Chapter-III

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3.1 INTRODUCTION

This chapter attempts to present a profile of "Neyveli Lignite Corporation, Neyveli".

India plays most important role in the world energy market, because it is one of the world's largest energy producers and consumers. While India contains large reserves of oil, natural gas and coal, rising domestic energy demand will continue to make India a major force in the world energy markets well into the next century.¹

3.2 GENERAL BACKGROUND OF COAL

By the beginning of the carboniferous period, plants had spread across the world's continents and had evolved into many different kinds, including massive trees. About 350 million years ago, Europe and North America were tropical lands. Hot steamy jungles blanketated the low lands. They are known as the coal swamps.

The continental cycle of growth and death of swampy vegetation produced thick layers of rotting matter that turned to peat, a dense, dark soil. Over millions of years, the thick beds of

peat, overlain by sediments, were compressed, eventually becoming rock. This we know today as coal.²

3.3 FORMATION OF COAL

Fossil fuels – coal, oil gas were formed from the remains of living things that died millions of years ago and are preserved as fossils.

Coal began to form about 350 millions years ago. At that time parts of the earth’s surface were covered with swamps and lakes. Forests of huge trees and giant ferns grew in the swamps. When these plants died, they rotted down and gradually changed into a type of dark soil called peat. As the centuries passed, the peat was buried under the layers of sand and mud. Successive layers pressed down more and more tightly until the peat was compressed into layers of hard, black and shiny rock called coal. Folding and faulting of rock layers, the result of earth movements over millions of years together with erosion have brought some coal layers close to the surface and within reach of underground mines.³

² Visual Encyclopaedia – Earth history
³ Visual Encyclopaedia – Industry
3.4 TYPES OF COAL FIELDS IN INDIA

In India, the main workable deposits of coal are found in the Permian series known as Gondwana. Geographically the major part of these coal reserves lies along the 24° North Parallel. In this range, the country’s reserve is mainly lignite and bituminous coal. Most of the well known coal fields like Raniganj, Jharia, Giridih, East and west Bokara, Ramgarh, South and North Karanpura fields in Damodar valley and also the coal fields of Rewa, Korba, Korea and Orissa lie in these areas. In addition to these are Pench-kanhan valley coalfields. Isolated patches of Gondwana measures are also found in Assam, Sikkim, and Uttar Pradesh. The tertiary deposits producing Lignite are mainly found in Tamil Nadu and to a lesser extent in Kerala, Rajasthan, Gujarat, Jammu and Kashmir.4

3.5 LIGNITE

Lignite is a low rank, consolidated, brownish - black coal that produced less than 8,300 British Thermal Units (Btu) per pound on a moist, mineral-matter-free basis when burned. Lignite has a high content of volatile matter which makes it more convertible into gas and liquid petroleum products than the higher ranking coals. However, its high moisture content and

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susceptibility to spontaneous combustion may cause problems in transportation and storage.5

3.6 HISTORY OF MINING

Lignite was mined in South Arkansas by underground methods and used before the civil war. It was first used for steam - boiler fuel and later as fuel for small locomotives near the mines in Orachita country. In 1907, two small oil distilling plants were operating in Ouachita country. The plants produced oils from lignite mined by open pit methods in the Camden field in orachita country. In 1913, lignite from the Camden area was yielding upto 38 gallons per ton, although the average oil recovery was 25 gallons per ton. In 1938, a plant was constructed in Dorado, Union Country, to extract Vandyke brown dye as a product of lignite processing, followed in 1943 by production from a plant at Malvern, Hot spring country.

During the 1970's various companies enacted exploration programs and discovered a number of major lignite deposits in the state. The lignite was examined for use as a boiler fuel for electric power generation, as a source of chemical feedstock, and as a

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source of petroleum-type products through gasification and liquefaction.6

3.7 THE LIGNITE LEGEND OF TAMIL NADU—A CHRONOLOGY

It is a long history with lots of efforts behind the birth of baby of coal family, the fossil fuel; “LIGNITE” arrived in the coal starved Southern region of India. The following is the gist of events that took place in the legend of Tamil Nadu before the formation of Neyveli Lignite Corporation as a corporate body.

Table 3.1
Chronology of Events

<table>
<thead>
<tr>
<th>Year</th>
<th>Chronology of Events</th>
</tr>
</thead>
<tbody>
<tr>
<td>1828</td>
<td>Occurrence of “PEAT” a low calorific fuel of coal family near point calimere is reported to the then Madras Government by the Sub-Collector of Tanjavur, Mr. Nelson.</td>
</tr>
<tr>
<td>1830</td>
<td>General Cullen discovers Lignite deposits at the base of the cliffs on the sea-shore near Cannanore – Later near Varkala near Quilon and also at Vaikam in Kerala.</td>
</tr>
<tr>
<td>1840</td>
<td>Captain New Bold discovers Lignite at the foot of the cliffs of laterite on the river banks near Beypore.</td>
</tr>
<tr>
<td>1870</td>
<td>Peat bogs found in Nilgiris (Peat is considered to be the first stage in the formation of coal from vegetable matter accumulating in swamps).</td>
</tr>
</tbody>
</table>

6 Prior, W.L. et. al. 1985, “Arkansas Lignite investigations” Arkansas geological commission information circular, 28 – C, P. 214
<table>
<thead>
<tr>
<th>Year</th>
<th>Chronology of Events</th>
</tr>
</thead>
<tbody>
<tr>
<td>1877</td>
<td>Mr. W. King of the Geological Survey of India takes up a study of artesian wells around Pondicherry. He comes across a carbonaceous stratum.</td>
</tr>
<tr>
<td>1884</td>
<td>Mr. Poilay, a French Engineer encounters a Lignite seam in a bore hole at Bahoor, the then French territory. Further exploration along the belt indicates possible Lignite deposits at Udhamanickam, Aranganur and Kanniarkoil near Cuddalore. Lignite deposits are indicated at Kasargod and the Collector of South Kanara reports it to the board of revenue.</td>
</tr>
<tr>
<td>1934</td>
<td>Industries Department of the then Government of Madras drills bore holes for tapping artesian water in the neighbourhood of Neyveli. Lignite particles encountered are taken as “black-clay” by unlettered workmen engaged in drilling.</td>
</tr>
<tr>
<td>1935</td>
<td>Bore wells sunk in Jambulinga Mudaliyars land in Neyveli and the black particles gushing forth attract the attention of camping Geologist engaged in some other mission in the Neyveli-Virudhachalam area.</td>
</tr>
<tr>
<td>1937-38</td>
<td>Samples of the black substance taken from the above form were sent to the Government of Madras for analysis.</td>
</tr>
<tr>
<td>1941</td>
<td>M/s Binny &amp;Co., Madras put down four or five bore holes at Aziz Nagar, near Neyveli. Two of them show evidence of lignite deposits; but for want of casing pipes and drilling equipments further work is given up.</td>
</tr>
<tr>
<td>Year</td>
<td>Chronology of Events</td>
</tr>
<tr>
<td>--------</td>
<td>-----------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>1943 - 46</td>
<td>The Geological survey of India starts drilling operations near Neyveli. Preliminary investigations indicate the existence of lignite to the extent of about 500 tonnes in that area.</td>
</tr>
<tr>
<td>1947</td>
<td>Mr. H. K. Ghose, Geologist and Mining Engineer deputed by the Government of India arrive in Neyveli and start his operations.</td>
</tr>
<tr>
<td>1948</td>
<td>The first bore holes sunk by Mr. Ghose have to be abandoned because of water logging and sand-beds. The third one, “September 1951” yields samples of Lignite.</td>
</tr>
<tr>
<td>1951</td>
<td>Sinking 175 bore wells in a cluster punctuating the chosen area, Mr. Ghose proves the existence of about 2000 million tonnes of Lignite reserves in the area. State Governments’ industries and Commerce Department also sinks over 150 bore wells South of Virudhachalam. Mr. Paul Eyrich a mining engineer is deputed by the Bureau of Mines, United States of America, to assist the Government of Madras under point four programmes to determine the Engineering and Economic aspects of Lignite mining in Neyveli. Upon his recommendation, the US Government sponsors a study on the subject under the direction of Mr. V. F. Parry.</td>
</tr>
<tr>
<td>1952</td>
<td>The High Power Committee for Lignite Mining recommends the pilot Quarry project.</td>
</tr>
<tr>
<td>Year</td>
<td>Chronology of Events</td>
</tr>
<tr>
<td>------</td>
<td>---------------------</td>
</tr>
<tr>
<td>1953</td>
<td>Pilot Quarry being commissioned by Dr. U. Krishna Rao, Minister for Industries, Government of Madras.</td>
</tr>
<tr>
<td>1954</td>
<td>Pandit Nehru's visit to the Pilot Quarry. Government of India's committee comprising Mr. C.V. Narasimhan, ICS, Mr. A.C. Guha and Mr. A. Lahiri inspect the pilot Quarry and submit a report to the Government under the Colombo plan. Services of the UK firm PDTS (M/s Powell Duffryn Technical Services Limited) are availed of for a project report.</td>
</tr>
<tr>
<td>1955</td>
<td>Neyveli Lignite project's affairs, hitherto managed by the State Government, get passed on to the central Government with full financial responsibility. Mr. T.M.S. Mani, ICS, Secretary, Department of Industries, Labour and Co-operation, takes over as the Chief Executive of the project.</td>
</tr>
</tbody>
</table>

3.8 THE STORY OF LIGNITE MINING IN NEYVELI

Incessant explorations, prudent exploitation with the urgent, current concerns of ecology and environment, are the lignite mining story of India, Asia as well.

NLC has achieved the objectives it has set for itself: Fulfilling its corporate mission to be the leader in the Industry. It comprises of three open-cast mines, three pit-head Thermal Power Stations.
NLC'S growth is sustained and its contribution to India's Social and Economic Development is significant.

3.9 OCCURRENCE OF LIGNITE

The occurrence of lignite in Neyveli, Cuddalore District of Tamil Nadu, first came to light in 1934, what appeared as 'black clay' gushing out from bore-wells dug for agriculture was later identified as lignite. The then Government of Madras took up regular exploration in 1943 to demarcate the extent of the field. This exploration was followed by detailed survey by the Geological Survey of India.

The NLC Ltd. was born as a government sponsored commercial concern in the year 1956 and its functioning was inaugurated on May 20th 1957 by the then Prime Minister of India, Pandit Jawaharlal Nehru.

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Name of Lignite Field</th>
<th>District</th>
<th>Area in Km²</th>
<th>Total Geological Reserves in MT</th>
<th>OB range in m.</th>
<th>Lignite thickness in m.</th>
</tr>
</thead>
<tbody>
<tr>
<td>01</td>
<td>Neyveli</td>
<td>Cuddalore</td>
<td>480</td>
<td>4150</td>
<td>45 to 150</td>
<td>2 to 30</td>
</tr>
<tr>
<td>02</td>
<td>Jayamkondam</td>
<td>Trichy</td>
<td>120</td>
<td>1168</td>
<td>65 to 160</td>
<td>2 to 21</td>
</tr>
<tr>
<td>03</td>
<td>Bahur</td>
<td>Mostly in Pondicherry and Partly in Cuddalore</td>
<td>52</td>
<td>575</td>
<td>45 to 135</td>
<td>2 to 22</td>
</tr>
<tr>
<td>04</td>
<td>Mannargudi</td>
<td>Nagapattinam &amp; Tanjavur</td>
<td>570</td>
<td>22726</td>
<td>160 to 450</td>
<td>2 to 87</td>
</tr>
<tr>
<td>05</td>
<td>Others</td>
<td>-</td>
<td>-</td>
<td>1904</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

Source: NLC, The Resounding Success, 2004
3.10 LOCATION OF NLC

It is located on the highway between Virudhachalam and Cuddalore in the Cuddalore District, Tamil Nadu.

3.10.1 By Road

Neyveli Township is located at about 200 Kms. South-West of Chennai (the State Capital of Tamil Nadu). Neyveli is well connected by Road from Chennai and can be reached by road transport. The place is located on the highway to Tanjore from Chennai at about 15 Kms. from Panruti. There are frequent bus services available and journey time is about 4½ to 5 Hours from Chennai.
3.10.2 By Rail

Travelling up to Villupuram (which is about 50 Kms from Neyveli) on the main line by train from Chennai and then taking up bus to reach Neyveli. Frequent bus services are available from Villupuram to Neyveli.

Travelling upto Virudhachalam from Chennai/Trichy by train and from there taking a bus to Neyveli. The distance from Virudhachalam to Neyveli Township is about 30 Kms.

3.10.3 By Air

Nearest International Airport is Chennai which is 200 Kms away from Neyveli. There is a domestic Air Port at Trichy which is about 150 Kms. from Neyveli.

3.11 TOWNSHIP ADMINISTRATION

Township established in February 1959, is spread over 50 Kms. The township is divided into 30 blocks each of size 1000 m X 700 m with 21,515 quarters and a total population about 1,35,000 has all facilities. The facilities include Schools, College, Hospital, Central Library, Swimming pools, Auditorium, Stadium, Community Welfare Centres, Recreation Clubs, Reading rooms, Parks, Banks, Shopping complexes, Government agencies, etc. NLC continues to maintain excellent civic services for the convenience of employees.
3.12 PRODUCT OF NLC

The main product dug out from the NLC mine is Lignite, which is used in generating power through Thermal Power Station.

The first mining block of lignite was marked for exploitation in the northern part of the field and mining operations (mines-I) commenced in May 1957.

3.12.1 Mine-I

Mine-I with a production capacity of 10.5 million tonnes of lignite per annum feeds lignite to Thermal Power Station-I (600 MW) and Thermal Power Station-I expansion (420 MW). This mine is spread over an area of 26.69 Sq. Kms., with a reserve of 365 million tonnes.

The lignite seam was first exposed in August 1961 and regular mining of lignite commenced in May 1962. German Excavation Technology in opencast mining using Bucket Wheel Excavators, Conveyors and Spreaders was used in the mine for the first time in the country.

3.12.2 Mine - II

This mine with an annual production capacity of 10.5 million tonnes is spread over an area of 26 Sq. Kms with 390 million tonnes reserves. The Lignite seam in mine-II was first exposed in September 1984 and the excavation of lignite
commenced in March 1985. The lignite excavated from this mine meets the fuel requirements of Thermal Power Station - II (1470 MW). The method of mining and equipment used are similar to that of Mine-I.

3.12.3 Mine - IA

Mine - IA is adjacent to the existing mine-I block was commissioned in 2001. The total reserve in Mine-IA is 120 million tonnes in an area of 11.6 Sq. Kms. The annual capacity of this mine is 3 million tonnes and lignite was first exposed in March 2003. This mine feeds lignite to an independent Power Project of 250 MW and NLC's Thermal Power Stations.
### Table 3.3

**Equipment Population in Mine-I, Mine-II & Mine-IA**

**Specialized Mining Equipment**

<table>
<thead>
<tr>
<th>S. No.</th>
<th>EQUIPMENT</th>
<th>CAPACITY</th>
<th>MINE-I</th>
<th>MINE-II</th>
<th>MINE-IA</th>
</tr>
</thead>
<tbody>
<tr>
<td>01</td>
<td>Bucket wheel Excavator (BWE) Bridge Type</td>
<td>1400L</td>
<td>3</td>
<td>3</td>
<td>-</td>
</tr>
<tr>
<td>02</td>
<td>BWE (Normal type)</td>
<td>1400L</td>
<td>3</td>
<td>2</td>
<td>-</td>
</tr>
<tr>
<td>03</td>
<td>BWE</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>a) With deep cut facility</td>
<td>700L</td>
<td>2</td>
<td>2</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>b) Without deep cut facility</td>
<td>700L</td>
<td>1</td>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td>04</td>
<td>BWE</td>
<td>500L</td>
<td>1</td>
<td>-</td>
<td>1</td>
</tr>
<tr>
<td>05</td>
<td>BWE</td>
<td>350L</td>
<td>1</td>
<td>-</td>
<td>1</td>
</tr>
<tr>
<td>06</td>
<td>Bucket Chain Excavator</td>
<td>500L</td>
<td>1</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>07</td>
<td>Mobile Transfer Conveyor</td>
<td>11,000 tph</td>
<td>3</td>
<td>2</td>
<td>-</td>
</tr>
<tr>
<td>08</td>
<td>Mobile Transfer Conveyor</td>
<td>4,700 tph</td>
<td>-</td>
<td>2</td>
<td>5</td>
</tr>
<tr>
<td>09</td>
<td>Spreader</td>
<td>20,000 tph</td>
<td>1</td>
<td>2</td>
<td>-</td>
</tr>
<tr>
<td>10</td>
<td>Spreader</td>
<td>11,000 tph</td>
<td>3</td>
<td>2</td>
<td>-</td>
</tr>
<tr>
<td>11</td>
<td>Spreader</td>
<td>8,000 tph</td>
<td>1</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>12</td>
<td>Spreader</td>
<td>4,700 tph</td>
<td>3</td>
<td>-</td>
<td>4</td>
</tr>
<tr>
<td>13</td>
<td>Tripper Car</td>
<td>20,000 tph</td>
<td>1</td>
<td>2</td>
<td>-</td>
</tr>
<tr>
<td>14</td>
<td>Tripper Car</td>
<td>11,000 tph</td>
<td>3</td>
<td>2</td>
<td>-</td>
</tr>
<tr>
<td>15</td>
<td>Tripper Car</td>
<td>8,000 tph</td>
<td>1</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>16</td>
<td>Stacker (Rail Mounted)</td>
<td>-</td>
<td>1</td>
<td>1 (at TPS-II)</td>
<td>1</td>
</tr>
<tr>
<td>17</td>
<td>Reclaimer</td>
<td>2,700 tph</td>
<td>2</td>
<td>2 (at TPS-II)</td>
<td>-</td>
</tr>
</tbody>
</table>

**Source:** NLC, The Resounding Success, 2004
3.12.4 Thermal Power Station - I

The 600 MW Neyveli Thermal Power Station-I consists of six units of 50 MW each and three units of 100 MW each. The first unit of this power station was synchronised in May 1962 and the last unit in September 1970.

The power generated from this TPS is fed into the grid of Tamil Nadu Electricity Board, which is the sole beneficiary.

Since all the units of this power station have served more than one lakh hours, Life Extension Programme (LEP) was carried out between 1992 and 1999 in tandem, thus extending the life by another 15 years.

3.12.5 Thermal Power Station - II

The 1470 MW second Thermal Power Station consists of 7 units of 210 MW each. The Power Station was constructed in two stages as 630 MW and 840 MW. The first 210 MW unit was synchronised in March 1986 and the last unit was synchronised in June 1993.

Some of the special features of this power station are:

➤ Largest lignite-fire Thermal Station in Asia.
➤ First and tallest tower type boiler in the country (92.7 m height)
➤ First Software based burner management system
➤ First boiler to be cleaned by hydrofluoric acid.
The Power generated from this power station is shared by all the Southern States, Viz., Tamil Nadu, Kerala, Karnataka, Andra Pradesh and Pondichery as shown in the following table.

Table 3.4
Energy shared by the different states in South India

<table>
<thead>
<tr>
<th>STATE</th>
<th>RESPECTIVE SHARES AS FINALISED BY THE MINISTRY OF ENERGY</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>STAGE - I (630 MW)</td>
</tr>
<tr>
<td></td>
<td>IN MW</td>
</tr>
<tr>
<td>Tamil Nadu</td>
<td>180.75</td>
</tr>
<tr>
<td>Kerala</td>
<td>67.75</td>
</tr>
<tr>
<td>Karnataka</td>
<td>131.50</td>
</tr>
<tr>
<td>Pondicherry</td>
<td>65.00</td>
</tr>
<tr>
<td>Andra Pradesh</td>
<td>135.00</td>
</tr>
<tr>
<td>Unallocated</td>
<td>-</td>
</tr>
<tr>
<td>Total</td>
<td>580.00</td>
</tr>
</tbody>
</table>

3.12.6 Thermal Power Station - I Expansion

This power station consists of two units of 210 MW each. The first unit of this power station was synchronized on 21.10.2002 and the second unit on 22.07.2003. The power generated from this power station is shared by Tamil Nadu, Kerala, Karnataka and Pondicherry.
Some of the special features of this power station are:

- Fully automated plant controlled by Distributed Digital Control Monitoring and Information System (DDCMIS).
- Environment-friendly Equipment and Dry Ash collection System.
- Online Sulphuric dioxide (SO₂) Monitoring.
- Oxidex of Nitrogen (NOₓ) Analysers.

3.13 FERTILIZER PLANT

The fertilizer plant at Neyveli with an installed capacity of 1,52,000 Tonnes of Urea p. a. went on production stream in 1976 as a part of the Neyveli integrated complex. The plant was designed to utilize raw lignite and at that time it was the only one in India to adopt direct solid fuel gasification for synthesis gas production. Due to certain technological and operational constraints in the lignite gasification, the plant could not reach the designed capacity.

The target could not be achieved due to initial teething problem subsequent to Revamping of Ammonia Reactors. Further due to leak developed in one of the Urea reactors, the plant could not be operated at its full capacity. Further, acute marketing problems had to be faced due to poor demand of urea. So, the Fertilizer plant was shut down in March 2000.
3.14 BRIQUETTING AND CARBONISATION PLANT (b & c)

The B & C plant with an installed capacity of 4,36,000 tonnes of coke was commissioned in 1976 as a part of the Neyveli Integrated Complex. In the 70's the capacity utilisation of the plant was restricted giving priority for power generation with the available lignite. In 1983-84, the committee constituted by the Department of Coal assessed the achievable capacity of this plant as 2, 62, 000 Tonnes of coke. When the lignite supply position improved vastly, all efforts were made to improve the capacity utilisation. Only 86,426 Tonnes of coke was produced against the target of 2,62,000 tonnes mainly due to very poor off-take of coke owing to stiff competition from imported coal and availability of alternate fuels at cheaper rates in the market. In order to avoid further accumulation of stock due to lesser demand, the B & C plant was not operated to its full capacity from 2001 onwards.7

3.15 PERSPECTIVE PLAN

Lignite deposits in Neyveli field have the potential for establishing more mines linked with power stations as shown below:

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7 NLC, The Resounding Success, 2003
### Table 3.5
**Perspective Plan of NLC Limited**

<table>
<thead>
<tr>
<th>Mine</th>
<th>Production Capacity</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mine</td>
</tr>
<tr>
<td>Mine - III</td>
<td>11.00 MT/a</td>
</tr>
<tr>
<td>Mine - IV</td>
<td>4.00 MT/a</td>
</tr>
<tr>
<td>Mine - V</td>
<td>10.00 MT/a</td>
</tr>
<tr>
<td>Mine - VI</td>
<td>6.50 MT/a</td>
</tr>
</tbody>
</table>

### 3.16 LAND ACQUISITION AND REHABILITATION

For the initial scheme in NLC i.e., First Mine, First TPS, B&C, Fertilizer plant, Township and other infrastructural facilities, about 15,025 acres of land were acquired. For the subsequent development and expansion schemes and new schemes such as 2nd mine, 2nd TPS, about 15,875 acres were requisitioned, out of which 11,474 acres have been acquired up to July 1994.

#### 3.16.1 Rehabilitation

As a part of rehabilitation measures, the following facilities have been provided.

1. Each family is given well developed rehabilitation plot of 5 cents.

2. They have been given cash assistance of Rs.2000/- to Rs.5000/- depending on the type of Structure to enable them to
dismantle transport and re-erect the structure in the rehabilitation centre.

3. Salvage materials are given free of cost.

4. Agriculture land to a maximum of 2 acres per family rehabilitated in Kuppanatham and Edaikkal Villages was given.

5. In the rehabilitation area, basic amenities like roads, drinking water, street lighting, and sanitary arrangements have been made. Public buildings like elementary School, Shop building, Training Centre, Balwadi, Reading room, Bus shelter, Temples, etc are also constructed.

3.17 RESEARCH & DEVELOPMENT

The Centre for Applied Research and Development (CARD), and in-house R & D Unit of NLC are continuously pursuing research and Development programmes in the area of diversified use of lignite, waste utilisation, soil reclamation and much more. It has well established analytical facilities and is rendering services towards quality control of various products, materials used in various units of NLC.

3.17.1 R & D Projects Carried Out by Card

➤ “Utilisation of fly ash” in agriculture.

➤ “Pond ash reclamation, possibilities of utilisation of industrial waste for developing green cover” in collaboration with Annamalai University.
“Bio-Technical Conversion of Lignite to humic acid”, a collaborative research project with Dhanbad.

“Field studies on application of lignite humic acid and crop response in various agro-climate conditions” in collaboration with Tamil Nadu Agricultural University, Coimbatore.

3.17.2 Proposed R & D Projects Of Card


b. Development of fly ash based pesticides; CARD & Annamalai University.

c. Lignite/Coal gasification: CARD, Dhanbad.

3.18 ECOLOGICAL AND ENVIRONMENTAL CARE

Since the NLC Complex is engaged in a wide spectrum of industrial activities, the environmental problems to be tackled have become pronounced from the stage of lignite mining, its utilisation and final disposal of the wastes. NLC's afforestation efforts are conceived as a measure for preserving ecological balance and for increased stability of the soil.

3.18.1 Afforestation Activities in NLC

NLC has launched a massive afforestation programme not only in and around mines, but also in the Industrial and Township area. So far, 17 million trees of various species are planted in 2,750 hectares. The dry and hot atmosphere of Neyveli when
mining began, has now given way to lush greenery. This programme is aimed for maintaining ecological balance and for the increased stability of soil. The dense tree coverage helps to control air pollution, act as wind barrier, prevent soil erosion and reduce the atmospheric temperature to a certain extent.

3.18.2 From Barren Brown to Glorious Green

NLC, over the years, has successfully converted the spoils into agricultural fields through modern techniques. The dumped soil, after excavation, is improved in stages to match its original fertility and the agricultural operations are carried out by adding nutrients like organic, inorganic and bio-fertilizers in sufficient measures to make the soil suitable for cultivation. Now crops and vegetables of various varieties are being continuously raised in about 250 hectares. Further it is also proposed to increase the back-filled area into cultivable land in the future. Apart from the agricultural crops, horticulture, orchard and cashew plantations were also planted. The crops growth and yield are in the appreciable level.

3.18.3 Reclamation of Ash Pond

In NLC, Ash ponds are spreading over an area of 45 hectares which is an environmental problem, besides occupying valuable cultivable lands. Hence there is every need to reclaim this area and cover it with green vegetation, thus resulting in a stable eco
system. CARD, an in-house R & D unit of NLC have taken up R & D activities for the reclamation of these ash ponds. So far, NLC has reclaimed an area of 11.5 acres and planted 3,500 trees of different species in the reclaimed ash pond.

3.18.4 Indigenisation

NLC started the process of indigenisation of spare parts, components, etc., for the various imported equipment and machinery from the middle of 1960.8

3.19 HUMAN RESOURCE DEVELOPMENT

Though NLC’s main operation area is mining of lignite, generation of power, etc., it gives equal importance to HRD. In addition to a well laid-out township, transport, medical facilities, NLC takes special care in training and re-training its employees. Brief details are given below.

3.19.1 HRD Organisation

HRD itself is an organisation process. It starts from organisational planning which identifies projects and fixes targets. Flowing through all faces of job analysis, manpower and recruitment, the process of HRD takes place in a number of areas.

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8 NLC, Annual Report, 2003-04
1. Training for existing employees in terms of inhouse programmes, training outside the organisation (within India and Foreign)

2. Induction training for newly recruited graduate engineers, junior engineers (Diploma holders) and Artisans (Workers)

3. Institutional collaboration training with various universities and educational institutions.

4. Integrated training approach with other government agencies and public sector undertakings.

5. Workers' education


7. Identified special programmes in specific thrust areas of the organisation.

The organisation's aim is to increase productivity, develop participative culture aiming at total employee satisfaction. In this area, a number of employees are trained. Under the integrated approach in training, NLC is conducting training programmes sponsored by BPE in the NLC Training Complex.

Keeping in mind that 'trained human resource is a major asset', the company has placed Training and Development on its priority agenda.

Training / re-training, development of skills, application of these skills in job situation in changing technological scenario is
considered by the company as the most important methods of training.

The real approach on HRD has been introduced by using the following concepts.

1. Quality Circle Movement
2. Self Development and Growth.

The first of which has been vague in a few enterprises with varying degree of success, while the second is a new attempt in motivating the people to make them deliver their best willingly and voluntarily.9

3.20 WELFARE

The company, as a model, lays great stress on the welfare of its employees and peripheral villages. Some of the salient features of its welfare programmes are:

3.20.1 Transport

For catering to the transport needs of NLC workers and residents of the township, the company operates bus transport of its own which helps the employees attending to the shift duties and other commuters. The commercial bus service in township area has over 67 buses in the fleet and substantially subsidised.

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9 NLC, Personnel Manual, Volume I & II
The township is connected by bus service with all important towns in Tamil Nadu and nearby states.

3.20.2 Canteen

Seven industrial canteens are run by the corporation in the production units / service department with subsidised rates to cater to the needs of over 20,000 work force. Tea is being supplied to the employees who are working in production units at free of cost.

3.20.3 Medical Services

NLC has 369 bedded General Hospital with 5 peripheral dispensaries and caters to the medical needs of employees, their dependent family members and the General public and provides quality medical treatment on Allopathic, Ayurvedic, all by specialties and occupational health services. With a vision to build a more efficient and productive Human Resource, health preventive and Promotive Programmes are being carried out. As a matter of policy and goodwill towards the well being of surrounding rural population, NLC hospital has opened up an exclusive outpatient service unit wherein Medical consultations is offered at free of cost.

During the Polio Immunization Camps, Children were administered Polio Vaccine. System of Referral treatment for
certain major ailments and further treatment in outside hospitals were reviewed and streamlined and tariff agreement signed with the approval of hospitals.

3.20.4 Community Welfare

As a part of Social responsibility of business and commitment to the neighbouring community, NLC is discharging its duty by implementing various welfare activities for the needy village population surrounding Neyveli complex. Basic amenities like provision of bore wells for the villages in and around Neyveli with the aim to provide potable water, connecting roads, basic educational facilities, health care, etc were provided to the needy village in a planned manner under the Peripheral Development Programme.

3.20.5 Education

Neyveli Township proves to be a good educational centre. The total student strength of Neyveli Schools including 17 schools (run by NLC with grant-in-aid from state government) is around 43,000. NLC also patronizes Jawahar Education Society which also runs schools and a college and offers curriculum based on CBSE and Matric Syllabus Systems. Year after year, the schools are achieving excellent results in various examinations and continue to produce an impressive number of meritorious candidates. The free noon meal scheme, through the State
Government, for the poor children of NLC schools, nourishes around 6,500 children.

3.20.6 Sports

NLC has good facilities for almost all Sports and Games. Bharathi Stadium Complex has facilities to conduct events/tournaments in athletics, cricket, football on turf, and separate courts for Basketball, Ball-Badminton, Kho-Kho, Kabaddi and Volley Ball. It has also two swimming pools and a Yoga centre.

3.20.7 Cultural Activities

Cultural activities in all languages are encouraged and a cultural body to co-ordinate the activities of various groups is functioning. In addition to this, 22 dramatic groups are functioning under one umbrella called, “Neyveli Federation of Dramatic Association”. This association holds drama festival 3 to 4 times in a year in various languages and on many themes. During employee’s or their son/daughter’s marriage, a pair of ‘Kutthuvilakku’ (big brass lamp) is presented by the Management.

3.20.8 Social Welfare & Peripheral Development

- Sneha opportunity school for mentally challenged special children.
Neyveli Health promotion and Social Welfare Society for handicapped and destitute women.

A Centre for making Jaipur type artificial limbs for the handicapped.

Anbalayam - a creche for children.

Drinking water to surrounding villages.

Formation of connecting loads.

Construction of Culverts/Overbridges.

Sinking of bore wells.

Education and medical facilities for the adjoining villages.

Vocational training for rural youth.\(^{10}\)

### 3.21 HUMAN RESOURCE

The manpower strength of NLC stood at 19,180 employees.

The number of employees in various categories as on 31.03.2005 is furnished below:

<table>
<thead>
<tr>
<th>CATEGORY</th>
<th>NO. OF EMPLOYEES</th>
</tr>
</thead>
<tbody>
<tr>
<td>Managerial Level</td>
<td>880</td>
</tr>
<tr>
<td>Executives</td>
<td>2,764</td>
</tr>
<tr>
<td>Supervisors</td>
<td>3,548</td>
</tr>
<tr>
<td>Workmen</td>
<td>11,988</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>19,180</strong></td>
</tr>
</tbody>
</table>

\(^{10}\) NLC, The Resounding Success, 2004
Managerial level employees and are generally known as Executives. Supervisors are non-executives and workmen are known as Labourers.

The company gives High Priority to the training of executives, supervisors and workers. Apart from utilising the training facilities available in the training complex of the company, the employees are deputed to the other training centres within the country, and training facilities provided by the equipment manufacturers within the country/abroad are also cultivated.

3.22 PRODUCTIVITY

The output per man shift for each plant is used as a yardstick for assessing its performance. All efforts are made to increase the productivity by critical assessment of manpower, improving the availability of equipments and improvement in the production output, etc.

3.23 SAFETY

NLC is committed to promote safety across in all its operations. To ensure safety and minimize the chances for accidents, periodical inspection of the production units are being carried out by the central safety wing at corporate level, apart from the unit safety departments. Apart from celebrating the safety
week every year, safety posters are displayed at prominent places to create awareness and for adopting safety measures.

3.24 AWARDS

NLC has not confined itself to production activity alone, it has done equally well in the field of training, safety, sports, social welfare, etc. These are reflected by the number of awards it has received in various fields such as productivity, safety, energy conservation, excellence in performance, etc. So far, the company has won more than 95 awards in different fields.

3.25 VISION OF NLC

To emerge as a leading Mining and Power company, continue to be a socially responsible company and strive for operational excellence in Mining and Exploration.

3.26 MISSION OF NLC

Strive for greater cost competitiveness and work for continued financial strength.

Continually imbibe best practices from the Indian and International Organisations engaged in Power Generation and Mining.
Be a preferred employer by offering attractive avenues of career growth and excellent work environment and by developing human resources to match international standards.

Play an active role in society and be sensitive to emerging environmental issues.\textsuperscript{11}

3.27 SUMMARY

Today, Neyveli is in every sense a mini India with the project town's employee strength drawn from the length and breadth of the country. They live as one family enunciating the emotional integration of independent India.

\textsuperscript{11} NLC, Annual Report, 2004-05