 240T Rear Dumpers. Existing HEMM i.e. combination of 10 cum capacity Rope shovels & 100T Rear Dumpers will be continued. The existing 85T & upcoming 120T dumpers will be replaced by 100T dumpers.

Coal will be extracted with the help of surface miner. As coal is being extracted through outsourcing, fresh set of combination of surface miner with matching dumpers & FEL will be procured from the beginning matching with the work load as given in calendar programme given in the following table.

For In-seam band, 5 cum Backhoe with 45T dumper are provided. As removal of In-seam band varies every year, provision of equipment has been made for an average removal of 3.5 Mcum. Most of the drilling activities will be under taken by 250mm Blast Hole Drills. The existing 160 mm drills will be continued. Similarly, on benches 410 Hp & 850 Hp dozers will take care of dozing requirements necessitated for every shovel. For dumps, 850 Hp dozers will be deployed for levelling and reclamation operations.

CALENDER PROGRAMME FOR KUSMUNDA OC EXPANSION (60 MTY)

YEAR	TOTAL COAL	E&F	UK	LKT	LKB/C	TOP OB NATURAL	TOP OB PLANNED	E&F BAND	PARTING E&F UK	UK BAND	PARTING LKT/CBAND	LKT CBAND	PARTING LKB BAND	TOTAL OB NATURAL	Total Inseam Bands	Total Nat.Excl. bands	Total OB Adj. excl. bands .	Total OB Adj. incl. (Adj.) bands	S.R. (Adj.)	
1 (13-14)	15.00		0.26	11.52	3.22	5.25	7.91			0.08	9.72	0.99	1.77	0.24	18.05	1.31	16.74	19.40	20.71	1.38
2	15.00		0.26	11.52	3.22	5.25	7.91			0.08	9.72	0.99	1.77	0.24	18.05	1.31	16.74	19.40	20.71	1.38
3	15.00		0.26	11.52	3.22	5.25	7.91			0.08	9.72	0.99	1.77	0.24	18.05	1.31	16.74	19.40	20.71	1.38
4	22.00		0.89	12.47	8.65	10.72	17.68			0.19	10.50	1.15	1.82	0.52	24.90	1.86	23.04	30.00	31.86	1.45
5	30.00		1.43	15.05	13.52	15.95	25.19			0.29	12.67	1.43	2.14	0.77	33.25	2.49	30.76	40.00	42.49	1.42
6	37.00		1.72	18.28	17.00	21.71	25.31			0.35	12.09	1.34	2.60	0.90	38.99	2.59	36.40	40.00	42.59	1.15
7	44.00		1.97	21.29	20.74	29.07	38.22			0.40	8.75	0.91	3.03	0.98	43.14	2.29	40.85	50.00	52.29	1.19
8	50.00		5.16	14.34	30.50	32.95	44.13			0.76	18.33	0.45	2.54	1.44	56.47	2.65	53.82	65.00	67.65	1.35
9	50.00		8.55	9.50	31.94	28.62	38.34			1.25	24.83	0.18	1.83	1.37	58.08	2.80	55.28	65.00	67.80	1.36
10	50.00		10.64	8.34	31.02	24.78	35.59			1.59	27.94	0.12	1.47	1.20	57.10	2.91	54.19	65.00	67.91	1.36
11	50.00	0.01	10.96	8.33	30.70	25.39	35.49		0.04	1.60	28.01	0.12	1.46	1.20	57.82	2.92	54.90	65.00	67.92	1.36
12	50.00	0.22	15.92	8.27	25.59	34.98	33.99	0.01	0.71	1.75	29.01	0.15	1.29	1.22	69.12	3.13	65.99	65.00	68.13	1.36
13	50.00	0.22	15.92	8.27	25.59	34.98	33.99	0.01	0.71	1.75	29.01	0.15	1.29	1.22	69.12	3.13	65.99	65.00	68.13	1.36
14	50.00	0.52	15.88	8.20	25.40	35.10	32.91	0.03	1.88	1.72	28.94	0.15	1.27	1.24	70.33	3.14	67.19	65.00	68.14	1.36
15	50.00	2.14	15.67	7.81	24.38	35.77	27.14	0.16	8.12	1.56	28.58	0.18	1.16	1.35	76.88	3.25	73.63	65.00	68.25	1.37
16	50.00	2.14	15.67	7.81	24.38	35.77	27.14	0.16	8.12	1.56	28.58	0.18	1.16	1.35	76.88	3.25	73.63	65.00	68.25	1.37
17	50.00	2.33	15.56	7.91	24.21	35.09	26.33	0.21	9.23	1.57	28.27	0.19	1.17	1.38	77.11	3.35	73.76	65.00	68.35	1.37
18	50.00	4.09	14.59	8.75	22.57	28.81	18.93	0.63	19.52	1.65	25.34	0.26	1.21	1.70	79.12	4.24	74.88	65.00	69.24	1.38
19	50.00	4.09	14.59	8.75	22.57	28.81	18.93	0.63	19.52	1.65	25.34	0.26	1.21	1.70	79.12	4.24	74.88	65.00	69.24	1.38
20	50.00	4.14	15.19	7.08	23.59	25.00	15.67	0.75	24.09	1.65	24.36	0.22	0.88	1.63	78.58	4.25	74.33	65.00	69.25	1.39
21	49.99	4.17	15.56	6.06	24.20	22.69	13.69	0.81	26.87	1.65	23.77	0.20	0.67	1.58	78.24	4.24	74.00	65.00	69.24	1.39
22	50.00	3.83	15.35	4.57	26.25	20.18	16.00	0.77	25.75	1.55	22.74	0.15	0.51	1.62	73.27	4.09	69.18	65.00	69.09	1.38
23	50.00	2.82	14.72	0.17	32.28	12.80	7.84	0.66	22.44	1.27	19.70	0.01	0.02	1.74	58.64	3.68	54.96	50.00	53.68	1.07
24	27.40	1.55	8.07	0.09	17.69	7.02	5.70	0.36	12.30	0.70	10.80	0.01	0.01	0.95	32.15	2.02	30.13	28.81	30.83	1.13
TOTAL	1005.40	32.27	234.79	225.90	512.43	561.94	561.94	5.19	179.30	26.70	496.72	10.78	34.05	27.78	1342.46	70.45	1272.01	1272.01	1342.45	1.34

GENERAL MANAGER
SECL. KUSMUNDA AREA

Sl. No.	Particulars	Unit	Size/ Capacity	Existing	Additional Provision	Deployment of HEMM								
				As on 1.4.13		1st 2013	2nd 2014	3rd 2015	4th 2016	5th 2017	6th 2018	7th 2019	8th 2022	
				Coal(Mt)										
OB(Mcum)						20.73	20.73	20.73	31.86	42.49	42.59	52.29	67.6	
A. OVERBURDEN														
1	Electric Rope Shovel	Cum	42		5									
2	Electric Rope Shovel	Cum	10	7	5	12	12	12	1	2	2	3	5	
3	Electric Rope Shovel	Cum	4.6/5	1		-	-	-	-	-	-	-	12	5
4	Rear Dumpers	T	240		52									
5	Rear Dumpers	T	120	22		3	2		10	20	20	32	52	
6	Rear Dumpers	T	100	40	75	84	84	84	99	112	112	115	115	
7	Rear Dumpers	T	85	1		-	-	-	-	-	-	-	-	
8	Elect. RBH Drills	mm	250	10	12	13	13	13	14	16	16	18	22	
9	Dozers	HP	850		5				1	2	2	3	5	
10	Dozers	HP	410	14		14	14	14	14	14	14	14	14	
11	Wheel Dozer	HP	410		4	2	2	2	3	3	3	4	4	
B. COAL														
1	Surface Miner	KW	>1000		10									
2	Diesel RBH Drills	mm	160	4		4	4	4	5	6	8	9	10	
3	FEL	Cum	10		20				4	4	4	4	4	
4	Truck for Coal	T	60		148				10	12	16	18	20	
5	Backhoe	Cum	5		3				65	89	110	130	148	
6	Truck for in-seam band	T	60		21				2	2	3	3	3	
7	Water Tanker / Sprinkler	KL	28	1	4	4	4	4	5	5	5	5	5	
8	Diesel Bouser	KL	22		3				2	2	3	3	3	
9	Dozers	HP	410	7	3	8	8	8	8	8	8	9	10	

GENERAL MANAGER
SECL-KUSMUNDA AREA

Executive Summary

P.R. for Kusmunda OC Expm.(15-50Mtp)

Sl. No.	Particulars	Unit	Size/ Capacity	Deployment of HEMM											
				Existing As on 1.4.13 Coal(Mt) OB(Mcum)	Additional Provision										
						1st 2013	2nd 2014	3rd 2015	4th 2016	5th 2017	6th 2018	7th 2019	8th 2020		
				20.73	20.73	20.73	31.86	42.49	42.59	52.29	67.65				
C. RECLAMATION															
1	Dozers	HP	400-410	2	2	2	2	2	2	2	2	2	2	2	
2	Dozer	HP	850		4				3	3	4	4	4	4	
3	Water Sprinkler	KL	60	4	6	4	4	4	6	7	8	10	10	10	
D. COMMON															
1	Grader	HP	500		10	3	3	3	5	6	7	8	10	10	
2	Grader	HP	280	7		4	4	4	4	4	3	2			
3	Diesel Hydraulic Backhoe	Cum	1.3-1.5	2		2	2	2	2	2	2	2	2	2	
4	Vibratory Compactor	T	25		2	1	1	1	1	1	1	1	1	2	
5	Crane	T	190/150/75	1	2	1	1	1	1	1	2	2	2	3	
6	Crane	T	40-60	2	4	3	3	3	3	3	4	5	6	6	
7	Crane	T	20		4	2	2	2	2	2	2	3	4	4	
8	Crane	T	8-10	6		6	6	6	6	6	6	6	6	6	
9	Mobile Field Workstation				3	1	1	1	1	1	1	2	3	3	
10	Diesel Bouser	KI	22		3	1	1	1	1	1	1	2	3	3	
11	Cable Reeler				3	1	1	1	1	1	1	2	3	3	

R/V, CMPDI

Job No. 502243

S23

GENERAL MANAGER
SECL. KUSMUNDA AREA

9.1 COAL QUALITY

On the basis of moisture and ash percentage different litho units are defined as under -

Coal	:	Ash + Moisture upto 40%.
Shaly Coal	:	Ash + Moisture from 40% to 55%.
Carbonaceous shale/ combustible dirt band	:	Ash + Moisture from 55% to 75%.
Obvious dirt bands	:	Ash + Moisture more than 75%.

Initially, the band by band analysis of the coal cores were obtained and subsequently special tests and the proximate analysis at 60% RH and 40°C were advised for Bcs, I₃₀, I₁₀, I₁₀₀ and I_p basis which are defined as under: -

Bcs Sample : only coal and shaly coal.

I₃₀ Sample : including combustible bands upto a thickness of 30cm. This type of analysis has been asked only for assessing under ground reserves. Dirt bands upto 5 cm irrespective of lithology have been included in the seam for quality assessment. Carbonaceous shale bands having thickness more than 30cm have been excluded from the seam thickness.

I₁₀ Sample : including both combustible and non-combustible bands upto 0.10m thickness. This analysis has been carried out for the seams having quarriable potentiality.

I₁₀₀ Sample : 'Bcs' sample + carbonaceous shale (ash + moisture upto 75%) bands upto 1m in thickness + grey shale (ash + moisture >75%) bands upto 1m in thickness and excluding all other obvious bands such as sandy shale, shaly sandstone, sandstone etc. irrespective of their thickness.

I_p Sample : I₁₀₀ Sample + carbonaceous and grey shale bands irrespective of their thickness and excluding all other obvious bands as in I₁₀₀ Sample.

10.0 WATER MANAGEMENT (PUMPING AND DRAINAGE)

At present, two independent pumping station is in operation. In the proposed 15-50 Mty expansion, main pumps will be provided at the dip most point of the quarry. Peak pumping requirement at 5 th year, 20th year and final year have been calculated (based on open excavation area, area beyond excavation, backfilled areas, runoff co-efficients, seepage of strata water, maximum rainfall in a day, sump capacity, water lying outside the sump, 18 hours

dewatering time for water lying outside the sump etc) and found out to be 2315 LPS, 6221 LPS and 8725 lps respectively.

The existing pumps which are operating on 3.3kV/415V will meet the requirements upto next 4th year. After 4th year 225 lps 200/250/330 m head 700/850/1200 kW. 6.6kV electricals will be provided as per required, no. of quantity of pump stated in the Appendix A-3.4, also existing diesel engine operated pump 38 lps. 60 m head with will be in operation in the 4th year also. Also other diesel engine operated centrifugal pump of 80 lps 150m head will be in operation 10th year and 15th year which are stated in appendix A.3.4.

These pumps will pump water through delivery range consisting of ERW pipes of 406.4mm, 355.6 mm and 324mm outside dia. As these pumps and pipes are required onward 4th years upto 20 th year after reaching the target the same has been considered as cash outflow in RR calculations. Slurry pumps of small capacity have been envisaged for pumping the silts settled in the sump due to the OB material washed away during rainy season.

11.0 COAL HANDLING PLANT

Kusmunda OCP CHP was originally designed to dispatch 6 Mty. (4.2 Mty to CSEB by belt conveyor, 1.8 Mty to other consumers by rail) after crushing the coal (-) 200 mm size. Later on OCP expansion (6-10 Mty) has been approved in 2006 and 10-15 Mty has been approved in 2008. Now it is proposed to produce 50 Mty by surface miners with FEL and dumper with inpit conveyor system (i.e. Inpit Central, Inpit East and Inpit West). Around 10 Mty of coal will be transported to a 20000Te OH RCC bunker through belt conveyors either directly or via the proposed washery for supply of coal to CSPGCL power plant. Supply of coal from the bunker to the power plant will be through CSPGCL belt conveyors. Approximately 40 Mty coal will be dispatched to distant consumers by rail through 4 nos. silos.


GENERAL MANAGER
SECL-KUSMUNDA AREA

For increasing coal production of 50 Mty. It is proposed to construct (1) coal handling plant (ii) 2 nos. 40,000 te RCC OH Bunker with plough feeder arrangement for storing ROM coal (iii) 12,000 te RCC OH Bunker with vibro feeder arrangement for ROM coal to feed washery (iv) 2 nos. 30,000 te RCC OH Bunker with plough feeder arrangement for washed coal (v) 1 no. 20,000 te RCC OH Bunker with plough feeder arrangement for CSPGCL.

4 nos. silo of 4000 te capacity each with rapid loading arrangement to load a full rake of 58 N Box wagons to dispatch coal by rail loading system to distant consumers.

11.0 POWER SUPPLY, ILLUMINATION AND COMMUNICATION

The main source of 132 kV power for Kusbunda OCP Expansion Project has been envisaged from CSEB Churi or other CSEB Substation. Provision for 15 Km double ckt incoming overhead line has been kept for this purpose which may vary depending on source substation. A Central substation of 2 x 40/50 MVA, 132/33 kV has been proposed to feed quarry inpit and CHP loads.

Two numbers quarry substation (installed capacity 2x16 MVA, 33/6.6 kV for quarry alongwith 2x6.3 MVA, 33/6.6/3.3 kV for pumping loads) have been proposed for feeding quarry HEMM, part of inpit loads and pumps. The capacity of CHP substation shall be 2X16 MVA, 33/6.6 KV. CHP substation will receive power at 33 V from the 132/33 kV central substation. A provision has been also kept for supplying power at 33 kV to 10 Mty washery from the 132/33 kV substation till a separate 132/33 kV substation for washery as a whole is constructed. A new colony substation has been proposed having installed capacity of 2 x 6.3 MVA, 33/6.6 kV for feeding the colony power requirement.

The specific energy is estimated at 4.58 kWh/t.

Keeping in view, the upcoming 4 nos. of washery units of 10 Mty capacity each, it is envisaged that 220 kV (double circuit) line shall be required to cope up the demand of Kusbunda OCP and washery.

The double circuit incoming line from the Churi or other substation shall be drawn on 220 kV towers and insulators and shall be charged at 132 kV initially till the construction of a 220 / 132kV substation at Kusmunda for the total load of mine and washeries. From 220/132 KV substation, 2 nos. of 132 KV feeders shall be drawn to the mine 132 KV substation and washery 132 KV substation separately.

The following communication facilities have been envisaged for Kusmunda Opencast Project: -

- Administrative communication with voice & data networking
- Mobile communication
- Point to point / multi point radio system
- LAN & internet facility
- Truck dispatching system

12.0 ENERGY CONSERVATION AND UTILISATION

Utilisation voltage of HEMM has been kept at 6.6 kV to reduce the power losses. Capacitor banks have been provided at substation to improve the power factor to 0.98 and capacitors at big motors are also proposed to reduce the system losses. Other measures have been proposed to conserve the energy.

13.0 WORKSHOP

At present, a unit excavation workshop (for HEMM) and E&M workshop (for other P&M) are in operation. Unit excavation workshop has been divided into two sections and one section was constructed near Quarry-1 and the second section was constructed near Quarry-3. The E&M workshop was constructed by the side of unit excavation workshop near Quarry-3.

In these workshops, the daily maintenance, schedule maintenance as per manufacturer's recommendations, minor repairs, washing of equipment, manufacture of spares to a limited extent are being carried out.

All these workshop building would be demolished during expansion of Kusmunda OCP from 15 Mty to 50 Mty.

As such it is proposed to construct a new unit workshop and store complex keeping all the facilities at one place.

The new unit workshop will have HEMM workshop, E&M workshop and store shed. It will also have erection yard nearby store shed. Two nos. of input workshop have also been prepared nearby two input CHP. This input workshop will carry out only daily maintenance for dozers.

There will be mobile team for repairs maintenance of field machineries. This team will consist of mobile workshop, mobile service team, mobile crane, mobile washing system, DG welding set etc.

14.0 CIVIL CONSTRUCTION

Kusbunda Opencast is an existing project; hence most of residential buildings, service buildings, roads and culverts etc. already exist. However, keeping in view, expansion of its existing capacity upto 50 Mty, additional capital provision for service buildings, residential buildings, roads and culverts etc. have been made in the Project Report based on CI 2505 in May 2013 with reference to 100 base in Delhi as on 1.10.1976.

Additional service buildings envisaged is sub-station and repair shed for dumpers. In residential buildings, additional types of quarters envisaged are 'B' type quarters. The details of capital provision for service buildings, residential buildings, roads and culverts and water supply & sewerage have been given in Appendix-A.2.1, A.2.2, A.8.2 and A.8.3 respectively.

15.0 MANPOWER & PRODUCTIVITY

The requirement of manpower at the rated capacity of 50 Mt of coal and 68.33 Mcum of OB estimated as 4130.

16.0 LAND

The project envisages 4029.38 Ha of land for quarry, industrial and residential complex, safety zone and external dumps etc. This includes 1663.62 Ha of land already acquired for the existing Kusbunda OCP (6 Mty), 10 Ha of land to be acquired for Kusbunda OC Expansion (6-10 Mty), 862.62 Ha of land for Kusbunda OC Expansion (10 to 15 Mty) and 1493.14 Ha of additional land for Kusbunda OC Expansion (15 to 50 Mty).

The break-up of the land is as follows:-

(land in Ha)

SL. NO	PARTICULARS	Existing	INCREMENTAL LAND TO BE ACQUIRED					TOTAL	TOTAL LAND REQUIREMENT
			AGRICULTURE LAND	FOREST LAND	GRAZING LAND	WASTE LAND	SURFACE WATER BODY LAND		
1.	QUARRY AREA	780.00	199.19						
2.	SAFETY ZONE	89.00							
3.	REHABILITATION	69.95							
4.	COLONY	40.25							
5.	EXTERNAL DUMP	325.00							
6.	INFRASTRUCTURE	300.00							
7.	SERVICE ROAD	7.95							
8.	OTHERS	51.47							
	GRAND TOTAL	1663.62	1950.24	190.36	169.86	33.93	21.38	2365.76	4029.38

17.0 ENVIRONMENT MANAGEMENT

The approximate number of affected land oustees in the additional area is 1495. The approximate number of families to be displaced from the villages falling within the additional quarry area has been assessed as 7135. This is in addition to the families already rehabilitated and to be rehabilitating in various rehabilitation colonies of Kusunda OCP. Thus total number of affected land oustees is 3390 and number of families to be displaced from the villages has been assessed as 8200.

Estimated capital investment for the rehabilitation of affected families has been given in Appendix-A.8.1 and Appendix-A.1.

18.0 CAPITAL INVESTMENT

18.1.1 Additional capital with phasing

(Rs. in lakhs)	
Year	Capital
1	53286.93
2	26933.42
3	61173.54
4	149567.64
5	65269.97
6	28780.00
7	74059.46

8	112223.95
9	692.57
10	62826.60
11	40.00
12	274.10
13	50.00
14	40.00
15	49286.40
16	40.00
20	6677.99
Total	691222.57

18.1.2 Basis of price of P&M, Civil works & hiring rate

Price of P&M has been taken from the standard price list published by CMPDI, HQ on June 2012. Prices have been updated upto May 2013 as per escalation rate given in the price list. But in case of Surface Miner and few common equipments, budgetary tentative price has been considered for the purpose of economic evaluation.

The preparation of cost estimates for civil infrastructure is based on prevailing cost index of the area in May 2013. The cost index value has been calculated from the market rate of the area. Considering the prevailing rates of materials and labour in Kasmunda Area, the cost index works out to 2505 w.r.t. 100 base in Delhi as on 1.10.1976.

18.1.3 Capital Requirement (Foreign Component)

Foreign component investment has been envisaged as US \$299.63 million.

Particulars	Option-IV
Foreign capital investment(Milion US \$)	192.38

18.1.4 Capital Investment

Particulars	Option-IV
Capital upto target year (Rs. crores)	5712.94
Specific investment (Rs./t)	1522.46
Specific investment for P&M (Rs./t)	1119.19

18.2 The capacity build-up for the Project would be as follows:-

Year	Coal Prodn. (Mt)	OB Removal Including Band (Mcum)
1	15.00	8.82
2	15.00	20.73
3	15.00	20.73
4	22.00	31.86
5	30.00	42.49
6	37.00	42.59
7	44.00	52.29
8	50.00	67.65
9	50.00	67.80
10	50.00	67.91
11	50.00	67.92
12	50.00	68.13
13	50.00	68.13
14	50.00	68.14
15	50.00	68.25
16	50.00	68.25
17	50.00	68.35
18	50.00	69.24
19	50.00	69.24
20	50.00	69.25
21	50.00	69.24
22	50.00	69.09
23	50.00	53.68
24	27.40	30.82

Within the above mentioned construction period, the project is in commercial readiness as it would be able to yield production on sustainable basis and most of the infrastructure facilities like Road, CHP, Workshop, Service building, Power Supply, Water Supply and Development activities for mine operation would be completed and accordingly capital provision has been made.

18.3 REPLACEMENT CAPITAL

Year-wise phasing of replacement capital is given in Appendix-D.1 column No.3.

18.4 SOURCES OF FINANCE

The project will be financed completely by internal resources.

18.5 COMPLETION COST

As per the latest guidelines, the completion cost of a project will qualify all the following conditions:

- Achievement of coal production capacity of 80% of the rated output.
- Completion of all major facilities and initial mine development work.
- Procurement of major and essential plant & machinery.

18.6 METHOD OF ESTIMATION OF CAPITAL COST**a) Land**

Rate of forest & Govt. land is considered as Rs.10 lakhs per Ha and agriculture land is considered as Rs.20 lakhs per Ha.

b) Civil Construction (alongwith Cost Index)

The preparation of cost estimates for civil infrastructure is based on prevailing cost index of the area in December 2011. The cost index value has been calculated from the market rate of the area. Considering the prevailing rates of materials and labour in Kasmunda Area, the cost index works out to 2505 w.r.t. 100 base in Delhi as on 1.10.1976.

c) P&M

Price of P&M has been taken from the standard price list published by CMPDI, HQ on June 2012. Prices have been updated upto May 2013 as per escalation rate given in the price list.

18.7 COST OF PRODUCTION AT DIFFERENT LEVEL OF PRODUCTION

S.NO	Particulars	TOTAL COST(Rs/Te)
1	Salaries,wages,and benefits	65.78
2	Stores	161.38
3	Power	22.21
4	Miscellaneous expenses	23.15
5	Community development cost	2.00
6	Mine closure cost	3.80
7	Admn expenses	48.99
8	Int. on wkg capital@14.50%	15.82
9	Int. on loan capital@11.50%	0.00
10	Depreciation	99.70

a) Salaries & Wages Cost

The detail of category-wise / scale-wise manpower requirement and year-wise estimated wages cost is given in Appendix-B.1.

Estimated salaries & wages cost for all the options is as shown in the table above.

b) Stores Cost

Stores Cost has been estimated taking into account provision for Repair & Maintenance, POL, Explosive and miscellaneous stores cost. The estimated Stores Cost worked out for all the options is as shown in the table.

c) Power Cost

Estimated Energy Consumption is given in the relevant chapter for Power Supply. The power cost has been taken as Rs.6.0/unit. The average power cost per tonne of coal production works out to be as shown in the table above at 100% level of operation.

d) Misc. Expenditure

This cost has been estimated to cover expenditure on Printing & Stationary, Postage, Telephone, repair & Maintenance of assets other than P&M, Workshop Debit, and Insurance & Taxes for vehicles and other repairs and a further provision has been made for deterioration of coal stock. Miscellaneous expenditure per tonne works out to be as shown in the table above.

e) Administrative Charges

A provision has been made in total revenue cost estimate for Administrative charges based on the Admn. Cost per tonne of coal production as was appearing in the last Annual Report of Coal India Ltd. Total Admn. Cost has been calculated at 100% level and treated as fixed cost. As such for all other estimated level of operation the absolute Admn. cost has been taken as it worked out for 100% level of operation. The Admn. Cost comes to Rs.48.99/Te.

f) Outsourcing cost -

No operation will be carried out on outsourcing basis. However, for initial three years outsourcing cost for coal has been taken as Rs. 65 per tonne of coal output.

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SECL-KUSMUNDA AREA

g) Interest on Working Capital

Interest on Working Capital has been calculated on the basis of 4 months operating expenditure. Rate of interest is taken as 14.50%.

h) Depreciation

Straight line method of depreciation has been provided to arrive at depreciation cost per tonne of coal production. is as shown in the table above.

i) Interest on Loan Capital

Interest @11.5% on loan capital is to be considered for computation based on given Debt Equity Mix. However, loan capital in this project is NIL.

j) Environment related Cost

Rs.22.23/Te of coal has been provided to absorb Environmental related Cost in the project.

k) Mine Closure Cost

Rs.3.80/Te has been provided in the project against Mine Closure Cost.

l) Cost of production per tonne at 100% and 85% level of production has been given as shown below.

S.NO	Particulars	Cost
1	Cost of production at 100% level of production(Rs/Te)	445.88
2	Cost of production at 85% level of production(Rs/Te)	506.31

18.8 SELLING PRICE

The weighted average grade of coal for economic evaluation of the project is considered as 'F' grade, which corresponds to GCV of 4497Kcal/kg. Therefore, the weighted average selling price of coal for economic evaluation of this project has been taken as Rs.860.00 per tonne for ROM processed coal (-) 100 mm.

CALCULATION OF SELLING PRICE

(a) Price of coal per tonne as per GCV norms	-Rs.860.00
(b) Price taken in PR of 'F' grade coal per tonne*	-Rs.817.00
(c) Sizing charges (- 100 mm) per tonne	-Rs. 61.00
(d) Rapid loading chargers by silo	-Rs. 20.00
(e) Selling price considered in PR per te (b+c+d)	-Rs.898.00

*95% of the grade based on borehole data as per norms.

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- 18.9 Profitability (Profit/Loss) Rs./t at 100% and 85% level of production has been as shown below.

S.NO	Particulars	Cost
1	Profitability at 100% level of production(Rs/Te)	452.12
2	Profitability at 85% level of production(Rs/Te)	391.69

- 18.12 Manpower - 4130.
O.M.S - 43.16
18.13 EMS - Rs. 2839.32

18.14 Financial IRR

IRR at 100% & 85% level of production level of production and NPV @12% at 100% and 85% level of production are summarized in the following table.

S.NO	Particulars	Cost
1	Financial IRR at 100% level of production(%)	91.77
2	Financial IRR at 85% level of production(%)	56.86
3	NPV@12% at 100% level of production(Rs Crores)	8784.33
4	NPV@12% at 85% level of production(Rs Crores)	5970.09

18.15 BREAK-EVEN PRODUCTION

It is estimated that the project will achieve Break-even point as shown below for different options.

S.NO	Particulars	
1	Breakeven point (%)	43.10
2	Breakeven point (Mty)	21.55

- 18.16 Desired Selling Price: IRR of the project at 85% level of production is more than 12% .

- 18.17 Completion IRR: Capital Expenditure has been estimated / increased for forward escalation on the Phasing of Initial Estimated Capital. The escalation rate is based on W.P.I. of preceding 12 months.

- 18.18 Sensitivity Analysis - Given in the Appendix-C.4.

18.19 CONCLUSION

The project has been planned with a high degree of mechanisation, in line with the present and forthcoming changes in neighbouring mines as well as in other parts of the country.

The techno-economics have been worked out based on the prevalent norms of productivity, operating cost, spare consumption etc.

For meeting increasing demand of power grade coal in XI Five Year Plan for upcoming thermal power houses, it is essential to approve and implement this project.

PR for Kusunda OC Expansion (15-50 Mty) is giving IRR more than 12% at 85% level of production. The overall grade of coal is "F" (equivalent GCV of 4497 Kcal/Kg), which is easily marketable. As per the guidelines, a Project is economically viable when it achieves more than 12% IRR at 85% level of Production.

Vinod
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