Neyveli Lignite Corporation Limited

welcomes

DELEGATES OF

INDO- US WORKING GROUP ON COAL AND LIGNITE.

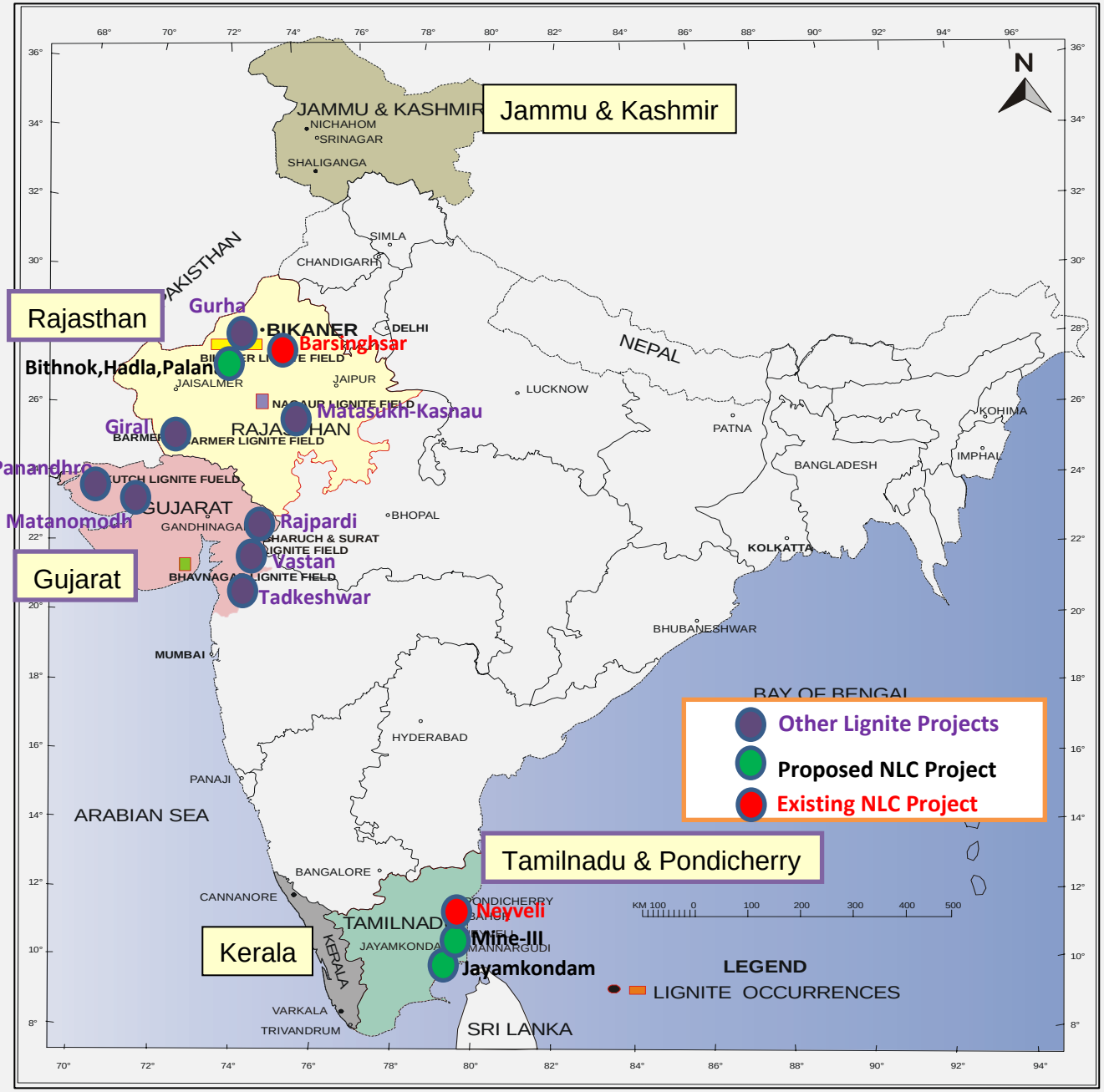
NEYVELI LIGNITE CORPORATION LIMITED

(A MINIRATNA GOVT. OF INDIA ENTERPRISE)

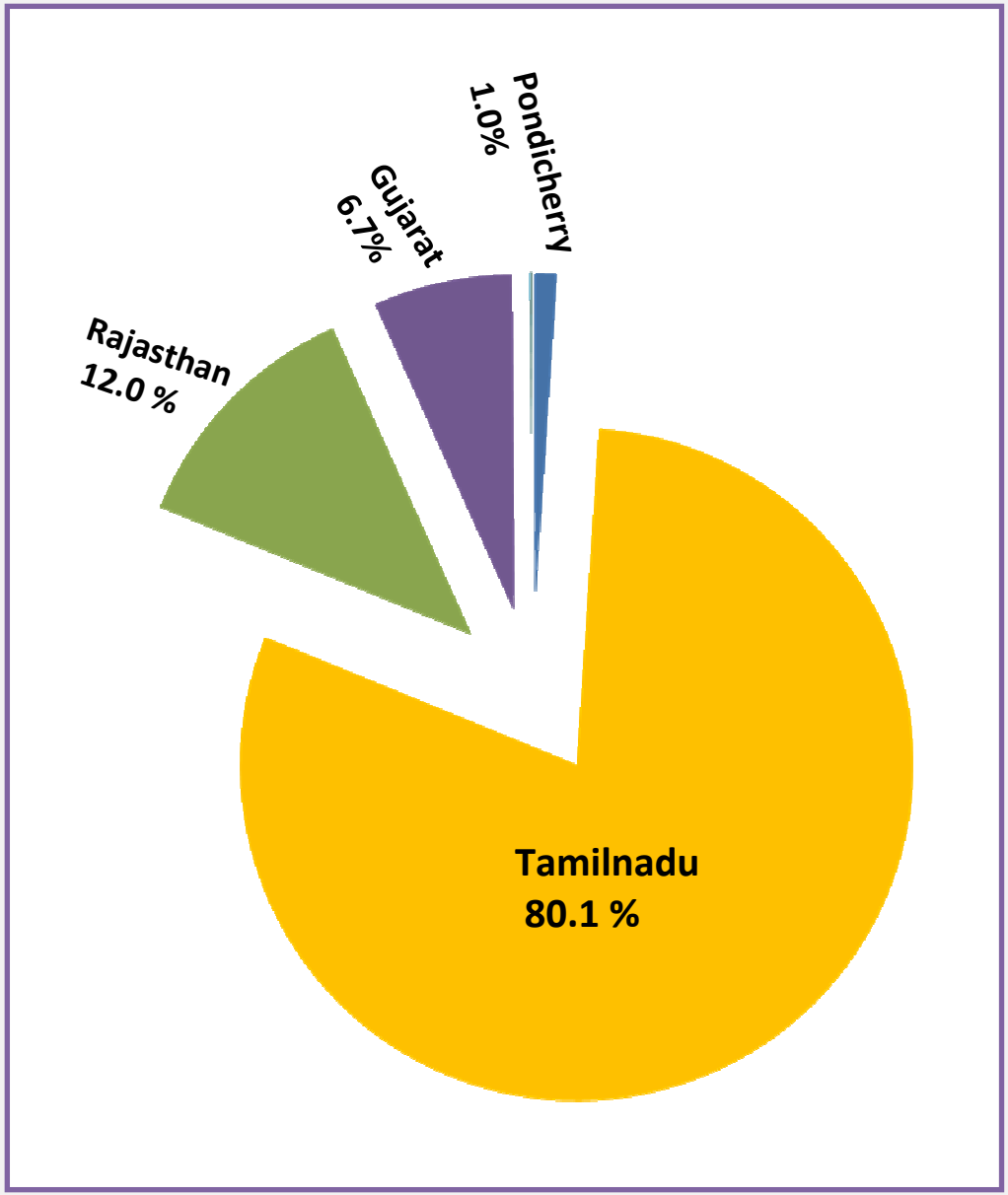
NEYVELI

- Incorporated on 14-11-1956 under Companies act 1956
- The biggest lignite mining company in India.
- 'Mini Ratna' Scheduled 'A' Government of India Enterprise
- Core business : Lignite Mining 26.1 MT per annum and Power Generation 2990 MW
- It has highest credit rating and net worth of Rs.8600 Crores (AR 2009-10)
- Over 50 Years of Service to the nation.
- Poised for many expansion & New Projects in the country.
- Outlooking for venturing into clean Coal technologies viz. UCG & non-conventional energies such as Wind Power & Solar.
- A frontrunner in environmental Care.

LIGNITE MINE PROJECTS IN INDIA



LIGNITE RESOURCES IN INDIA



Total Lignite Reserve: 39.89 BT

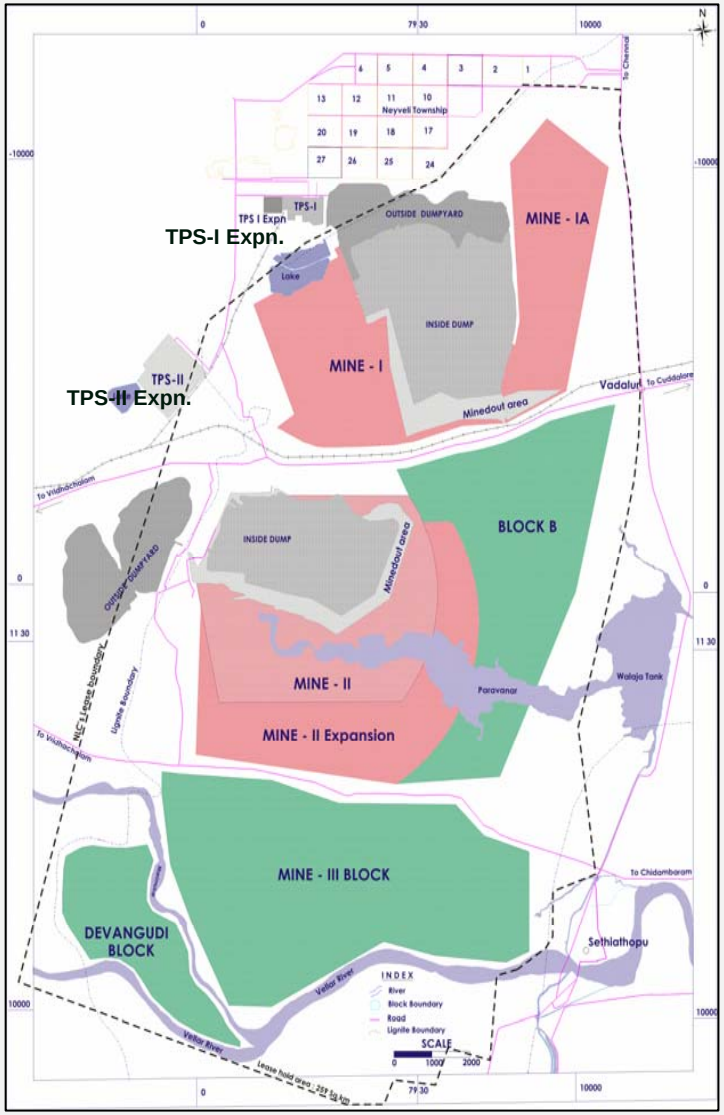
As on 01-04-2010

	Reserves in MT	Proved in MT
Pondicherry	416.61	--
Tamil Nadu	31975.85	3735.00
Rajasthan	4803.93	1167.00
Gujarat	2662.75	1243.00
J & K	27.55	--
Kerala	9.65	--
West Bengal	1.15	--
TOTAL	39897.49	6145.00

QUALITY OF LIGNITE IN NEYVELI MINES (Range)

PROXIMATE ANALYSIS (In-situ condition)		
Moisture	45 – 55	%
Ash	3 – 12	%
Volatile Matter	20 – 30	%
Fixed Carbon	18 – 22	%
Gross Calorific Value	2400-2800	Kcal/Kg
Sulphur	0.5 – 0.75	%

MINES AND POWER STATIONS OF NLC



Four Lignite Mines of capacity 30.6 MT		
Mine	**Lignite Production per annum in MT**	**Over Burden Removal per annum in Mm^3**
Mine-I	10.5	57.75
Mine-IA	3.0	21.00
Mine-II Mine-II Expansion	10.5 4.5	51.00 22.50
Barsinghsar	2.1	11.50

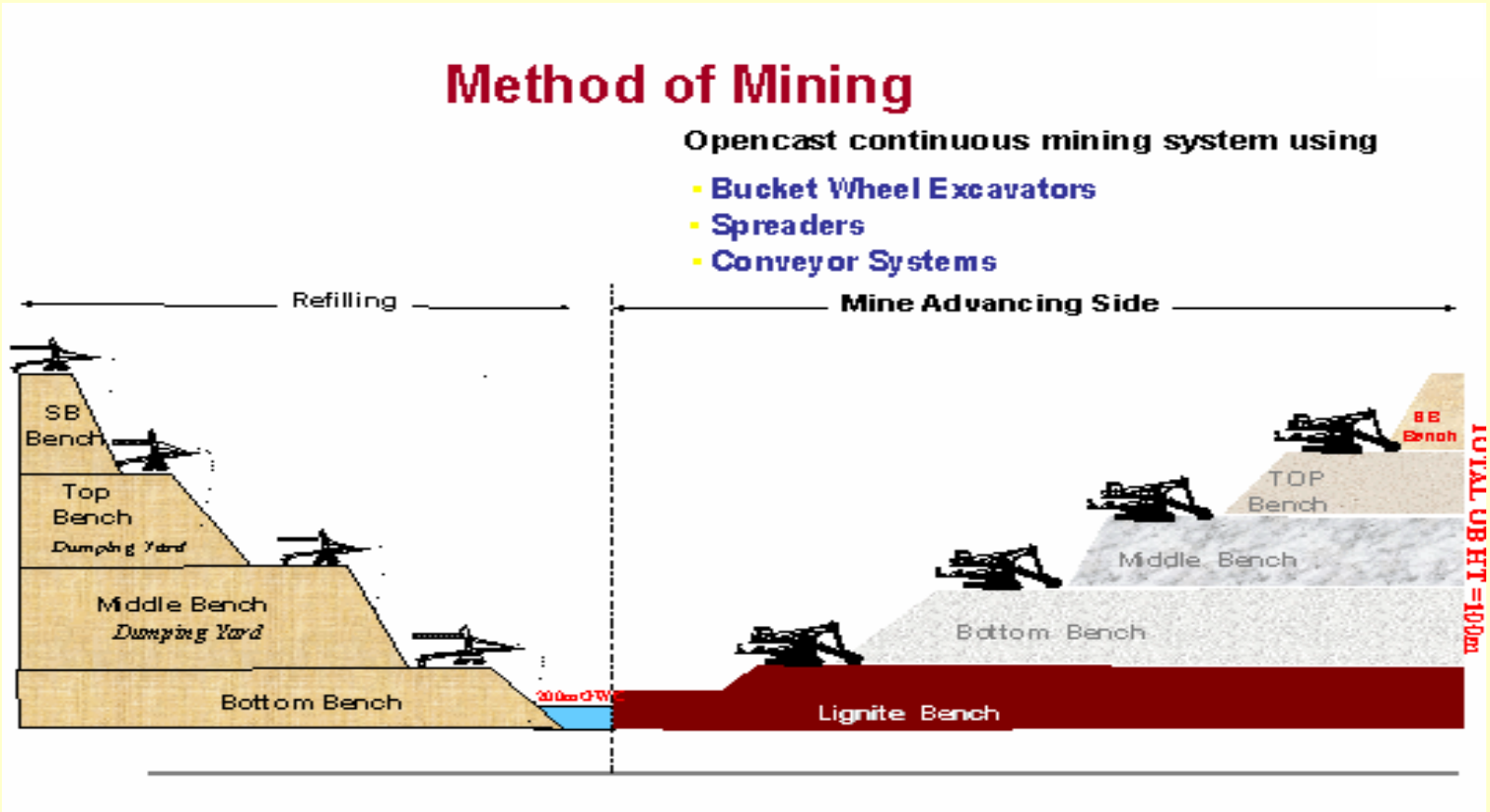
Five Thermal Power Stations of capacity 3240 MW		
TPS	**No. & Unit size**	**Capacity MW**
TPS-I	6x50MW + 3x100MW	600
TPS-II	7x210MW	1470
TPS-I Expansion	2x210 MW	420
TPS-II Expansion *	2x250MW	500
Barsinghsar *	2x125MW	250

* Projects are under implementation

Method of Mining in Neyveli Opencast Mines

The soft sedimentary formation of the strata and the existence of powerful system of confined aquifer rules out the possibility of under ground mining method.

In NLC mines, Specialized Mining Equipment (SME) are used for mining both overburden and lignite. The SME includes equipment such as Bucket Wheel Excavators (BWE), Mobile Transfer Conveyors (MTC), Conveyor system, Tripper and Spreader etc.



BARSINGHSAR MINE AND POWER STATION, RAJASTHAN

CME Machinery in operation

Barsinghsar Lignite Mine 2.1 MTPA

CME Machinery in operation

Barsinghsar TPS 2 x 125 MW

MINE-I

- Capacity-10.5 Million Tonnes of Lignite per annum, with OB excavation of 57.75 Mm3
- Continuous mining technology with Bucket Wheel Excavators, Conveyors and Spreaders.
- Regular Lignite mining commenced in May 1962.
- Meets the fuel needs of TPS-I (600 MW) and TPS-I Expn. (420 MW).

OVERALL VIEW OF BENCHES

BRIDGE TYPE 1400 LITRE BWE IN OPERATION

7 LITRE BWE OPERATION IN LIGNITE BENCH

DUMPING OPERATION OF 20,000 TPH SPREADER

MINE-II

MINE-II :

- Capacity –10.5mt of Lignite /Annum, and OB Excavation of 51Mm^3
- Meets the fuel needs of TPS-II (1470 MW).
- Regular Lignite mining commenced in March 1985.

MINE-II EXPANSION :

- Existing Mine-II Lignite production capacity expanded from 10.5 MTPA to 15.0 MTPA
- OB excavation increased from 51 Mm^3 to 73.5 Mm^3
- Meets the fuel needs of TPS-II Expansion (500MW)
- Lignite Mining commenced in April 2010

MINE-IA

- CAPACITY – 3 MT PER ANNUM OF LIGNITE AND 21 Mm^3 OF OVERBURDEN
- LIGNITE PRODUCTION COMMENCED ON 30th MARCH, 2003

- MEETS THE FUEL REQUIREMENT OF AN INDEPENDENT POWER PRODUCER- M/s ST-CMS AND OTHER INTERNAL USES.
- PROJECT IMPLEMENTED WITHOUT COST & TIME OVER-RUN

PHYSICAL PERFORMANCE DURING 2009-10

PRODUCT	PRODUCTION IN 2009-10	PRODUCTION IN 2008-09	GROWTH IN %
Lignite (MT)	22.34	21.31	4.84
Power Generation (MU)	17657.94	15767.98	11.99

- Total Overburden removal of 1594.25 LM3 from all the mines put together in 2009-10.

- Supply of Power from all thermal station put together 14827.5 MU in 2009-10.

NLC'S PROJECT COMMISIONED IN 2010-11 & UNDER IMPLEMENTATION

Sl. No	Name of the Project	Capacity	Project Cost in Crores
Project Commissioned in 2010-11:			
a.	Lignite Mine II Expansion at Neyveli	4.5 MT/A	2295.93
b.	Barsingsar Lignite Mine	2.1 MT/A	254.60
Project Under Implementation:			
c.	Thermal Power Station II Expansion at Neyveli (Completion -June-2011)	500 MW (2 X 250 MW)	2453.57
d.	Barsingsar Thermal Power Station (Completion -June-2011)	250 MW (2 X 125 MW)	1626.09

NLC'S PROJECT UNDER FORMULATION

Sl. No	Name of the Project	Capacity	Project Cost Crores
a.	Lignite Mine at Jayamkondam in Tamilnadu	13.5 MT/A	8750.00
b.	Thermal Power Project at Jayamkondam in Tamilnadu	1600 MW (2 X 800 MW)	9433.77
c.	Bithnok Lignite Mine in Rajasthan	2.25 MT/A	385.66
d.	Bithnok Thermal Power Project in Rajasthan	250 MW (1 X 250 MW)	1670.54
e.	Hadla Lignite Mine in Rajasthan	1.9 MT/A	342.26
f.	Barsingsar TPS Extension	250 MW	1667.86
g.	New Thermal Power Project at Neyveli	1000 MW (2 X 500 MW)	4954.95
h.	Lignite Mine III at Neyveli	8.0 MT/A	5000.00
i.	Thermal Power Station III at Neyveli	1000 MW (2 X 500 MW)	5000.00
j.	Coal based TPS at Jharkand	1000 MW	5000.00
k.	Wind Power	50 MW	313.00
l.	Solar Power	25 MW	375.00
m.	TPS at Orissa with linked Talabira coal Mine	2000 MW	7000.00
	Total	7175 MW/ 25.65 MTPA	49893.04

NLC'S JOINT VENTURE PROJECTS

Sl. No	Name of the Project	Capacity	Project Cost in Crores
I.	Projects Under implementation:		
a.	Coal based Tuticorin Thermal Power Station	1000 MW (2 X 500 MW)	4909.54
b.	Talabira coal Mine	(20.0 MTPA)	475.00
	Sub Total (I)	1000 MW	5384.54
II.	Projects under Formulation:		
a.	Coal Based Thermal Power project in Uttar Pradesh	2000 MW	10000.00
b.	Lignite Mine in South Gujarat	8.0 MT/A	1700.00
c.	Thermal Power Project in South Gujarat	1000 MW (4 X 250 MW)	4700.00
	Sub Total(II)	3000 MW/ 8.0 MTPA	16400.00
	Grand Total (I+II)	5000 MW/ 8.0 MTPA	21784.54

SUMMARY OF NEW PROJECTS

Sr.No	PROJECTS	CAPACITY	PROJECT COST IN CRORES
1	NLC's Projects under Implementation	750 MW	4079.66
2	NLC's Projects under Formulation	7175 MW/ 25.65 MTPA	49893.04
3	NLC Joint Venture Projects under Implementation	1000 MW	5384.54
4	NLC Joint Venture Projects under Formulation	3000 MW/ 8.0 MTPA	16400.00
	TOTAL	**11925 MW/ 33.65 MTPA**	**75757.24**

AGENDA FOR

INDO-US WORKING GROUP

ON COAL AND LIGNITE

BY NLC

AGENDA

1)Clean Coal Technologies (Coal Bed Methane & Underground Coal Gasification)

2)Removal of Moisture in raw lignite while stacking before feeding to Thermal Power Stations

3)Lignite based Integrated Gasification Combined Cycle (IGCC) Power Plant

4)Management of Saline ground water from Bithnok Mine, Rajasthan

5)Seepage Water Control on Overburden Benches

AGENDA - I

CLEAN COAL TECHNOLOGIES

AGENDA - I CLEAN COAL TECHNOLOGIES

1. Neyveli Lignite Corporation Ltd, being a large power producing company, desires to develop various source of energy.
2. Till now entire power generation of NLC is through lignite mined from its mines
3. In order to diversify and also with a view to exploit vast deep seated and un-mineable lignite resource, NLC started its endeavour to enter into field of Underground Coal Gasification and CBM from lignite.

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CLEAN COAL TECHNOLOGIES

4. To gainfully utilize the vast potential of lignite deposits which are uneconomical for conventional mining, the following Non-conventional/clean coal technologies are considered.

a) Coal Bed Methane (CBM)

b) Coal Mine Methane (CMM)

c) Underground Coal Gasification (UCG)

Contd…

a) COAL BED METHANE (CBM)

Tamilnadu Lignite Field As CBM Resource:

Tamilnadu has the largest established resource of Lignite in country. These are mainly developed in the following four sub basins:

1. **Bahur**
2. **Mannargudi**
3. **Ramnad**

Contd…

CBM Prospects – Ramnad Basin, Tamilnadu

1. Based on the regional exploration carried out in Ramnad Basin, a lignite potential of around 1500 million tonnes is anticipated in an area of 200 sq.kms in the areas Rajasingamangalam, Misal, Satthanur, Bogalur, Sikkal of Ramanathpuram district.

2. Lignite occurs at deeper depths between 300 to 500 metres with an average thickness of 6 metres, mostly single seam.

3. Groundwater in Ramnad Lignite Field occurs in Water Table, unconfined and confined conditions.

4. The quality of Groundwater is good to acceptable quality for Irrigation and domestic uses.

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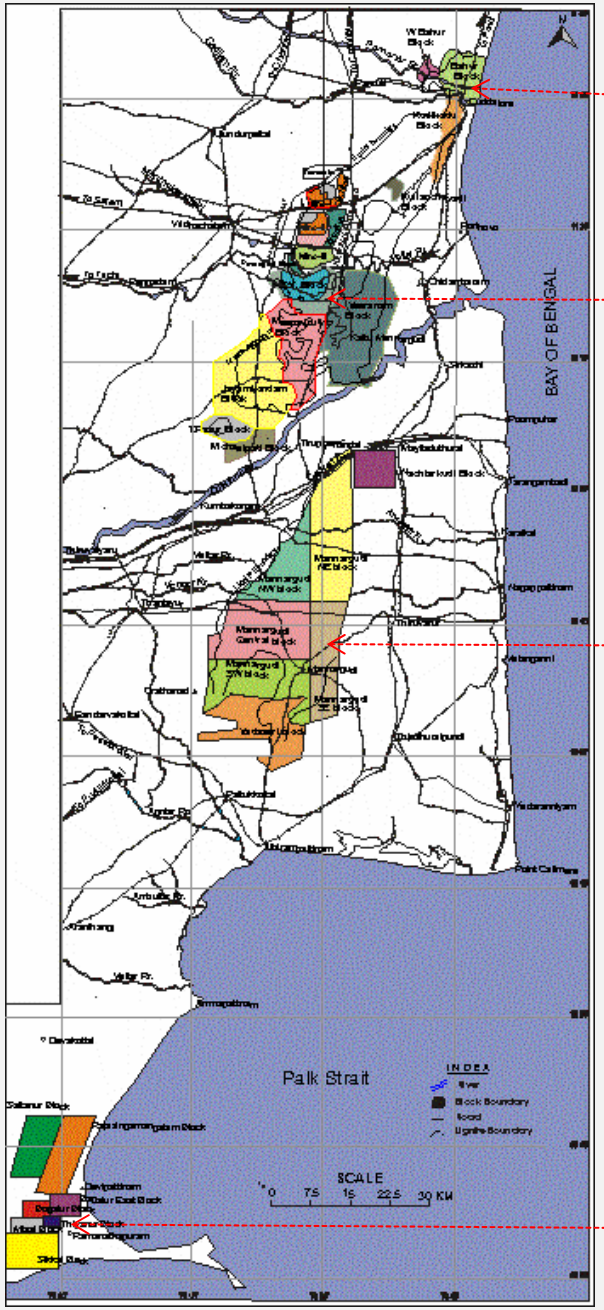
LIGNITE BASINS IN TAMILNADU & PONDICHERRY STATE



Sub-Basin	Geological Reserves in MT
Bahur	600
Neyveli	5500
Mannargudi	23000
Ramanad	1500

5) The lignite seams occur at deeper depths, the resource could not be exploited through conventional mining, hence alternate mining technology like Under Ground Gasification (UCG) or extraction of Coal Bed Methane is proposed to harness the energy resources.

6) Ramnad Basin Lignite Field is geologically similar to powder River Basin of Wyoming State in USA, where CBM development activities are going on.

7) Assistance is required in the following field:
   a) Exploration and Estimation of Gas in Place (GIP)
   b) Methods to extract methane from coal/lignite
   c) Expertise in UCG technology

Contd…

b) DEVELOPMENT OF COAL MINE METHANE (CMM) IN NLC'S LEASEHOLD AREA

1) In Neyveli basin, total available reserves of Lignite for CMM Development is 5500 MT.

2) Geological setup is similar to Powder River basin of USA.

3) 2400 MT reserves are already in NLC's Leasehold. Additionally 1000 MT in Jayamkondam is applied for Lease.

4) The above areas can be taken for immediate studies.

5) The above blocks have been considered for CMM assessment

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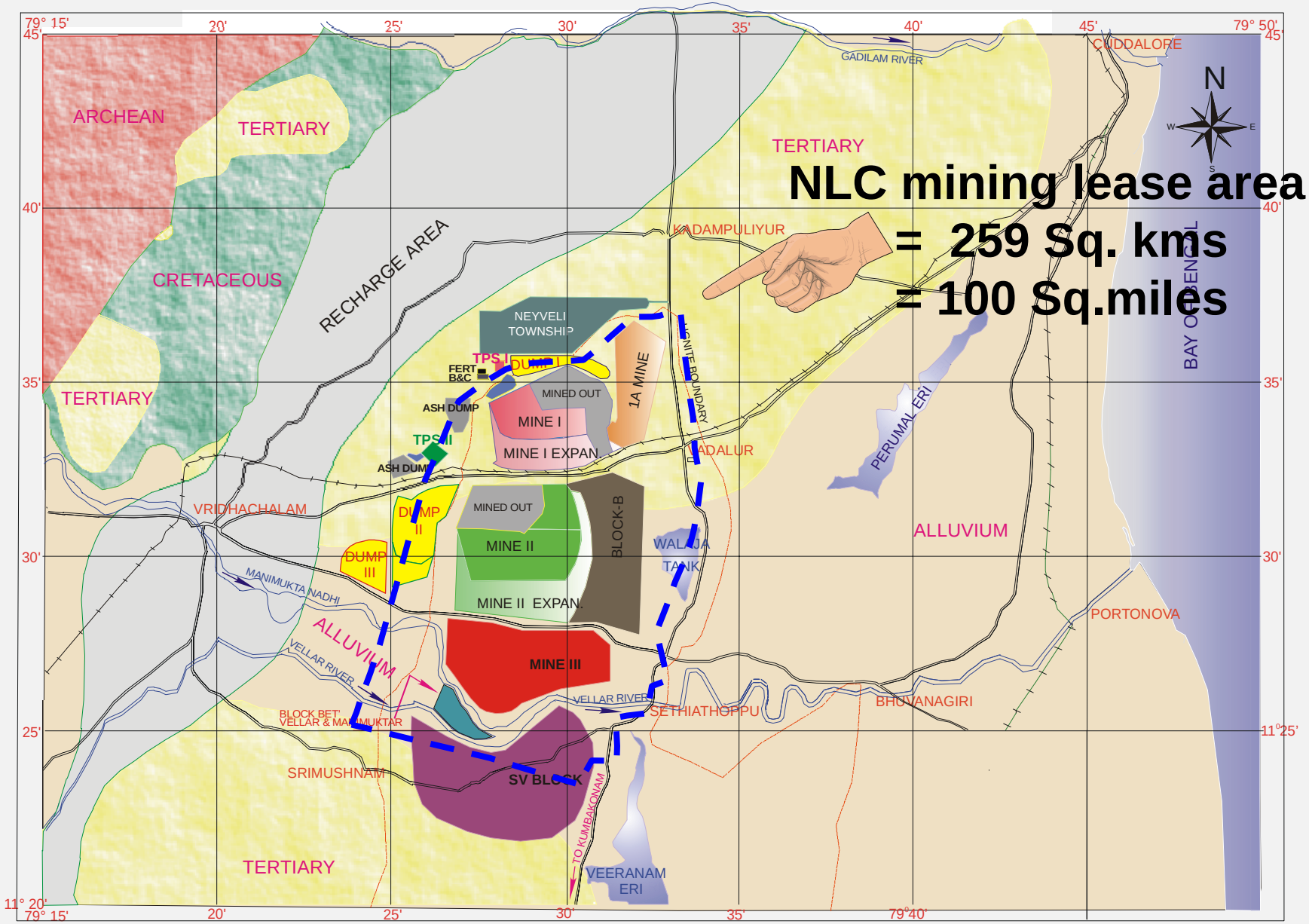
NLC's Leasehold area



Assistance is required in the following field:

1) **Exploration and Estimation of Gas in place (GIP).**

2) **Methods to extract Methane from Coal/Lignite.**

3) **Assistance required from USA for Exploration and Development of Coal Mine Methane in Neyveli Lignite Mines Area.**

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c) UNDERGROUND COAL GASIFICATION (UCG)

1. Earlier a project titled “Underground Coal Gasification” (UCG) and its utilization for power generation studies in lignite deposits in Rajasthan” was proposed to be implemented by Neyveli Lignite Corporation Limited in association with internationally reputed UCG expert agency.

2. Raneri lignite block located in Bikaner District of Rajasthan State having reserve of 34 MT was identified for the project. The details of the block are as follows:

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ABOUT RANERI

LOCATION	**The Block is situated about 80 Kms SW of Bikaner, Rajasthan along the NH No.15, covered in Survey of India Topo Sheet No. 45 A/10**
OVERBURDEN	**Overburden consists of wind blown sand, Kanker, variegated clays, fuller's earth, friable sandstone, shale, generally ranges from 75 to 115 mts. Average thickness is 97 metres.**
LIGNITE	**Lignite generally occurs as single seam, thickness ranges from 0.42 to 14 metres. Average thickness is 3.59 metres.**
LIGNITE QUALITY	**Moisture: 45 %, Ash : 7.2 %, VM : 25.58%, FC : 22.11%,CV : 3092 K.Cal/kg.**
LIGNITE RESERVES	**Geological : 33.92 MT, Within 1:15 - 4.61 MT, Within 1:10 - 2.54 MT**
Roof & Floor Strata	**Mostly clays**
Other details	**Water level 90 to 110 metre bgl, water is Potable Detailed hydro-geological studies required.**

Contd…

- The matter was also discussed in the earlier Indo-US Working Group meeting for arranging a consultant.

- Now, the Ministry of Coal, Govt. of India has advised to go for competitive bidding to develop UCG project by the UCG developer.

- Accordingly Central Mine Planning and Design Institute (CMPDI) has taken action to invite International Competitive Bidding for selection of Developer for Commercial Development of Underground Coal Gasification in two Coal blocks of Coal India Limited and one Lignite block (Raneri) of Neyveli Lignite Corporation Limited.

- It is requested, the US UCG Operators to come forward to develop the UCG projects in India through competitive bidding.

AGENDA - II

REMOVAL OF MOISTURE IN RAW LIGNITE WHILE STACKING AT BUNKER SITE BEFORE TRANSPORTATION TO THERMAL POWER STATIONS

Agenda II –REMOVAL OF MOISTURE IN RAW LIGNITE WHILE STACKING AT BUNKER SITE BEFORE TRANSPORTATION TO THERMAL POWER STATIONS

NLC is operating three pit head Thermal Power Stations (TPS):

Sr. No.	Mine	Mine Capacity Million Tonnes	Mine Bunker Capacity in Lakh Tonnes	Linked TPS	TPS Capacity (MW)	Lignite requirement to TPS per day Tonnes
1	Mine-I & Expansion	10.5	3.0	TPS - I	600	18000
2	Mine-IA	3.0	1 .0	TPS – I Expansion	420	10800
3	Mine-II & Expansion	10.5	3.0 (Mine)	TPS - II	1470	35000
		4.5	1.4 +1.05 (TPS)	TPS – II Expansion (Under Construction)	500	10000

Contd..

- **Neyveli lignite contains 50 to 55% Insitu moisture. While handling of lignite during monsoon, lignite becomes slushy.**

- **Difficulties faced during rainy season are:**
  - **Transporting of lignite to Surface Bunkers.**
  - **Surface Bunkers to TPS.**
  - **During pulverizing the lignite before feeding to boilers.**

- **Reduction of 10 to 20 % Moisture in lignite at bunker is required to minimize the difficulty before transportation to TPS and during pulverizing.**

- **Suitable technology/equipment for reduction of moisture in lignite bunker at mine site is requested.**

AGENDA – III

LIGNITE BASED INTEGRATED GASIFICATION COMBINED CYCLE (IGCC) POWER PLANT

Agenda III – LIGNITE BASED INTEGRATED GASIFICATION COMBINED CYCLE (IGCC) POWER PLANT

- **Total installed capacity of the power stations at Neyveli is 2940 MW. Average specific lignite consumptions is 1 kg per kWhr**

- **The major challenges being faced are:**
  - **Higher fuel cost**
  - **More *CO2* emissions due to low conversion efficiency.**

- **Proposed new power plants are required to improved efficiency which includes Supercritical steam plants or Integrated Gasification Combined Cycle (IGCC) Power plant.**

- **For efficient utilization of lignite and for better environmental care, it is proposed to implement advanced power generation technology.**

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Integrated Gasification Combined Cycle (IGCC) is an advanced power generation technology that offers substantial increase in efficiency over current steam plant technology:

a) In IGCC, the lignite is first gasified and then the gas is burned in a gas turbine to produce electricity.

b) Exhaust heat in the gas turbine is used to generate steam to drive a steam turbine to produce additional electricity (heat recovery boiler).

c) Overall, the conversion efficiency of an IGCC power plant is about 10 to12% higher than a conventional steam power plant, with correspondingly lower CO2 emission intensity.

d) IGCC power plant also offers lower pollutant emissions than conventional plants.

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e) **Study on implementation of lignite based Integrated gasification combined cycle (IGCC) are on the anvil.**

f) **For wet lignite, IGCC requires the addition of a drying process before the lignite can be gasified.**

To establish lignite based IGCC pilot power plant (10 MW) at Neyveli, expertise is required for design, fabrication, supply, erection, commissioning, trial runs, etc.

AGENDA - IV

MANAGEMENT OF SALINE GROUND WATER FROM BITHNOK LIGNITE MINE, RAJASTHAN

Agenda IV –MANAGEMENT OF SALINE GROUND WATER FROM BITHNOK LIGNITE MINE, RAJASTHAN

NLC proposed to develop a 2.1 MT/annum lignite mine at Bithnok located in Bikaner district , Rajasthan with linked power station of 250 MW.

Lignite seam is associated with saline aquifers.

Total Dissolved Solids (TDS) range of ground water : 12000 PPM to 15000 PPM.

Electrical conductivity value range: 17000 Micro Mohs to 21000 Micro Mohs.

Chloride (as Cl) range: 6800 PPM to 7200 PPM.

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- **For safe mining operation, around 5000gpm (32700 Cubic metre/day) of saline water required to be pumped out.**

- **As per statutory requirement, the saline aquifer water has to be pumped and transported to a salt lake located about 350 Kms away from the mine area, which may be highly expensive**

or

- **the saline ground water should be treated and used/ safely disposed without affecting the environment.**

- **As per Bureau of Indian Standards (BIS), the permissible limit of chloride for potable water is 1000 PPM.**

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- **Desalination plant is proposed at mine site and utilize the water for drinking/industrial use.**

- **The economic factors determine the capital and operating costs for desalination; capacity and type of facility, location, feed water, labor, energy, financing and concentrate disposal.**

- **Expertise required for low-cost technology for desalination of saline mine water for drinking/industrial use and management of disposal of brine sludge.**

AGENDA - V

SEEPAGE WATER CONTROL IN OVERBURDEN BENCHES

AGENDA – V SEEPAGE WATER CONTROL IN OVERBURDEN BENCHES

SALIENT FEATURES OF MINE WORKING AT NEYVELI

Overburden Thickness	:72 to 110 m
Lignite Thickness	:10 to 23 m
Number of Excavation Benches	:5
Height of Excavation Bench	:20-25 m

Method of Working:

Open cast mining utilizing Specialized Mining Equipments like Bucket wheel Excavators, (1400 lit & 700 Lit capacity) for Excavation, belt conveyors for transportation & spreaders (20000 & 11000 T /hr) for dumping.

GEOLOGY & GEO HYDROLOGY

I. The main Overburden formations consists of argillaceous & Ferruginous sandstone and clays with aquifer sands.

II. The sandstones constitute a major portion of the overburden and they are fine to coarse grained.

III. The annual rainfall varies between 860 mm and 2070 mm with an average of 1200 mm.

IV. A huge reservoir of ground water exists below the entire lignite bed, exerting an upward pressure of 6 to 8 kg/cm2, which is tackled by an effective ground water management system.

V. The pressure of the artesian aquifer is being controlled by pumping (around 49,000 gallons per minute).

VI. Drawdown requirement depends upon the disposition of the bottom of lignite.

SEEPAGE WATER CONTROL IN OVERBURDEN BENCHES

I. In the Neyveli Lignite Basin a Semi-confined aquifer is persisting apart from the sub-surface water and the confined aquifers. It gives lot of problems in excavation, transportation and dumping of Overburden and lignite.

II It was observed that similar situation has been prevailing in Jewett Mine of Westmoreland Coal company in Texas State. The methodology seems workable at Neyveli also to control the seepage water in the overburden benches.

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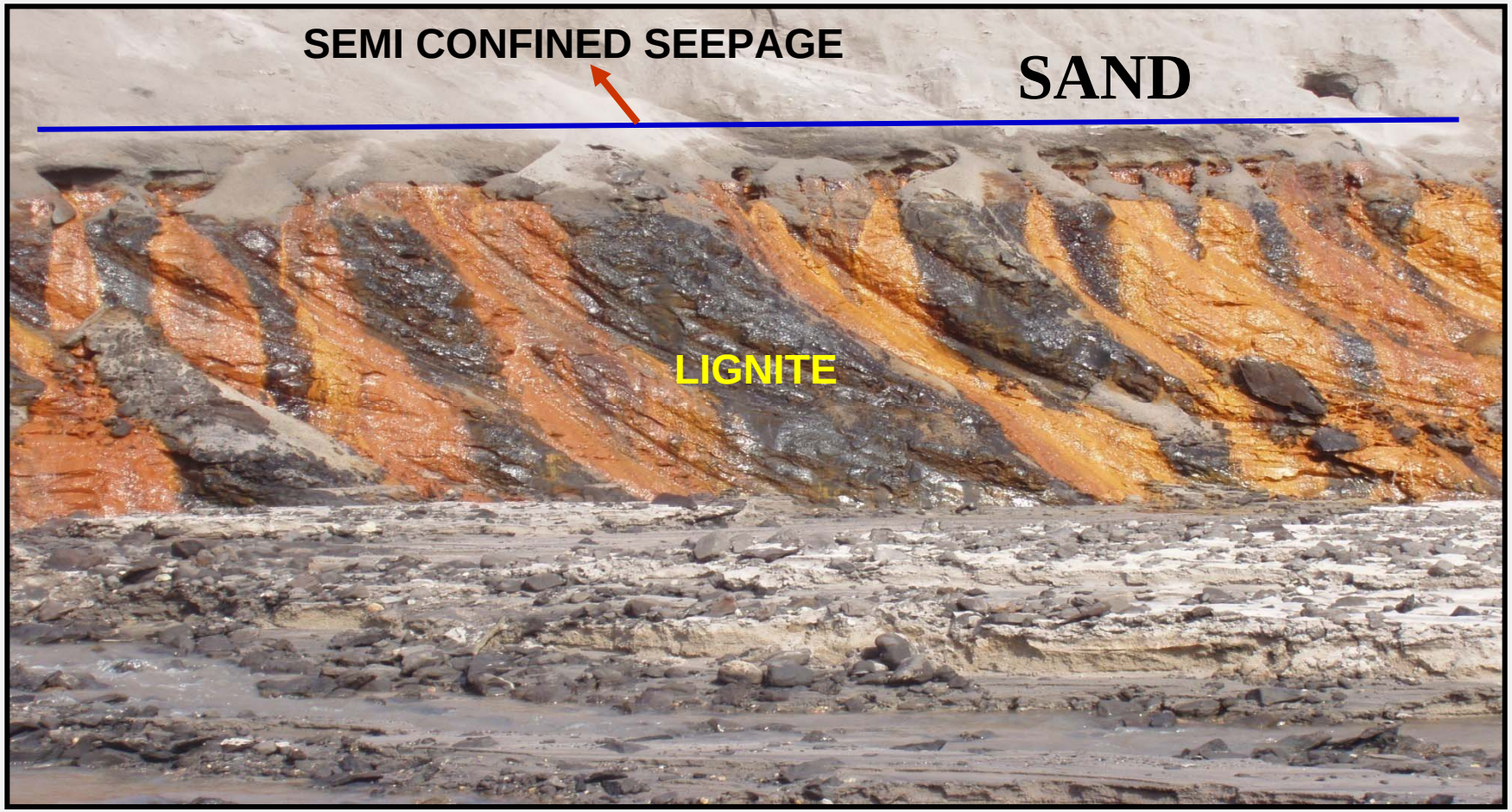
SEEPAGE WELL DETAILS (MINE – II)

Quantity of Seepage is about 1600 GPM.. Totally 39 borewells of diameter ranging 24/12 inches have been equipped with 50, 100 and 200 GPM pumps. Thereby the seepage has been brought down from 1600 GPM to 400 GPM.

The distance between well to well is 50 to 100m and distance between rows is 200m

MINE II – Water Seepage In The Middle of Top Overburden Bench

MINE-II - Lignite Bench L1
Semi Confined Seepage above Top of Lignite



SEEPAGE WATER FROM UPPER LAYERS FLOWING ACROSS THE LIGNITE BENCH


SEEPAGE WELLS

- **Though NLC is carrying out the seepage control measures, heavy seepages in the mines after monsoon period severely affects the mining operation.**

- **Expertise is required to overcome the seepage and semi-confined aquifer water problem by evolving suitable method considering the experience gained in similar condition in USA mines.**

Thank you all