It is a privilege and honor for me to deliver an address in the 5th Annual conference on “Mining Technology in India”. The mining technology is growing in a faster phase globally and India is quick enough to absorb and adopt few of them for the sustainable growth of the nation. Neyveli Lignite Corporation, the organization to which I belong, is adopting the state of art Specialized Mining technology for winning of lignite for the past six decades.

Every Nation’s growth depends upon the growth of energy sector. At present, Coal and Lignite together account for 58% of energy needs of India and the rest is met through Hydel, Nuclear and renewal energy sources. The lignite deposits available in the States of Tamilnadu, Gujarat and Rajasthan are exploited for power generation as it is the best economic & viable option for this Region.

Geological resource of lignite:

In India, predominantly lignite occurs at Tamilnadu, Rajasthan and Gujarat.

- India’s reserve: 44.11 Billion Tonnes
- Tamil nadu: 35.21 Billion Tonnes
- Rajasthan: 5.73 Billion Tonnes
- Gujarat: 2.72 Billion Tonnes
- Other States: 0.45 Billion Tonnes

A brief about NLC:

Neyveli Lignite Corporation Limited (NLC), Neyveli is the pioneer in lignite mining, having the expertise both in mining and power generation for more than five decades. NLC is identified as Nodal Agency for exploration of Lignite in the country. NLC, as the nodal agency for lignite, creates and maintains a database on lignite resources of India and mining information.

At present NLC operates three open cast lignite Mines at Neyveli and one at Barsingsar, Rajasthan with a total mining capacity of 30.6 MTPA with associated waste removal of 165.85 Million Cubic meter and pumping of water to a tune of about 110 MCM/year. These mines are linked to five Lignite based Thermal Power Plants with Power Generation capacity of 3240MW.
Mines and Lignite Power Stations of NLC:

<table>
<thead>
<tr>
<th>Mines</th>
<th>Lignite Production capacity per annum in MT</th>
<th>Over Burden Removal per annum in Mm³</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mine-I</td>
<td>10.5</td>
<td>57.75</td>
</tr>
<tr>
<td>Mine-IA</td>
<td>3.0</td>
<td>21.00</td>
</tr>
<tr>
<td>Mine-II</td>
<td>15.0</td>
<td>78.00</td>
</tr>
<tr>
<td>Barsingsar</td>
<td>2.1</td>
<td>9.10</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>TPS</th>
<th>NO. &amp; UNIT SIZE</th>
<th>CAPACITY MW</th>
</tr>
</thead>
<tbody>
<tr>
<td>TPS-I</td>
<td>6x50MW + 3x100MW</td>
<td>600</td>
</tr>
<tr>
<td>TPS-II</td>
<td>7x210MW</td>
<td>1470</td>
</tr>
<tr>
<td>TPS-I Expansion</td>
<td>2x210 MW</td>
<td>420</td>
</tr>
<tr>
<td>TPS-II Expansion *</td>
<td>2x250MW</td>
<td>500</td>
</tr>
<tr>
<td>Barsingsar</td>
<td>2x125MW</td>
<td>250</td>
</tr>
<tr>
<td>NTPL</td>
<td>2 X500 MW</td>
<td>1000</td>
</tr>
<tr>
<td>Solar Power Plant</td>
<td>10 MW</td>
<td>10</td>
</tr>
<tr>
<td>Wind</td>
<td>51 MW</td>
<td>51</td>
</tr>
</tbody>
</table>

Future Projects – Power & Mining:

- Mine-II expansion -15 Million Tonnes per annum to 18.75 MTPA.
- TS-II expansion -1970MW to 2470MW.
- Mine-III and power station-III at Neyveli -9 MTPA, 1000MW.
- Thermal Power Station Second Expansion.
- Lignite mine and power station in Bithnok-2.1MTPA, 250MW.
- R&D for tapping energy through underground coal gasification, exploring deep lignite deposits at Sindhari and Kurla and Raneri in Rajasthan.
- Barsingsar expansion & Hadla -1.9MTPA & 250MW power plant.
- Neyveli Uttar Pradesh Power Project Limited (NUPPL)-1980MW.
- Pachwara South Coal Block
- Sirkali power project - 4000MW.
- Solar total planned - 4000MW
- Barsingsar solar power project-15MW.
- Wind total planned -250MW.
### NLC Vision - 2025:

<table>
<thead>
<tr>
<th>Sl. No</th>
<th>Project</th>
<th>Existing Capacity</th>
<th>Addition Proposed</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Lignite (MTPA)</td>
<td>30.6</td>
<td>26.3 (MI &amp; IA- 4, Bithnok, Hadla &amp; Barsingsar – 4.55, MII Expn – 3.75, MIII – 9, Jayankondam – 5- being explored)</td>
<td>56.9</td>
</tr>
<tr>
<td>2</td>
<td>Coal (MTPA)</td>
<td>0</td>
<td>31.5 (Pachwara -11- allotted Talibara II &amp; III – 20.5 – allocated)</td>
<td>31.5</td>
</tr>
<tr>
<td>3</td>
<td>Power - Lignite Based (MW)</td>
<td>3240</td>
<td>2400 (NNTPP – 1000, TSII 2nd Expn – 1000, Bithnok &amp; Barsingsar – 500, Jayankondam – 500, Retiring of TPSI – 600)</td>
<td>5640</td>
</tr>
<tr>
<td>4</td>
<td>Power - Coal Based (MW)</td>
<td>1000</td>
<td>5940 (NUPPL - 1980, Sirkali – 3960 – Land acquisition under process)</td>
<td>6940</td>
</tr>
<tr>
<td>5</td>
<td>Power - Renewable (MW)</td>
<td>31</td>
<td>4220 (Barsingsar – 125, Neyveli -130, Wind – 30 Andaman – 50, wind – 200, other states – 3680)</td>
<td>4251</td>
</tr>
<tr>
<td>6</td>
<td>Acquisition of Power Assets (MW)</td>
<td>0</td>
<td>3000 (DVC Offer – 1200- Due diligence under process)</td>
<td>3000</td>
</tr>
<tr>
<td></td>
<td><strong>TOTAL</strong></td>
<td><strong>4271</strong></td>
<td><strong>15560</strong></td>
<td><strong>19831</strong></td>
</tr>
</tbody>
</table>

### Mining Practices at Neyveli:

Lignite is associated in sedimentary type of formation of loose unconsolidated strata comprising of sand stones and clay. The floor and roof underlining the lignite seam are weak and hence it is not contusive for Underground mining. Hence, Neyveli lignite mine is adopting Open Cast method of mining.

Lignite mining at Neyveli commenced about six decade ago by NLC. The lignite mining at Neyveli has twin challenges of handling of Overburden with a tune of 6 Cu. M per tonne of Lignite and adverse hydrological conditions requiring pumping of 8 to 10 Cu. M of water. The lignite is underlined by powerful artisan aquifer which extends around 400 mts below lignite with an upward thrust of 3 to 5 Kg/cm2. Depressurization of aquifer is being done to control the upward pressure of water for safe mining. The various challenges in lignite
mining are overcome at Neyveli by adopting Environment Friendly Mining Practices coupled with the Specialized Mining technology.

In Neyveli overburden strata there are sporadic occurrence of hard sand stones which have cutting resistance far exceeding the cutting force that could be exerted by Bucket Wheel Excavators. At present this problem is tackled by selective blasting and mining by conventional mining equipments.

In order to have better productivity NLC would like to have technique to identify and locate the hard strata in advance from the eminent participants of this Conference.

Continuous Mining Technology using Bucket Wheel Excavators (BWE), Belt conveyors and Spreaders was adopted. The BWE and transporting media – belt conveyors are electrically operated and are Superior in Environment Friendliness as its Carbon Emissions are Negligible with Low Heat Emissions compared with diesel operated equipments / machineries.

The total SMEs deployed presently at NLC:

1) 1400 L BWEs : 13 Nos
2) 700 L BWEs : 16 Nos
3) 20000 TPH Spreader : 4 Nos
4) 11000 TPH Spreader : 7 Nos.
5) 5000 TPH Spreader : 4 Nos
6) 2400 mm Conveyor : 27.34 Km
7) 2000 mm Conveyor : 61.80 Km
8) 1500/1600/1800 mm Conveyor : 34.08 Km

The transfer and adoption of Bucket Wheel Excavator technology at Neyveli was a landmark event, and it has helped the company to reap profits during its life. In Neyveli, the mining operation is being carried out by excavating the formation in benches, approximately 18-20 m height, using the Specialized Mining Equipments (SME) namely the Bucket Wheel Excavators, transporting the excavated solid waste through Conveyor belts and dumping the material in the dump yard and back filling in the void area generated after advancement of mine. The lignite is fed to pit head thermal power stations for generation of power.

The successful deployment of BWEs was made possible by adopting suitable modifications in the design of the buckets, teeth and structural parts to tackle the hard and abrasive nature of the Neyveli Overburden strata consisting of Cuddalore Sandstone which is hard compared to the German Lignite Mines.

Bucket Wheel Excavators, the main production equipments in the continuous mining system of NLC are severely strained due to the hard nature of the sandstone, resulting in
reduced teeth life, damages to differential & other gears, the slewing mechanism and the structures with consequent reduction in efficiency of operation. Yet another factor is the reduction in the hourly output of production which varies inversely as the square of the hardness of the strata.

In spite of large scale experimenting on teeth design & finally providing Tungsten Carbon tips with hard-faced sides on the teeth and modifications on the structural side of the bucket wheel excavators, the strain on the machine was not reduced appreciably.

Hence Blasting of the overburden at Neyveli mine to loosen the strata for efficient handling by bucket wheel excavators has become a necessary event. Loosening the hard strata has become beneficial to the bucket wheel excavator by reducing strain on it and thereby increasing the rate of output.

Mining operation at NLC like any other mining operation involves in generation of mass mine waste, altering the existing landscapes, alterations to drainage patterns. As a result of mining, significant areas of land are degraded and existing ecosystems are replaced by undesirable wastes. To mitigate the impact on environment a structured and adoptable environment management practice is being continuously cultivated at Neyveli.

As a responsible mine owner, NLC is committed in the best practice of environment management with prime focus on concurrent reclamation for protecting the land environment. The SME technology facilitates continuous reclamation by re-filling the voids through conveyors facilitating restoration of the area matching with the advancement of the mining front.

NLC not only concentrates on production and profitability of the company but also accords highest priority to statutory compliance with respect to Safety, Environment, Mineral Conservation, R&D and CSR activities involving development of peripheral villages etc. NLC has taken number of steps to minimize impacts on all aspects of the environment. By carefully planning the projects, monitoring the effects of mining, implementing pollution control measures and reclaiming the mined out areas, the impact of mining on the Ecology and environment of the neighboring Ecosystem is minimized.

Green Environment:

All of us know that, Land use is only for a temporary period in Mining of any size of operations – large or small. NLC is making concurrent refilling and reclamation adopting various initiatives to bring back the mined out land to near original condition with a view to handover it to the Government on cessation of its use.

The mined out land is finally planned to be utilized for agricultural, horticultural and forestry developments. Over 19 million trees have been planted in and around Neyveli Mines and Township which helps in maintaining ecological balance.
SOLID WASTE MANAGEMENT AND LAND RECLAMATION IN NLC MINES:

OBJECTIVE:

Large scale mining operation will result in massive excavation of overburden (solid waste) which leads to destruction of land. Solid waste was dumped as external dump at the surface during the initial stage of mining and later back filled in the voids created after the extraction of the lignite in all the NLC mines.

RECLAMATION CONCEPT

Refilling the mine void area is the best solid waste management which is practiced in NLC followed by reclama

This will helps in bringing a new landscape and at the same time result in economically sustainable, socially acceptable and environmentally stable status. The principles applied by NLC to restore the land lost by mining is follows: a) Advance planning of the excavation, dumping and reclam activities over the whole life of the mine, b) Minimising the time gap between excavation of lignite and backfilling, c) Restoration of the land to its original or pre-mining state or invariably in a better state by proper reclam measures, culminating in a land use pattern comprising of forest land, Agricultural land, orchards, picnic centres, etc.

RECLAMATION PROGRAMME

The dumped soil is very poor in plant nutrients and almost nil in organic matter and sterile. This sterile soil is restored to original condition by reclam and afforestation. The ground is prepared in a manner suitable for the plantation/afforestation. Then the area to be taken up for afforestation has to be divided into different plots. For taking up afforestation, a network of roads capable of plying lorries are being constructed.

Saplings of different species of local tree varieties brought from the nursery are planted. Normally, the plantation are commenced during the monsoon period as this will save initial watering and also will enhance the survival percentage. The survival percentage at Neyveli is more than 95%. The survival rate and growth of the plant depends largely on the care taken especially during the initial stages of the plantation.

The reclaimed and afforested area are protected from cattle grazing by proper fencing. The soil erosion, gully formation etc are controlled by establishing chutes. The backfilled area is transformed into productive purposes such as agricultural and horticultural crop also.
The land used for mining and reclamation made up to Mar-2016 is furnished below:

<table>
<thead>
<tr>
<th>Particulars</th>
<th>Mine-I</th>
<th>Mine-IA</th>
<th>Mine-II</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Land used for mining</td>
<td>2135.34</td>
<td>217.46</td>
<td>2153.07</td>
<td>4505.87</td>
</tr>
<tr>
<td>Reclaimed area</td>
<td>787.56</td>
<td>221.89</td>
<td>684.50</td>
<td>1693.95</td>
</tr>
<tr>
<td>Area afforested</td>
<td>630.20</td>
<td>161.71</td>
<td>546.50</td>
<td>1338.41</td>
</tr>
</tbody>
</table>

**Conclusion:**

To conclude, I would like to say that the Mining methods and/or technologies adopted in a mining project should have a focus on the level of extraction, keeping in mind the fact of the safety, Compliance of all statutory and regulatory requirements in the changed scenario in a scientific manner so as to contribute to the Sustainable Development with environmental protection.

We at NLC adopting mixed technology comprising of Specialized Mining Equipments for large open cast mines and Conventional Mining equipment for small and marginal mines. The SME technology has been modified in many fronts to suit the specific Geomechanical conditions prevailing at Neyveli.

NLC is pioneer in SME at the same time flexible enough to absorb and adopt the current proven mining technologies for its feature mining projects.

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