SUPREME AUDIT INSTITUTION OF INDIA
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Report of the Comptroller and Auditor General of India on Operational Performance of NLC India Limited

Union Government
Ministry of Coal
No. 35 of 2025
(Performance Audit-Commercial)

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PREFACE

The Performance Audit Report on Operational Performance of NLC India Limited has been prepared for submission to the Government of India by the Comptroller and Auditor General of India (CAG) for laying before the Parliament under the provisions of Section 19(1) and 19-A of the Comptroller and Auditor General's (Duties, Powers and Conditions of Service) Act, 1971. The Audit has been carried out in line with the Regulations on Audit and Accounts, 2007 (amended in 2020) and Performance Audit Guidelines, 2014 of the CAG. The Performance Audit covered operational performance of lignite mines and selected thermal power stations situated at Neyveli, for the period from 2017-18 to 2022-23.

EXECUTIVE SUMMARY

About this Audit

Neyveli Lignite Corporation Limited, incorporated in November 1956 and renamed as NLC India Limited in April 2016, is under the administrative control of the Ministry of Coal, Government of India (GoI). As of March 2023, GoI held 79.20 *per cent* of its shares and the balance 20.80 *per cent* shares were with other institutions and public. NLC India operates three open cast lignite mines in Neyveli (Tamil Nadu) and one mine at Barsingsar (Rajasthan). The lignite extracted from the Neyveli mines is supplied to NLC India's five pit-head thermal power stations, as well as to a private power producer based in Neyveli. Similarly, the lignite from the Barsingsar mines is supplied to NLC India's pit-head thermal power station located at Barsingsar. As of March 2023, the installed lignite mining capacity of NLC India at Neyveli and Barsingsar was 27.10 MTPA with pit-head thermal power generation capacity of 3,640 MW. The electricity generated by NLC India is supplied to distribution companies in Tamil Nadu, Andhra Pradesh, Karnataka, Kerala, Telangana, Puducherry and Rajasthan.

The Performance Audit was conducted to assess whether the production of lignite and operation of power generating stations at Neyveli were carried out efficiently, economically, and effectively. The scope included three lignite mines at Neyveli viz. Mine-I, Mine-IA, and Mine-II. Out of the five thermal power stations located at Neyveli, audit reviewed the operational performance of TPS-I Expansion, TPS-II and TPS-II Expansion.

Significant audit findings and recommendations:

Chapter 2 - Mining Operations

Total identified mining area of three mines at Neyveli was 12,835 hectares out of which NLC India acquired and took possession of 9,180 hectares of land as of March 2023. However, 580 hectares of land was still not in its possession, even though the same was acquired between 2000 and 2023. Of the land available in possession, 5,880.34 hectares had already been mined-out and 3,253.47 hectares were used for dumping mined-out soil and creation of infrastructure, leaving only 46.19 hectares of land for mining operations. This land of 46.19 hectares had only estimated 44.10 million tonnes of lignite deposits, whereas NLC India required 26.66 million tonnes every year for generation of electricity. This reserve was sufficient only for about 20 months (till November 2024) for electricity generation. Due to shortage of land, there was short supply of lignite (2.77 million tonnes) from Mine-II to linked TPS-II and TPS-IIE during the second half of 2022-23, leading to a potential revenue loss of ₹338.62 crore in mining operations. In Mine-IA, NLC India could not obtain land on the eastern side due to opposition from landowners, so it was

forced to mine in the western side which was already filled with dumped soil (previously mined soil). This resulted in an additional expenditure of ₹364.80 crore for removal of dumped soil thereby increasing the overall cost of lignite production.

Recommendation No. 1: NLC India should expedite land acquisition and possession to ensure uninterrupted lignite production.

(Para 2.4)

NLC India obtained Environmental Clearance (EC) for Mine-II in December 2002 under the Environmental Impact Assessment Notification (EIA) Notification, 1994. However, following an order from Hon'ble Supreme Court in August 2017 and a subsequent notification (April 2018) from Ministry of Environment and Forests and Climate Change (MoEFCC), the EC required revalidation under EIA Notification, 2006 within a period of six months from April 2018. Even though an online portal for submission of application towards this purpose was available from April to October 2018, NLC India did not submit the application for re-validation. Hard-copy of the application was submitted in February 2019 after the online portal was closed and it was accepted only in December 2020 under the violation category. Lack of coordination between the Corporate Environment Cell and Mine-II Planning Department of NLC India led to the delay, as both departments denied responsibility for submission of application for re-validation of EC. As a result, Mine-II was operated without a valid EC. This restricted NLC India from production and sale of its minor minerals (Ball Clay and Silica Sand).

(Para 2.5)

The EC conditions of MoEFCC stipulated maximum limits for external overburden dump height and slope for Neyveli mines. However, NLC India violated these norms in both Mine-I and Mine-II. For Mine-I, the permissible maximum dump height was 20 metre with a 28-degree slope, but the average overburden dump height reached 50 metre. In Mine-II, the EC allowed a maximum height of 65 metre and 28-degree slope, but overburden was dumped even up to 120 metre high. This caused soil sliding which blocked the drainage system and damaged nearby agricultural lands at multiple occasions between 2012 and 2018, leading to protests by farmers. NLC India paid ₹2.18 crore as compensation and spent ₹14.98 crore to clear soil from drains and agricultural land up to September 2023.

Best practices as noted by Audit in Mines: NLC India has reclaimed 2,188 hectares of mined-out land and planted over 27.96 lakh native tree saplings. Despite poor soil quality, 100 hectares now support high-tech vegetable cultivation using scientific methods. The company also created 52 water bodies for rainwater harvesting and developed eco-tourism facilities, helping increase biodiversity and attract migratory birds.

(Para 2.6)

Government of Tamil Nadu (GoTN) granted a mining lease to NLC India in December 1956 (renewed every 20 years) for mining lignite and associated minerals like silica sand, ball clay and fire clay. In February 2015, these associated minerals were classified as minor minerals by GoI which provided power to state governments to make rules in respect of minor minerals. Accordingly, in April 2016, the GoTN required a separate lease to mine them (minor minerals). Although NLC India received a temporary permit in February 2017 to mine minor minerals, it was revoked in January 2018. NLC India subsequently applied for a separate lease to GoTN only in January 2018, with a delay of 20 months. Permission for mining minor minerals was granted by GoTN in January 2023 for Mine-I and Mine-IA, but not for Mine-II due to lack of environmental clearance. During the period between February 2018 and January 2023, NLC India did not segregate the minor minerals and dumped them along-with overburden. The delay in obtaining separate lease for mining minor minerals caused avoidable loss of potential revenue from sale of ball clay, silica sand and fire clay.

(Para 2.7)

Coal Mine Regulations 2017 stipulate open-cast mines to follow scientifically determined limits for pit and dump slopes and monitoring of slope stability. Director General of Mines Safety also highlighted (April 2017) that Neyveli mines were located in a groundwater basin with weak soil layers and required installation of a slope monitoring system. A scientific study by IIT Varanasi (August 2019) recommended a 30 metre height limit for internal dumps and installation of a continuous slope monitoring system using radar. However, as of March 2023, NLC India had not procured and installed the continuous slope monitoring system. Further, internal dumps exceeded the 30 metre limit in two out of five locations in Mine-II and reached up to 50 metre. This resulted in soil sliding in September 2021, damaging a spreader equipment, which resulted in non-availability of the equipment for two months and compromising the safety of mine workers.

Recommendation No. 2: NLC India should prioritize the procurement and installation of the slope monitoring system and strictly adhere to the 30 meters dump height limit to ensure safety. Timely implementation of these measures is essential to prevent further incidents and ensure the safety of personnel and equipment.

(Para 2.9)

In 2016, the Ministry of Coal directed NLC India to conduct an energy audit to reduce energy consumption by 25 *per cent*. However, NLC India delayed action and initiated steps to undertake energy audit only in June 2020 and awarded the work to an external agency in August 2021. The agency completed the energy audit in December 2021 and submitted its report in July 2022. The report recommended various energy-saving measures that could save ₹47.92 crore annually in all the three mines. The delay in conducting the energy audit by more than four years (i.e. from 2016 to 2020) resulted in loss of energy savings.

(Para 2.10)

Chapter 3 - Operation of Thermal Power Stations

TPS-IE, TPS-II and TPS-IIE did not achieve the normative Plant Availability Factor prescribed by Central Electricity Regulatory Commission (CERC), resulting in a loss of revenue of ₹2,353.99 crore in capacity charges. Audit noted that TPS-IIE faced 33,451.55 hours of outages due to repeated faults in the Fluidised Bed Heat Exchanger (FBHE) system of its Circulating Fluidised Bed Combustion (CFBC) boiler. TPS-II suffered major outages in 2020-21 due to fire incidents (12,260 hours) and additional shutdowns due to maintenance and technical issues (4,819.48 hours). In 2021-22, a generator stator earth fault in TPS-II led to 1,590.38 hours of outage and in 2022-23 due to lignite shortages and poor quality of lignite caused 4,952.12 hours of outages. TPS-IE also did not meet normative PAF in 2020-21 due to turbine bearing failures, causing outages of 1,840.15 hours.

(Para 3.2)

TPS-IE, TPS-II and TPS-IIE faced 742 forced outages which caused 62,857.43 hours of plant shutdown which resulted in loss of power generation of 14,538.66 million units. Major reasons for forced outages included equipment breakdowns like FBHE coil punctures in TPS-IIE (66.22 *per cent* of its outages); turbine bearing failures in TPS-IE (66.66 *per cent* of its outages); tube punctures (31.04 *per cent* of its outages) and lignite shortages (22.50 *per cent*) in TPS-II. In TPS-IIE, issues in FBHE system alone caused 22,152 hours of outages due to inherent design deficiency. In TPS-IE, poor handling of turbine thrust bearing failure led to repeated shutdowns and resulted in 2,536.41 hours of outages in 2020-21. In TPS-II, non-conduct of timely maintenance on a circuit breaker caused rotor damage, leading to 716.03 hours of outages. Fire incidents in TPS-II in May and July 2020 caused shutdown totalling 12,260 hours, with additional 2,108.72 hours lost for shutdown on account of safety reasons.

Recommendation No. 3: NLC India should ensure timely preventive maintenance as per laid out SOP to reduce forced outages.

(Para 3.3)

TPS-IE, TPS-II and TPS-IIE operated with partial load due to issues like load restrictions, lignite shortage and quality issues, equipment breakdowns and inadequate storage. These inefficiencies led to a total generation loss of 1,594.77 million units and under-recovery of lignite extraction costs of ₹360.52 crore. Key reasons included poor mill performance in TPS-II (650.88 million units loss) due to ageing of mills and leakages in ducts; unresolved lignite feeding system issues in TPS-IIE (295.37 million units loss); delayed procurement of conveyor belts in TPS-II (281.53 million units loss) and insufficiently covered lignite storage yard in TPS-II and TPS-IE, which caused wet lignite issues during monsoon, resulting in generation loss of 366.99 million units.

Recommendation No. 4: NLC India should analyse the reasons to address the partial load operations and to minimize the loss to the extent possible.

(Para 3.4)

NLC India's thermal power stations, particularly TPS-IIE, recorded Auxiliary Power Consumption (APC) consistently above CERC norms. TPS-IIE consumed 15 to 17 *per cent* auxiliary power against the 10 *per cent* norm, while TPS-IE and TPS-II also exceeded norms in few years. High APC reduced sent-out energy and impacted revenue earnings. Audit noted that NLC India lacked adequate systems to monitor equipment-level energy use, making it difficult to identify equipment with high energy consumption. Additionally, no energy audit was conducted for TPS-IIE and recommendations from energy audits in TPS-IE and TPS-II were either delayed or not implemented. Forced outages and partial load operations also contributed to higher APC.

(Para 3.5)

TPS-IIE consistently recorded higher Station Heat Rate (SHR) above CERC norms mainly due to sub-optimal performance of the CFBC technology, which was installed and commissioned by BHEL without prior experience for such high capacity plant (250 MW). In 2022-23, TPS-II also exceeded the SHR norm due to poor lignite quality with high ash and sand content, reducing boiler efficiency and causing partial load operations.

Recommendation No. 5: NLC India should ensure timely completion of FBHE modifications at TPS-IIE to reduce high Station Heat Rate and ensure good quality of lignite to its power stations.

(Para 3.6)

NLC India's power stations, particularly TPS-IIE, recorded specific oil consumption consistently higher than CERC norms, mainly due to frequent Unit outages (250 forced outages and 32 planned outages). TPS-II Stage-II also exceeded norms in 2020-21 and 2021-22, which faced 81 and 45 outages respectively. In 2022-23, the rise in oil usage at TPS-II (Stage-I and II) was mainly due to inadequate supply and poor quality of lignite. On the other hand, TPS-IE operated within the specified consumption norms.

Recommendation No. 6: NLC India should minimise forced outages to reduce high specific oil consumption. Adequate covered lignite storage should be ensured to prevent challenges associated with wet lignite.

(Para 3.7)

As per the Central Electricity Authority's 2011 safety regulations, plant operators must ensure safety for all personnel, including contractors and visitors. However, NLC India's TPS-II experienced recurring fire incidents, including two major accidents. In May 2020, a fire incident in Unit-6 led to five fatalities and three injuries, resulting in an outage of

4,560 hours. Another fire incident in July 2020 in Unit-5 caused 15 deaths and eight injuries, with the Unit remaining shut-down for 7,700 hours. Investigations found that both incidents were caused by the accumulation of hot lignite dust in the girders over a period of time and ignition of flammable gases might have caused the explosion. The safety lapses continued despite earlier recommendations from incident review committees following fire incidents (in 2001, 2016, 2017 and 2019) to improve housekeeping and regularly clean lignite dust. Audit noted that NLC India could have prevented these accidents by regular cleaning of lignite dust.

Recommendation No. 7: NLC India should avoid accumulation of lignite powder inside girder box by inspection of all manholes and ensuring that these are properly sealed.

(Para 3.8)

As per CERC regulations, Operation and Maintenance (O&M) expenses for thermal power stations are subject to normative limits covering costs like manpower, repairs, consumables and insurance. TPS-IE incurred O&M expenses above the norm in all years except 2019-20, while TPS-II exceeded the norms in 2017-18, 2018-19 and 2021-22. The O&M expenses of TPS-IIE remained within norms. A key factor contributing to these higher costs was the excess deployment of manpower. As per Central Electricity Authority's National Electricity Plan (2018 and 2023), the standard requirement is 0.486 technical staff per MW of capacity. However, NLC India deployed 1.87 and 1.64 personnel per MW at TPS-IE and TPS-II respectively, above three times the recommended level, indicating inefficient resource utilization and contributing to higher O&M expenses.

Recommendation No. 8: Employment of manpower should be within CEA norms. O&M costs should be restricted within CERC norms.

(Para 3.9 and 3.10)

In December 2015, MoEFCC mandated that existing thermal power plants must limit Sulphur Dioxide (SO_2) emissions to 600 mg/Nm³ by December 2017. This deadline was later extended to December 2026. Plants which will not comply the requirements by this deadline may face a penalty of environmental compensation of ₹0.40 per unit of electricity produced. Despite SO_2 emissions at NLC India's TPS-IE and TPS-II exceeding the limits, reaching up to 2,842 mg/Nm³ and 3,623.57 mg/Nm³ in 2019-20 and 2018-19 respectively, installation of Flue Gas Desulphurization (FGD) systems has been delayed. Although the NLC Board approved (April and May 2018) FGD installation for these Units with timelines ranging from 33 to 41 months, tenders were floated in January 2019 and June 2020 which were cancelled due to high costs and internal committee decisions. As of February 2024, no FGD contracts had been finalised. Meanwhile, TPS-IIE remained largely within emission limits, owing to its use of environment-friendly CFBC technology. The continued delay in implementing FGD systems at TPS-IE and TPS-II resulted in non-compliance of emission norms and potential risks of penalties.

Recommendation No. 9: NLC India should expedite the tendering process for FGD installation at TPS-IE and TPS-II to meet the December 2026 deadline. Streamlining internal approvals and improving cost estimation can prevent further delays.

Best practices as noted by Audit in Thermal Power Stations: In compliance to MoEF's 2009 notification, NLC India has achieved 100 per cent fly ash utilization since 2013 at its thermal plants (TPS-IE, TPS-II and TPS-IIE), supplying fly ash to industries as raw material, supporting sustainable waste management.

(Para 3.12)

Chapter 1
Introduction

Chapter 1

Introduction

1. Introduction

Millions of years of deep burial engendered such physical and chemical changes which transformed the vegetation into peat. Initially the peat is converted into lignite or 'brown coal' – these are coal types with low organic maturity[1]. In comparison to coal, lignite is quite soft and its colour can range from dark black to various shades of brown.

Indian lignite deposits occur in the Tertiary sediments in the southern and western parts of peninsular shield particularly in Tamil Nadu, Rajasthan, Gujarat and Puducherry. The total geological resources of lignite is about 47,369 million tonnes (April 2023). Of which maximum resources are located in Tamil Nadu (79.37 *per cent*), followed by Rajasthan (13.90 *per cent*) and Gujarat (5.74 *per cent*). Other States where lignite deposits have been located are Jammu & Kashmir, Kerala, Odisha and West Bengal.

1.1 About the Company

Neyveli Lignite Corporation Limited was incorporated on November 1956 as wholly owned Government Company under the administrative control of Ministry of Coal. The Company was re-named as NLC India Limited (NLC India/Company) in April 2016. As of March 2023, Government of India (GoI) holds 79.20 *per cent* of shares in the Company while the remaining 20.80 *per cent* is held by other institutions and public. NLC India was designated (April 2011) as navaratna company by GoI. NLC India was the largest miner for lignite with a production of 24.49 million tonnes out of 44.99 million tonnes of lignite produced in India during the period 2022-23.

1.2 Mining by NLC India

NLC India operates three open cast mines at Neyveli, Tamil Nadu and one open cast mine at Barsingsar, Rajasthan. Lignite Mines at Neyveli are the largest open cast mines in the country. Lignite mined at Neyveli, Tamil Nadu and Barsingsar, Rajasthan is used to generate electricity at NLC India's five pit head thermal power stations (TPS) at Neyveli and one station at Barsingsar respectively. The mines at Neyveli also supply lignite to TAQA Neyveli Power Company Private Limited which is a private company.

Installed capacity of lignite mining for mines at Neyveli was in the range[2] of 24.00 to 28.50 Million Tonnes Per Annum (MTPA) during the period 2017-18 to 2022-23. Similarly,

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[1] ***The quality of each coal deposit is determined by temperature and pressure and by the length of time in formation, which is referred to as its 'organic maturity'.***

[2] ***The annual production capacity of NLC India's mines at Neyveli: - 28.50 MTPA (2017-18 and 2018-19), 24.00 MTPA (2019-20 and 2020-21), 24.50 MTPA (2021-22) and 25.00 MTPA (2022-23).***

installed capacity of lignite mining for mine at Barsingsar was 2.10 MTPA during the same period. Lignite production capacity at these mines was determined mainly based on lignite requirement at the respective linked TPSs. The table below provide details of installed mining capacity and linked TPS during 2017-18 to 2022-23.

Table 1.1: Installed mining capacity and linked Thermal Power Station during 2017-18 to 2022-23

Sl. No.	Mine	Capacity (MTPA)	Linked Thermal Power Station	No. of Units
1.	Mine-I, Neyveli	8.00 -10.50	TPS-I – 600 MW[3]	Six units of 50 MW and three units of 100 MW
			New Neyveli TPS[4] (NNTPS) – 1000 MW	Two units of 500 MW
			TPS-I Expansion – 420 MW	Two units of 210 MW
2.	Mine-IA, Neyveli	3.00 - 4.00	Independent Private Power Station[5], raw lignite sales and supply to own power stations.	
3.	Mine-II, Neyveli	13.00 -15.00	TPS-II – 1,470 MW	Seven units of 210 MW
			TPS-II Expansion – 500 MW	Two units of 250 MW
All TPSs at Neyveli		**24.00 - 28.50**	**3,990 MW**	**22 units**
4.	Barsingsar, Rajasthan	2.10	Barsingsar TPS -250 MW	Two units of 125 MW
Total		**26.10 - 30.60**	**4,240 MW**	**24 units**

Source: Records of NLC India and CERC Tariff Orders

When TPS-I was decommissioned and NNTPS was commenced, the production capacity of linked Mine-I was reduced[6] from 10.50 MTPA to 8.00 MTPA and Mine-IA was increased[7] from 3.00 MTPA to 4.00 MTPA. In respect of Mine-II, NLC India decided to reduce the capacity from 15.00 MTPA to 13.00 MTPA from 2019-20.

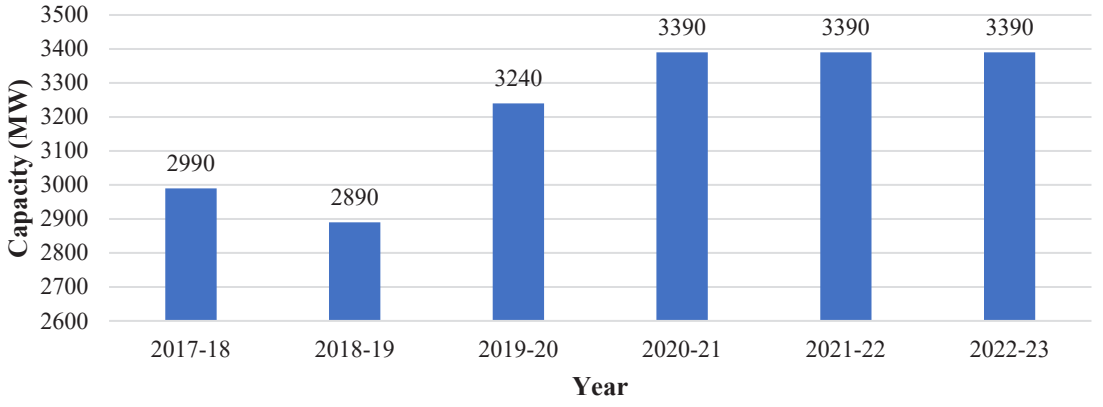
1.3 Power Generation by NLC India

Power generation capacity of NLC India's power stations at Neyveli varied during 2017-18 to 2020-21. From 2,990 MW in 2017-18, it reduced to 2,890 MW in 2018-19 due to closure of Unit-7 of TPS-I. In 2019-20, two Units of TPS-I were decommissioned and one Unit of 500 MW was added at NNTPS. In 2020-21, remaining six Units of TPS-I were

[3] ***In TPS-I, Unit-7 was decommissioned in September 2018, Units 1 and 9 were decommissioned in March 2020 and remaining six Units were decommissioned in 2020-21.***
[4] ***Unit-1 and Unit-2 were commissioned in December 2019 and February 2021 respectively.***
[5] ***TAQA Neyveli Power Company Private Limited (one unit of 250MW)***
[6] ***From 2019-20***
[7] ***Increased in stage - 3.00 MTPA (up to 2020-21), 3.50 MTPA (2021-22) and 4.00 MTPA (2022-23).***

decommissioned while the second Unit of 500 MW was added at NNTPS. The year-wise power generation capacity of the thermal power stations during the period 2017-18 to 2022-23 is given in Chart 1.1.

Chart 1.1: Thermal Power Generation Capacity at Neyveli



Source: Records of NLC India and CERC Tariff Orders

The electricity from NLC India is supplied to distribution companies (DISCOMS) in Tamil Nadu, Andhra Pradesh, Karnataka, Kerala, Telangana, Rajasthan, Union Territory of Pondicherry and Andaman through power purchase agreements.

NLC India also diversified its activities into renewable energy through wind and solar power generation since 2014-15. The combined capacity of these plants was 1,421.06 MW (March 2023). Power generation from these plants was 2,194.55 million units during 2022-23 being 9.09 *per cent* of total power generated by NLC India.

1.4 Financial Performance

The table below shows the financial status of NLC India during 2017-18 to 2022-23.

Table 1.2: Financial Performance of NLC India

(₹ in crore)

Particulars	2017-18	2018-19	2019-20	2020-21	2021-22	2022-23
Income						
From Operations	8,496.20	7,145.92	7,916.30	7,249.63	9,856.48	12,955.00
Other Income	586.85	913.35	1,216.98	1,716.88	805.89	1,240.90
Total Income	*9,083.05*	*8,059.27*	*9,133.28*	*8,966.51*	*10,662.4*	*14,195.90*
Total Expenditure	*6,452.79*	*6,747.6*	*6,920.84*	*7,512.37*	*8,719.31*	*10,166.77*

Particulars	2017-18	2018-19	2019-20	2020-21	2021-22	2022-23
Profit Before Tax[8]	2,640.67	2,135.87	2,204.59	1,722.07	2,606.42	1,724.15
Provision for tax	791.89	868.90	790.74	711.61	1,369.64	475.91
Net Profit	***1,848.78***	***1,266.97***	***1,413.85***	***1,010.46***	***1,236.78***	***1,248.24***

Source: Annual Report of NLC India

As compared to 2017-18, income from operations decreased due to reduction of power generation from TPS-I as Units of TPS-I were decommissioned during 2018-19 to 2020-21 and due to fire accidents in Unit-5 and 6 of TPS-II in 2020-21. Power generation and income from operations subsequently increased after commissioning of Unit-1 and Unit-2 of NNTPS in December 2019 and February 2021 respectively.

1.5 Organisational set up

NLC India is headed by a Chairman-cum-Managing Director (CMD) and assisted by five functional Directors for different department viz. Mines, Power, Planning and Projects, Human Resources and Finance. GoI and Government of Tamil Nadu (GoTN) each were represented by a nominee Director. Independent Directors were also present on the Board of Directors of NLC India. Each functional activity was headed by an Executive Director or Chief General Manager who report to the respective functional Director for day-to-day operations. Total manpower strength of NLC India was 10,380 personnel as on 31 March 2023.

1.6 Audit Framework

Audit objectives, audit criteria, scope, sampling and methodology adopted for the Performance audit are given in the following sub-paragraphs.

1.6.1 Audit Objectives

Performance Audit was carried out with the following objectives:

(i) Whether the production of lignite was carried out in efficient and economical manner.

(ii) Whether the Power Generating Stations were operating with efficiency, economy and effectiveness.

1.6.2 Audit Criteria

The Audit criteria used in audit included Coal Mine Regulations 2017, CERC's (Terms and Conditions of Tariff) Regulations and other regulations, CERC's operational norms for Thermal Power Stations and Mines, orders issued by Government of India, Environment

[8] ***After exception items and after regulatory deferral movements.***

Act, 1986 and related notifications/rules/orders, study reports of independent experts and approved annual plans of the Company.

1.6.3 Scope of Audit

Mining and Thermal Power generation at Neyveli formed the core of NLC India's business activities. The Performance Audit covered operational performance of lignite mines and thermal power stations[9] situated at Neyveli, for the period from 2017-18 to 2021-22, and updated the audit findings upto 2022-23.

1.6.4 Audit Sampling and Methodology

All three mines at Neyveli viz. Mine-I, Mine-IA and Mine-II were selected for audit. Out of five thermal stations situated in Neyveli, Audit reviewed the performance of TPS-I Expansion, TPS-II and TPS-II Expansion.

The audit methodology included examination of documents, physical visit to mines and thermal stations and discussion with stakeholders. The audit objectives, criteria and scope were discussed with Management during the entry conference held on 4 November 2022. Audit observations in the form of a Draft Report were issued to Management and Ministry. Upon receipt of reply for Draft Report, an exit conference was conducted with Management and Ministry of Coal to discuss the identified issues on 27 September 2023 and 19 March 2024 respectively. The views expressed by the Management and Ministry in the exit conference were also considered in finalisation of this report.

1.7 Audit Findings

Audit findings are grouped under the following chapters.

i. 'Chapter 2 – Mining Operations' include audit observations related to planning, land acquisition, compliance to environmental norms, issues related to excavation of lignite and minor minerals, performance of mining equipment, mines safety and energy conservation.
ii. 'Chapter 3 – Operations of Thermal Power Stations' include audit observations related to capacity utilisation, operational efficiency, compliance to various regulations and norms, economy in operations, fire safety and environmental issues.

[9] ***Thermal Power Station-I (TPS-I) and New Neyveli Thermal Power Station (NNTPS) were excluded due to short period of operation during 2017-18 to 2021-22.***

Chapter 2
Mining Operations

Chapter 2

Mining Operations

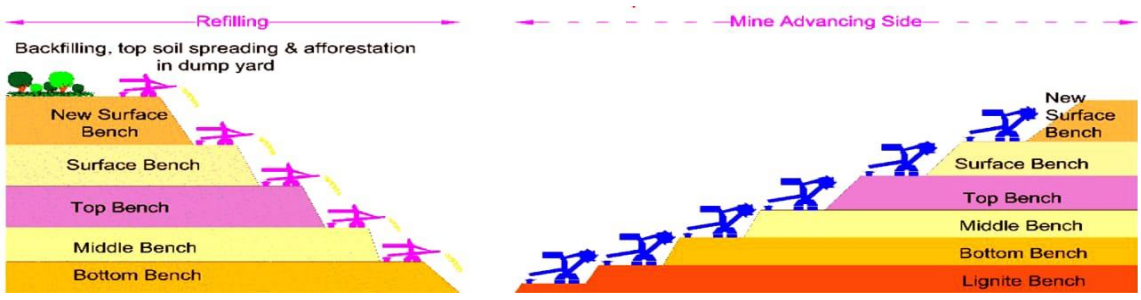
2.1 Regulatory Framework for Lignite Mining in India

Government of India enacted the Mines and Minerals (Development and Regulation) Act, 1957 (MMDR Act, 1957), as amended from time to time, which lays down the legal framework for regulation of mines. Section 11A of the MMDR Act, 1957 authorises the Central Government and State Government for granting mineral concession or composite licence in respect of coal or lignite. The MMDR Act, 1957 also authorises State Government to regulate the grant of quarry leases, mining leases or other mineral concessions in respect of minor minerals and for purposes connected therewith. Minor Minerals mean building stones, gravel, ordinary clay, ordinary sand other than sand used for prescribed purposes and any other mineral which the Central Government may declare as minor minerals. Central Government notified (10 February 2015) minor minerals in addition to the earlier declared minor minerals. The additional list included silica sand, ball clay and fire clay which were also available in lignite mines of Neyveli.

2.2 Process flow of mining activity in NLC India

Mining of lignite involves excavation of soil from earth in layers until the level is reached below the soil where lignite is available. The layers are called benches and named as New Surface Bench, Surface Bench, Top Bench, Middle Bench and Bottom Bench in descending order and lignite is available below the Bottom Bench. The soil removed to reach the lignite deposits is called overburden. The soil excavated as overburden may be dumped in the area where mining of lignite is completed. This is called reclamation/internal dumping. The excavated soil may also be moved and dumped outside the mine area. This is called external dumping. The figure 2.1 gives a picture of the process of excavation, mining and reclamation.

Figure 2.1: Lignite Mining and overburden dumping

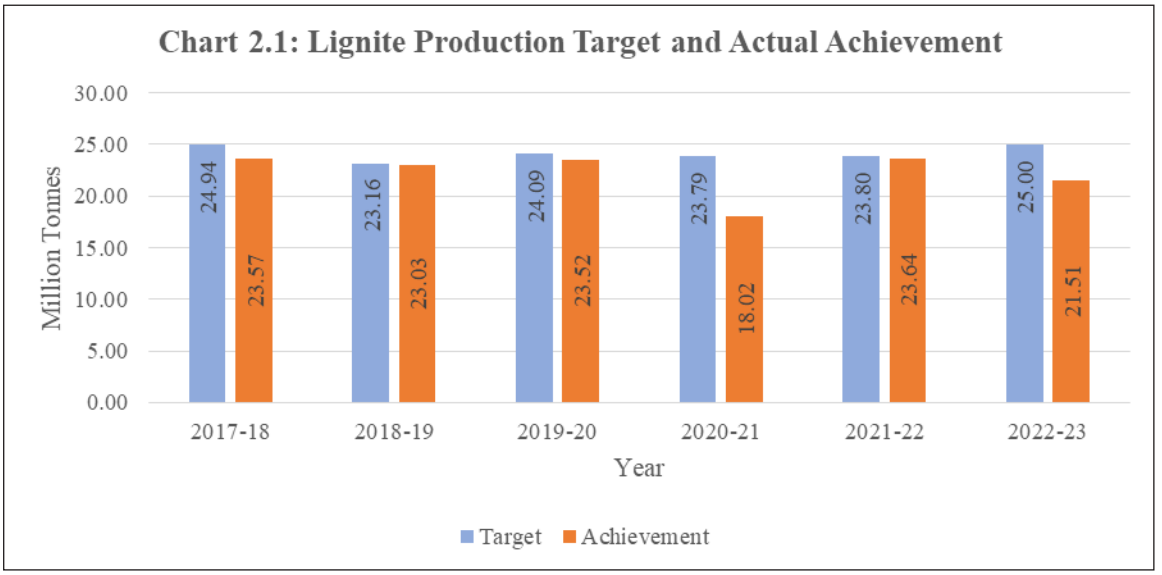


Source: Mining Plan of Mines

Specialized Mining Equipment (SMEs) are used for the excavation of soil, transporting and depositing the overburden at reclamation site or dump sites. Similarly, lignite is also excavated, transported and deposited at storage sites with these SMEs.

2.3 Lignite production by NLC India

Lignite production was linked to power generation at the pit head thermal power stations. The targets for mining of lignite were fixed for the respective mine on the basis of lignite requirements for power generation at the linked power station during the year. The chart 2.1 shows target and achievement of lignite production for the mines at Neyveli during the period 2017-18 to 2022-23.



Source: Data furnished by Management and Annual Reports of NLC India

Lignite production in Mine-II was impacted by reduction of power generation due to stoppage of power generation at TPS-II as a result of fire accidents as well as low demand during COVID-19 in 2020-21. Non-availability of land for mining in Mine-II area also impacted lignite production in 2022-23. The year-wise targets and actual production of lignite by NLC India for Mine-I, Mine-1A and Mine-II are given in **Annexure-I.**

2.4 Impact of non-availability of adequate land for Mining operations

Total identified mining area for three mines[10] at Neyveli was 12,835 hectares. Out of this, NLC India acquired and took possession of 9,180 hectares of land (March 2023). Physical possession for 580 hectares of land was yet (March 2023) to be taken by NLC India. Out of this, 77, 187 and 316 hectares land was acquired between 2000 to 2006, 2006 to 2013 and from 2014 onwards (March 2023) respectively. NLC India had already mined 5,880.34 hectares while 3,253.47 hectares were occupied by external overburden dump

[10] ***Mine-I: 3,635 hectares; Mine-IA: 2,006 hectares and Mine-II: 7,194 hectares***

and infrastructure. Thus, NLC India had only 46.19 hectares (9,180 hectares – 9,133.81 hectares) of land for mining (March 2023). As per NLC India's estimate, available land could provide 44.10 million tonnes of lignite (March 2023). Mine-wise break-up of land availability and lignite available for extraction is given in **Annexure-II A and B.**

Audit estimated lignite requirement at normative plant availability factor (PAF) [11] and the obligation to supply lignite for private power producer. On an average basis, NLC India required (March 2023) an estimated quantity of 26.66 million tonnes of lignite in a year **(Annexure-III)**. Thus, with an estimate of only 44.10 million tonnes of lignite reserve available as of March 2023, NLC India could operate the linked power stations only for about 20 months i.e. till November 2024. Earlier, NLC India had also assessed (November 2021) that on an average 225 hectares of land per annum was required to feed the linked power stations for production of electricity. Audit noted that the available land (46.19 hectares) as on March 2023 was short of the required land per annum to feed the linked power stations.

Audit observed that the delay in taking possession of acquired land and acquisition of additional land resulted in high cost of lignite production and loss of revenue as discussed below:

- Mine-II was operated in 2022-23 with lower production due to inadequate land availability for mining. Thus, there was short supply of lignite by 2.77 million tonnes to linked TPS-II and TPS-IIE in third and fourth quarters of 2022-23. This resulted in potential loss of opportunity to earn revenue in mining operations to the extent of ₹338.62 crore[12], determined on the basis of CERC's provisional tariff order (May 2023) for lignite transfer price from Neyveli mines.

Ministry replied (February 2024) that the delay in acquisition of land was the result of legal entanglement in implementation of Land Acquisition Act, 2013, which was beyond the control of NLC India. Ministry stated that even though land acquisition was affected since 2014, there was no short supply of lignite to linked power stations during 2017-22. The high aspirations and expectations of landowners were addressed though NLC India's all-out efforts in co-ordination with GoTN authorities.

The reply is to be viewed in light of the fact that delay in taking timely possession of land acquired at different points of time through GoTN authorities impacted land availability for mining and NLC India lost revenue besides incurring additional cost due to removal of soil from overburden dump site. Further, an area of 580 hectares of land acquired between 2000 and 2023 remained out of NLC India's possession till March 2023. Subsequently, 469.37 hectares out of the above area was taken into possession in short span of time

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[11] ***PAF is an indicator to assess the readiness of a power plant for power generation. CERC prescribes normative PAF which power plants must achieve in order to recover its Fixed Cost.***

[12] ***TPS-II: 1,336.45 MU*1.09 kg lignite per unit @₹2202/tonne (₹320.77 crore) and TPS-IIE: 83.57 MU*0.97 kg lignite per unit @ ₹2202/tonne (₹17.85 crore)***

between April 2023 and May 2024. This indicates that timely possession was possible and thereby production loss could have been avoided.

During Exit conference (March 2024) Management stated that Land Acquisition was also hampered during the period 2013-19 due to delay in revision of Tamil Nadu's Land Acquisition Act in consonance with Right to Fair Compensation and Transparency in Land Acquisition, Rehabilitation and Resettlement Act 2013.

➢ As NLC India could not acquire the additional land on the eastern side of Mine-IA, due to resistance from landowners and demand for enhanced compensation, NLC India carried out mining by moving the mine to the west which was already filled with overburden dump on lignite bearing area. Thus, NLC India incurred ₹364.80 crore[13] towards excavation of dumped overburden. This increased the cost of production of lignite.

Management replied (October 2023) that it had proceeded to remove the overburden dump due to difficulties in acquisition of land which was in the hands of state government. It also stated that the dumping was not done intentionally and due to expansion of capacity of Mine-IA boundary which overlapped with high dump of Mine-I.

Ministry replied (February 2024) that as per the Environmental clearance of Mine-I and Mine-IA, re-handling of overburden dump was a mandatory requirement and even if the overburden was dumped in the non-lignite bearing area, NLC India had to restore the land in its original position to the maximum extent possible.

The reply needs to be seen in light of the fact that as per Environmental Clearance conditions (September 2015) and Mining Plans of Mine I (April 2015 and revised March 2022), afforestation of the external dump (478.14 ha) was to be done post-mining. Moreover, NLC India ventured to establish overburden to M-sand (manufactured sand for construction activities) plant on Build-Own-Operate basis by utilising the external dump of mines and also obtained an environmental clearance for the same (December 2022). These actions confirm that land will not be restored to original condition.

Recommendation No. 1
NLC India should expedite land acquisition and possession to ensure uninterrupted lignite production.

[13] ***The contract for excavation of overburden was awarded (September 2015) and foreclosed in April 2018. From October 2015 to April 2018, 19.97 MM^3 of overburden was excavated from the dump at an expenditure of ₹135.42 crore (₹265.56 crore/39.16 MM^3 *19.97 MM^3). Another contractor excavated 25.02 MM^3 overburden from the dump during June 2018 to February 2024 at an expenditure of ₹229.38 crore.***

2.5 Mining operations without environmental clearance

NLC India obtained (December 2002) Environment Clearance (EC) under Environmental Impact Assessment (EIA) Notification, 1994 from Ministry of Environment and Forests for Mine-II.

Hon'ble Supreme Court of India ordered (August 2017) that all mining projects which were granted environmental clearance under the EIA Notification, 1994 will be valid for five years only and had to be revalidated under EIA Notification, 2006. To implement the above judgement, Ministry of Environment, Forests and Climate Change (MoEFCC) notified (April 2018) that all mining projects which had obtained EC under EIA Notification, 1994 need to be revalidated and to obtain EC under EIA Notification, 2006 within six months from April 2018. An online portal for submission of application towards this purpose was opened from April to October 2018.

NLC India obtained EC under this notification for Mine-I and Mine-IA in September 2015, however, NLC India did not obtain EC under the EIA Notification, 2006 for Mine-II. NLC India submitted hard copy of application for obtaining EC in February 2019 as the online portal was already closed. As the entire process of MoEFCC was online, the offline application of NLC India was not considered. NLC India continued to approach MoEFCC from time to time to re-open the portal until application was accepted online in December 2020 under violation category.

In reply to Audit enquiry, Mine-II (Planning Department) stated (December 2022 and January 2023) that Corporate Environment Cell (CEC) was looking after this work from 2018 to 2019. The task of obtaining EC was assigned to Planning Department from December 2019. CEC at Corporate Office used to liaison with the Ministry for Environment Clearances of Mines. However, the Cell denied its responsibility for obtaining EC/re-validation of EC and stated (January 2023) that re-validation of EC was never looked after by CEC and it was being looked after by the Mine-II (Planning Department). Hence, lack of co-ordination between the departments resulted in non-submission of the re-validation application on time.

Management replied (July 2023) that various legal cases on the Standard Operating Procedure for handling violation cases issued by MoEFCC delayed the process of obtaining EC. It was also stated that there was no impact on health and safety of employees as well as the environment as the mine was operating within approved norms and EC conditions.

Ministry added (February 2024) that the legal cases have been settled and Hon'ble High Court of Madras ordered (September 2023) MoEFCC to consider NLC India's application for revalidation.

The reply is to be viewed in light of the fact that Mine-II was being operated without a valid EC. Audit noted that in the absence of valid EC, NLC India was not able to sell minor

minerals from Mine-II which resulted in loss of anticipated production of minor minerals as discussed in paragraph 2.7. Delay in revalidation of EC could have been avoided had NLC India submitted the application in prescribed time.

2.6 Dumping of overburden beyond environmental clearance norms

a) Violation of EC norms in Mine-I

Ministry of Environment Forests and Climate Change (MoEFCC) while granting environmental clearance for Mine-I (September 2015) inter-alia stipulated that maximum height of external overburden dump should not exceed 20 metre and slope by 28 degrees. Audit noted that the average height of external dump of Mine-I was 50 metre, which did not conform to environmental clearance conditions.

Management replied (July 2023) that for Mine-I, from the date of receipt of EC (September 2015) there was no dumping in the existing external dump and the dump was formed into five benches with height of each bench varying from 7 to 14 metre.

Ministry concurred (February 2024) with the reply of the Management and added that the external overburden dump of Mine-I with a height of 50 metre was created during the initial mining period with hard soil and the same has been strengthened through benching, terracing and plantations to prevent soil sliding.

The reply need to be viewed in light of the fact that even after the corrective actions, the height of the initially created external dump was more than 20 metre as prescribed in EC conditions. The risk of soil sliding could not be ruled-out during incessant rains causing damages to adjoining areas and avoidable expenditure on clearance of the same, as noticed in case of Mine-II which is discussed in subsequent sub-para.

b) Violation of EC norms in Mine-II

As per the Environmental Clearance granted (December 2002) to Mine-II by MoEFCC, the height of external dump and angle of slope should not exceed 65 metre and 28 degrees respectively. Further, it directed to conduct a scientific study for advice on slope stability.

Audit noted that NLC India dumped overburden in Mine-II upto 120 metre in height contrary to stipulated norms of MoEFCC. Soil sliding resulted in blockage of drains and damage to adjacent private cultivable lands during the years 2012, 2013, 2015 and 2018. This led to repeated protests from the farmers for claiming damages to their land and loss of their income. NLC India paid compensation of ₹2.18 crore (upto March 2023) to private land owners. NLC India also awarded contracts (2020-21 and 2021-22) to remove soil from the drains and agricultural lands and paid ₹14.98 crore (till September 2023) to the contractors.

Management replied (July 2023) that outside dumping was resorted to due to non-availability of adequate land. It stated that unprecedented heavy rains caused choking of well-established canals and led to soil sliding. Keeping in mind social responsibility and welfare of farmers concerned, it was decided to restore the lands in cultivable condition. Management further stated that external dumping was done based on the scientific study conducted (July 2004) by Central Mining Research Institute, Dhanbad.

Ministry added (February 2024) that the sub-soil in the dump area has alluvial clay of highly compressible nature and caused lot of heaving and movement of earth mass when water entered it. It also stated that there was scarcity of land for dumping which led to dumping over the existing dump.

Management and Ministry's reply needs to be viewed in light of the fact that acceptance of MoEFCC was not received on NLC India's request for exceeding stipulated dump height based on study conducted by CMRI, Dhanbad.

In the Exit Meeting (March 2024), Management informed Audit that a scientist from Regional Office Chennai of MoEFCC visited (February 2024) Mine-II and certified that inactive overburden dump height was now being maintained as per the norms of EC conditions. The facts stated in the Exit meeting indicated that the compliance to norms was ensured subsequent to Audit. Had NLC India complied to the EC stipulations and restricted the height of the external dumps, it could have avoided compensation paid to farmers and expenditure to remove soil from cultivable land.

Best practices as noted by Audit: In the area of sustainable land reclamation activity and various other environment-friendly initiatives, afforestation and green belt creation projects were carried out in all mining areas in compliance with the mine closure plan. NLC India carried out afforestation in 2,188 hectares from mined out area and various types of native trees have been planted in this area. So far, more than 27.96 lakh saplings have been planted in the reclaimed land and high-tech vegetable cultivation is taking place in 100 hectares of land. This type of soil is unsuitable for cultivation due to the heterogeneous nature, devoid of plant nutrients. Moreover, such type of soil does not have proper texture and structure essential for vegetation growth. NLC India, with dedicated effort, converts such refilled areas into agriculture fields by improving the soil quality to pre-mining level and scientific agriculture methods are used for the same. Fifty-two water bodies have been created in 104 hectares facilitating rainwater harvesting by NLC India in line with sustainable mining initiatives. Eco-tourism park with boating facility, a mini zoo having variety birds are some of the other highlights. With sustained environment friendly initiatives of NLC India, the area has become home to large number of native and migratory birds.

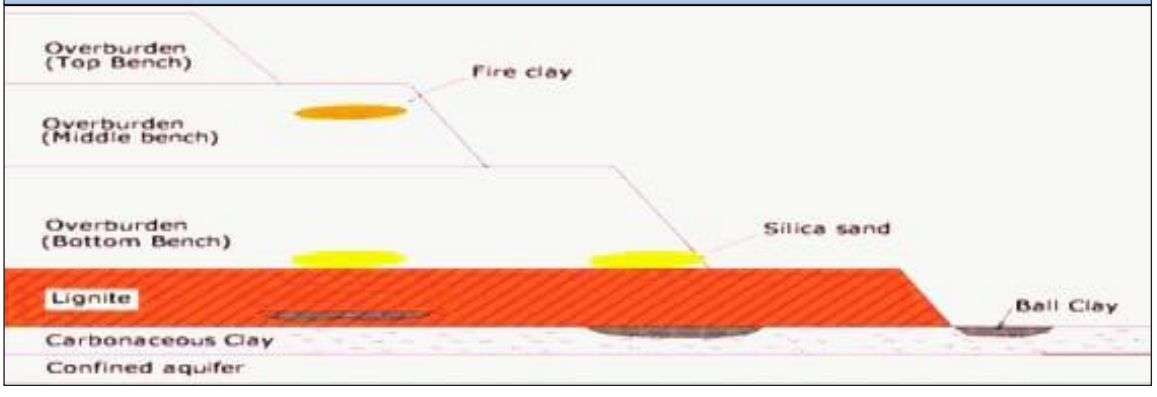
2.7 Avoidable loss of opportunity to earn revenue through sale of minor minerals

Government of Tamil Nadu (GoTN) granted (December 1956) mining lease[14] to NLC India for mining lignite along with silica sand, ball clay and fire clay in 259 Sq km covering 70 villages in Cuddalore District. Later Ministry of Mines, GoI notified (February 2015) silica sand, ball clay and fire clay as minor minerals. Section 15 of MMDR Act, 1957, provided power to State Governments to make rules in respect of minor minerals. GoTN amended (April 2016) Tamil Nadu Minor Mineral Concession Rules, 1959 and made it mandatory to obtain permission from GoTN for mining silica sand, ball clay and fire clay as minor minerals separately.

GoTN granted (February 2017) NLC India a temporary permit to mine, store and transport of minor minerals. Accordingly, NLC India mined, transported and sold minor minerals till January 2018 after which GoTN stopped the temporary permit. Consequently, NLC India applied (January 2018) for permission to mine and for sale of minor minerals. GoTN granted (January 2023) permission to mine, transport and sell minor minerals for Mine-I and Mine-IA and the lease deed was executed (March 2023) with GoTN. However, GoTN did not grant mining lease for minor minerals from Mine-II as there was no Environmental Clearance from MoEFCC for mining lignite from Mine-II.

Silica sand and fire clay are found embedded in the soil overburden. Ball clay is found below the lignite bed. A pictorial depiction of location of minor minerals in NLC India mines at Neyveli is given in figure 2.2.

Figure 2.2: Schematic diagram showing occurrence of Fire clay, Silica sand and Ball clay in the benches



Source: Mining Plan for Minor Minerals

Audit noted that GoI declared ball clay, fire clay and silica sand as minor minerals and GoTN made it mandatory to obtain a separate lease for mining minor minerals in February 2015 and April 2016 respectively. However, NLC India applied for the same in January 2018 with delay of 20 months. As per the mining plan[15], NLC India anticipated a

[14] ***Renewed every 20 years***

[15] ***As per Mining Plan for Minor Minerals of Mine-I (May 2020); Mine-IA (January 2020) and Mine-II (May 2019)***

production of 7.15 lakh tonnes of ball clay: 13.20 lakh tonnes of silica sand and seven lakh tonnes of fire clay in its three mines every year. But NLC India could not segregate minor minerals and dumped it along with the overburden during February 2018 to January 2023. Thus, delay in obtaining the separate lease for mining minor minerals caused avoidable loss of potential to earn mining revenue to NLC India.

Management replied (July 2023) that the process of obtaining mining lease for minor minerals for NLC India mines involved multiple compliances and that there was no delay on its part in obtaining mining lease for minor minerals. It also stated that as per mining lease conditions, no quarrying activities should be done before execution of lease deed and hence it was not permitted to mine the minor minerals. Ministry concurred (February 2024) with the reply of the Management and added that mineral patches in the bottom bench have never been excavated due to their sporadic occurrence, non-possibility of selective mining due to operation of bucket wheel excavator (BWE) and economic non-viability. It further stated that only the silica sand located between the two interburden benches were being mined selectively by conventional mining equipment (CME). It also stated that the areas where minor minerals were available were kept intact with an intention to materialize it after obtaining the related permissions/clearances and that overburden was not dumped over the mineral bearing area.

The reply may be viewed in light of the fact that NLC India did not apply for mining lease of minor minerals till January 2018 even though GoTN made it mandatory in April 2016 to obtain quarrying lease for mining silica sand, ball clay and fire clay as minor minerals separately. Thus, there was delay in filing lease application. The mining plan for minor minerals indicated that their occurrences were not sporadic. The fact that NLC India had been selling[16] these minor minerals indicated that their sale was economically viable. The removal of overburden and minor minerals was necessary to access the lignite bed. However, fire clay and silica sand which were removed during excavation were not segregated and dumped along with overburden soil, making their separation not feasible in future.

2.8 Maintenance of Specialised Mining Equipment

a) Usage of Specialised Mining Equipment beyond useful life

Specialised Mining Equipment (SME) are a special class of material handling equipment designed to handle bulk quantity of overburden and minerals. Bucket Wheel Excavators (BWE) removed the overburden to transfer it to a series of belt conveyors to finally fed the Spreader for dumping the overburden. Pictures and brief description of these SMEs is given in figure 2.3.

[16] ***NLC India sold (July 2015) fire clay from Mine-IA at ₹350 per tonne, ball clay and silica sand at average sale price of ₹710 per tonne and ₹560 per tonne respectively during 2017-18.***

Figure 2.3: Specialized mining equipment used for lignite mining

			
Bucket wheel excavator is used to dig out the soil or lignite at the respective benches and load the soil or lignite on to the conveyor system.	**Conveyor belt system** carries the soil or lignite across the mine to respective dumping/ storage site.	**Mobile transfer conveyors** connect two streams of conveyors.	**Spreaders** are used to transfer the over burden and lignite from the conveyor belt to their dumping/storage site.

Source: Mining Plan of Mines and Records of Management

The service life norms of SMEs as indicated in the perspective planning report (1980) by NLC India is detailed below:

Table 2.1: Details of Service Life of Specialized Mining Equipment deployed in Mines

Sl. No.	Type of SME	Service Life
1.	Bucket Wheel Excavators (BWE)	1,00,000 hours @ 5,000 hours per year
2.	Spreaders (SPR)	1,37,500 hours @ 5,500 hours per year
3.	Mobile Transfer Conveyors (MTC)	1,37,500 hours @ 5,500 hours per year

Source: NLC India's Committee Report on SME Service Life Norms

An internal committee for re-assessment of life of SMEs was constituted (July 2021) by NLC India. The committee recommended (December 2021) to retain the above-mentioned service life norms for BWEs and to reduce the service life of Spreaders and MTCs by 500 hours. The committee also considered the NLC India's Board resolution to rejuvenate the SMEs which had completed its service life to extend it further by 15 years. The rejuvenated SMEs after completion of 15 years of service may be replaced. However, the decision regarding rejuvenation and replacement upon completion of service life was to be performed after detailed technical evaluation, cost benefit analysis and structural stability[17] of equipment. This recommendation was approved by Director (Mines) in February 2022.

Audit observed that out of 72 SMEs deployed in all three mines (Mine-I, Mine-IA and Mine-II) during 2017-18 to 2022-23, data of working hours for 26 SMEs[18] was not

[17] ***A structural stability test for SMEs involves evaluating the equipment's ability to withstand the stresses and loads it will encounter during operation, ensuring it remains safe and functional.***

[18] ***Spreaders and MTCs***

maintained and analysis of the working hours of remaining 46 SMEs revealed the following:

- 15 SMEs[19] were used beyond useful life without rejuvenation or replacement.
- Eight SMEs[20] were rejuvenated after a delay ranging from four to 11 years.
- Four SMEs[21] were used even after usage for more than 15 years after rejuvenation
- Two SMEs[22] commissioned between 1961 to 1966 were used for two years even Though replacements were made for them.
- The remaining SMEs were found to be within their useful life or appropriately rejuvenated and used within prescribed norms.

Management (July 2023) stated that administrative approvals were obtained for carrying out life extension programme of outlived machinery. It also stated that delay in rejuvenation happened due to operational requirements and equipment used after 15 years from rejuvenation were overhauled or removed from active mine operations for use in bunker[23] operation.

Ministry replied that (February 2024) administrative approvals were obtained to undertake Life Extension Programme of SMEs which are crossing useful life during the period from 2024-2029.

The reply is to be viewed in light of the fact that SMEs which had crossed service life norms and 15 years after rejuvenation showed decreased performance as noticed by the internal committee for revision of service life norms. This would affect performance and supply of lignite to linked thermal stations.

b) Non-conduct of Structural Stability Test

After analysis of accidents in open cast mines, Directorate General of Mine Safety (DGMS) observed (January 2009) that fatal and serious accidents in open cast mines were mainly due to usage of surveyed-off equipment[24]. DGMS directed to strictly adhere to the condition of performing a Structural Stability Test of such equipment during the extended period of usage to prevent accidents. This was also highlighted by DGMS during its inspection of NLC India mines in March 2019.

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[19] ***BWE 1574, BWE 1440, BWE 1447, BWE 1648, BWE 1027, BWE 1028, BWE 1573, BWE 1422, BWE 1448, SPR 429, SPR 430, SPR 431, MTC 405, MTC 406 and MTC 1541***

[20] ***BWE 1355 (after five years); BWE 1356 (after six years); BWE 1357 (after 11 years); BWE 146 (after seven years); BWE 1572 (after five years); BWE 1420 (after seven years); BWE 1421 (after four years) and BWE 1571 (after seven years)***

[21] ***BWE 1355, BWE 1137, BWE 1231 and BWE 1356***

[22] ***BWE 1145 and BWE 1198***

[23] ***Lignite dumping yard***

[24] ***Once the equipment attains the designed life, it is surveyed off. Surveying-off and condemning the equipment is decided either by number of working hours or number of years completed.***

Audit observed that Structural Stability Test was not conducted for 12 SMEs out of 21 SMEs[25] which were continued to be used beyond its service life/rejuvenated life/replacement as mentioned in sub-paragraph above.

Management (July 2023) replied that the process of awarding contracts for conducting Stability Test for other outlived SMEs was in progress. Ministry concurred (February 2024) with the reply of Management.

The reply may be viewed in light of the fact that the continuous usage of machines after their service life, after 15 years from rejuvenation and usage of old machines without Structural stability test endangered the safety of mining operations.

2.9 Non-compliance with mine safety norms

As per regulation 106 of Coal Mine Regulations 2017, an opencast mine shall ensure that the pit slope[26], dump slope[27] and monitoring of slope stability was designed and worked as determined by a scientific study. Director General of Mines Safety also pointed out (April 2017) that all the three mines were operated in Neyveli ground water basin. The strata overlying the lignite was not fully consolidated and consisted of semi-confined aquifers. The nature of strata may affect the bench as well as dump stability. As the geo-mining condition in all the mines were similar, necessity of installation of a slope stability system was pertinent.

Accordingly, NLC India conducted a scientific study through Indian Institute of Technology, Varanasi which recommended (August 2019) a maximum height of 30 metre, for internal dumps as well as installation of continuous slope monitoring system using Slope Stability Radar. However, NLC India was yet to procure and install the continuous slope monitoring system (March 2023).

Audit observed that the prescribed height of 30 metre for internal dumps in Mine-II was exceeded in two out of five internal dumps[28] during 2019-20 to 2022-23. Continuous slope monitoring system, as recommended in the scientific study was also not deployed. Excessive internal dumping in Mine-II to a height of 50 metre led to soil-sliding (September 2021) and damaged a Spreader which was deployed in dumping operations

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[25] ***15 SMEs were used beyond useful life without rejuvenation or replacement (BWE 1574, BWE 1440, BWE 1447, BWE 1648, BWE 1027, BWE 1028, BWE 1573, BWE 1422, BWE 1448, SPR 429, SPR 430, SPR 431, MTC 405, MTC 406 and MTC 1541), four SMEs were not replaced even after usage for more than 15 years after rejuvenation (BWE 1355, BWE 1137, BWE 1231 and BWE 1356), two SMEs commissioned between 1961 to 1966 were used for two years even though replacements were made for them (BWE 1145 and BWE 1198).***

[26] ***Pit slope refers to the angle or inclination of the sides of the excavated pit.***

[27] ***Dump slope refers to the inclined surface or side of a mine's dump, where the excavated overburden is piled.***

[28] ***2019-20: (NSB-New Surface Bench and BB-Bottom Bench) and 2020-21 to 2022-23 (NSB and TB-Top Bench)***

which resulted in non-availability of the machine for two months and avoidable expenditure on its repairs of ₹71.75 lakh.

Management replied (July 2023) that Mine-II is presently operating with five overburden benches and dumping is being carried out in the de-coaled area. Starting from the lowermost bench, internal dumping was established in phased manner. It further stated that as per the recommendations of the scientific study, all the necessary precautionary measures are being taken to maintain the height and slope. An Empowered Committee of Directors approved the proposal for procuring three slope stability radars in May 2022 for all the three mines but the tender was cancelled. However, again the procurement process was started for obtaining approval from competent authority.

Ministry replied (February 2024) that during the COVID pandemic, purchase of conveyor materials could not be carried out as planned due to disruption of supply-chain which affected dumping operations. Moreover, during internal dumping at deep most sector, heavy water charging from confined aquifer was encountered due to which dumping was carried out to ensure machine safety.

The reply of Management and Ministry was silent on dumping operations at excessive heights in contravention to recommendations of scientific study even after an accident in 2021-22. Non-implementation of safe dumping heights and delay in procurement of continuous slope monitoring system would threaten the safety in mining operations.

Recommendation No. 2
NLC India should prioritize the procurement and installation of the slope monitoring system and strictly adhere to the 30 metre dump height limit to ensure safety. Timely implementation of these measures is essential to prevent further incidents and ensure the safety of personnel and equipment.

2.10 Energy Audit for energy conservation

Ministry of Coal (May 2016) forwarded direction (April 2016) of Ministry of Heavy industries and Public Enterprises on energy conservation and efficiency to NLC India. It was directed to undertake energy audit so as to initiate steps to reduce energy consumption by 25 *per cent*. However, NLC India initiated steps to undertake energy audit only in June 2020 and awarded (August 2021) the work to an external agency which conducted its audit from September 2021 to December 2021 and submitted (July 2022) its report. The report recommended energy saving measures through replacement, overhauling and installation of equipment involving investment ranging from low to high value. The report recommended that NLC India could achieve an energy cost savings of ₹47.92 crore per year in energy costs in all the three mines, by compliance to energy saving measures determined in the energy audit report.

Audit observed that NLC India delayed the energy audit by four years (i.e. from 2016 to 2020) and delayed the realisation of cost savings as stated by the energy audit report.

Management replied (July 2023) that there were certain internal delays in taking action to conduct energy audit based on directions from Ministry of Coal. However, steps have been taken for the purchase of Energy saving equipment based on energy audit report. It further stated that, irrespective of conducting Energy audit, many energy conservation activities were being carried out which included introduction of energy efficient electrical systems in specialised mining equipment and conveyor belt systems since 2008.

Ministry replied (February 2024) that NLC India did not conduct Energy Audit since Mines were not included in the "List of Energy Intensive Industries and Other Establishments" as per the Energy Conservation Act 2001. It stated that despite non-inclusion of Mines in the above schedule, NLC India has carried out Energy audit in 2020-21. Subsequently, the Act was amended (3 January 2022) to include "Mines including exploration" under the List of Energy Intensive Industries and Other Establishments. It further stated that various energy saving measures were adopted by NLC India which resulted in a net energy savings of ₹9.82 crore during the period 2017-22.

The Management has accepted the delay in compliance to directives from the Ministry. The fact however remains that NLC India had disregarded a directive from the Ministry which had instructed it to conduct energy audit and reduce energy consumption, regardless of the fact that Mines were not included in the "List of Energy Intensive Industries and Other Establishments" as per the Energy Conservation Act 2001. Though NLC India suo-moto implemented energy saving measures prior to energy audit, timely energy audit would have further increased the cost savings for NLC India.

2.11 Conclusion

Mining of lignite is primary operation to power generation by NLC India. Mining plans and targets of lignite production from mining operations for three mines at Neyveli are based on power generation capacities of the thermal power stations. NLC India achieved production targets within range of 75.75 *per cent* to 99.44 *per cent* during the year 2017-18 to 2022-23. Low production of lignite in the year 2020-21 and 2022-23 was due to reduction in power generation and inadequate land for mining respectively. Non-availability of land for mining due to non-possession of acquired land and non-acquisition of additional land by NLC India resulted in high cost of lignite production for Mine-1A since land filled with overburden was used for mining by incurring ₹364.80 crore for removal of dumped overburden. Lower production due to non-availability of land in Mine-II resulted in potential loss of opportunity to earn revenue from mining operations to the extent of ₹338.62 crore. Besides these financial losses in lignite production, potential opportunity to earn mining revenue was also lost since NLC India did not mine minor mineral viz. silica sand, ball clay and fire clay from February 2018 to January 2023.

Audit noted that mining operations were being carried out in Mine-II without a valid environmental clearance under Environmental Impact Assessment Notification, 2006 (March 2023). NLC India did not follow Environmental Clearance requirements on stipulated height of overburden dumps for external dumping of overburden in Mine-I and Mine-II. Audit observed that 15 Specialised Mining Equipment (SME) were in service beyond service life without rejuvenation and eight SME were rejuvenated with delay. Data for working hours of 26 SMEs was not maintained by the Company. Further, Structural Stability Test for such 12 equipment used for extended period was not carried to prevent fatal and serious accidents due to use of survey-off equipment by NLC India.

Thus, significant financial and operational losses in mining operations were suffered by NLC India during 2017-18 to 2022-23 and full compliance to environmental conditions was not done in mining operations. Maintenance of SME for optimal and safe performance of mining operations was not satisfactory as per the service life norms of SMEs. The company also did not comply with safety norms for slope stability in its mines, resulting in a soil-sliding incident in 2021. The steps to conduct energy audit was initiated in June 2020 despite Ministry direction of May 2016 and audit was completed only in December 2021, foregoing potential cost savings.

Chapter 3
Operation of Thermal Power Stations

Chapter 3

Operation of Thermal Power Stations

Lignite is the fuel for NLC India's thermal power generation stations. Lignite excavated from Neyveli mines was supplied to the pit-head thermal power stations and utilised for generation of power. Production of lignite from mines and electricity generation from power stations reciprocally affect the production of each other. NLC India operated five thermal power stations at Neyveli as given below.

Table 3.1: Thermal Power Stations (TPS) at Neyveli

Sl. No.	TPS	Number and date of commissioning of Units	Capacity (MW)
1.	TPS-I	Six Units of 50 MW each (May 1962) and three Units of 100 MW each (February 1970)	600
2.	TPS-II	Three Units of 210 MW each in Stage-I (March 1986) and 4 Units of 210 MW in Stage-II (June 1993)	1,470
3.	TPS-I Expansion (TPS-IE)	Two units of 210 MW each (October 2002 and July 2003)	420
4.	TPS-II Expansion (TPS-IIE)	Two units of 250 MW each (July 2015 and April 2015)	500
5.	New Neyveli TPS	Two units of 500 MW each (December 2019 and February 2021)	1,000

Source: Records of NLC India

In TPS-I, Unit-7 was decommissioned in September 2018, Unit-1 and Unit-9 were decommissioned in 2019-20 and remaining six Units were decommissioned in 2020-21. All the Units of TPSs except TPS-IIE have conventional boilers. TPS-IIE has Circulating Fluidised Bed Combustion[29] (CFBC) boiler.

3.1 Revenue from power generation

The revenue earned by NLC India was primarily from sale of electricity through power purchase agreements to Distribution Companies (DISCOMS) in Tamil Nadu, Andhra Pradesh, Karnataka, Kerala, Telangana, Rajasthan, Union Territory of Pondicherry and Andaman. Revenue earned by NLC India from power generation is regulated by

[29] ***CFBC is one such technology that operates under low combustion temperature. It has good control on SOx and NOx emission. It can also use low quality coal washery rejects and lignite.***

Central Electricity Regulatory Commission (CERC). The tariff for sale of electricity is determined on the basis of CERC's (Terms and Conditions of Tariff) Regulations[30].

Section 61 read with 79 of Electricity Act 2003 empowered Central Electricity Regulatory Commission (CERC) to regulate the tariff to be charged by electricity generating companies and specify the terms and conditions for the determination of tariff on commercial principles and recover the cost of electricity in a reasonable manner while safeguarding consumer interest. Accordingly, the power tariff of NLC India was based on the guidelines/ regulations notified by CERC from time to time. CERC regulations notify a two-part tariff as briefly given below:

a. Capacity Charges (Annual Fixed Costs): A fixed component of tariff which is required to be recovered regardless of power generation. It includes Return on Equity, Interest on Loan Capital, Depreciation, Interest on Working Capital, Operations and Maintenance Costs. The Capacity Charges are recovered through monthly bills.

b. Energy Charges (Fuel Costs): A variable component of tariff based on consumption of fuel which includes primary fuel (lignite) and secondary fuel (high speed diesel and furnace oil). Energy Charges are also recovered through monthly bills.

Since NLC India supplies lignite as fuel from its own integrated mines, CERC Tariff Regulation allows for recovery of the Annual Extraction Cost (AEC) of the integrated mines which consist of depreciation, interest on loans, return on equity, operation and maintenance expenses, interest on working capital, mine closure expenses and statutory charges. This AEC along with other consumables like specific oil and limestone consumed in electricity production constitute the energy charge recoverable by NLC India.

Recovery of actual cost incurred towards Capacity charges and Energy Charges were linked to achievement of normative operational parameters prescribed by CERC which include Plant Availability Factor, Auxiliary Power Consumption, Gross Station Heat Rate and Secondary Fuel Oil consumption.

Total electricity generation by NLC India's power stations at Neyveli as compared to capacity at normative plant availability[31] during 2017-18 to 2022-23 is shown in a chart below.

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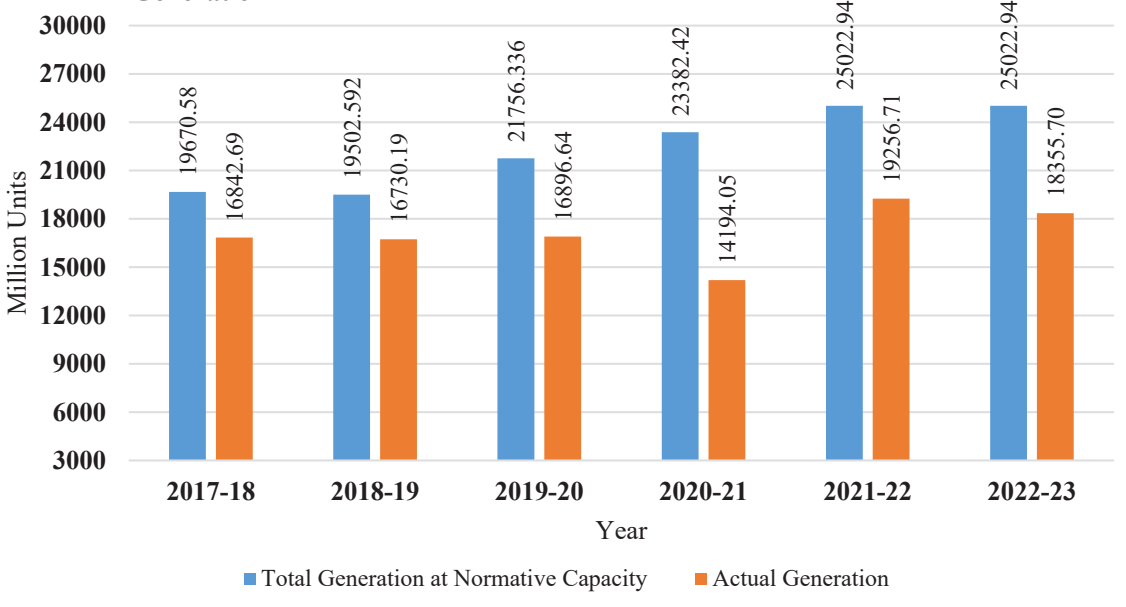
[30] ***The CERC Tariff Regulations, 2014 and the CERC Tariff Regulations, 2019 were applicable for the audit coverage periods April 2017 to March 2019 and April 2019 to March 2023 respectively.***

[31] ***2017-18: 19670.58 MUs; 2018-19: 19502.59 MUs; 2019-20: 21756.33 MUs; 2020-21: 23382.42 MUs; 2021-22 and 2022-23: 25022.94 MUs***

Chart 3.1: Energy generation at Normative Capacity and Actual Generation



Source: Normative PAF Capacity - Calculated by Audit based on CERC Norms, Actual Generation - Annual Reports of NLC India

Actual generation of electricity depended on the actual plant availability. From the above it is seen that the actual power generation was less than normative plant availability generation capacity for all the years. NLC India decommissioned 100 MW capacity (one Unit) and another 150 MW capacity (50 MW Unit and 100 MW Unit) of TPS-I in September 2018 and March 2020 respectively. The remaining 350 MW capacity of six Units of TPS-I was decommissioned in stages between April to September 2020. This decommissioning reduced the capacity available for energy generation. However, two new units of 500 MW each of NNTPS were added in December 2019 and February 2021 thus increasing the total power generation capacity of NLC India.

Audit reviewed the operations of TPS-IE, TPS-II and TPS-IIE during the performance audit. Audit findings on the same are discussed in subsequent paragraphs.

3.2 Non-achievement of normative Plant Availability Factor

Plant Availability Factor (PAF) is average of daily Declared Capacities (DCs) for all days during the operational period expressed as a *per cent* of installed capacity available during the year. It excludes normative auxiliary power consumption of the power plant.

PAF is an indicator to assess the readiness of a plant for power generation[32]. CERC prescribes normative PAF which power plants must achieve in order to recover the full

[32] ***Actual generation may be less or equal to the declared capacity. Actual generation is based on a schedule prepared by load dispatch center after balancing generation and demand for power.***

capacity charge (Fixed Cost). Under achievement of actual PAF with respect to normative PAF proportionately reduces recovery of capacity charges.

Audit noted that NLC India lost ₹2,353.99 crore[33] (**Annexure-IV)** as revenue in capacity charges i.e. under recovery of fixed cost due to non-achievement of normative Plant Availability Factor (PAF) in respect of TPSs selected in audit i.e. TPS-IE, TPS-II and TPS-IIE during the period 2017-18 to 2022-23. The unit wise actual PAF achieved by the selected power stations at Neyveli during 2017-18 to 2022-23 is given in **Annexure-V.**

Audit further analysed the forced outages of TPS-IE, TPS-II and TPS-IIE during the period 2017-18 to 2022-23 and noted the following facts:

- TPS-IIE had outages for 33,451.55 hours mainly due to faults in Fluidized Bed Heat Exchanger[34] (FBHE) system of CFBC boiler and did not achieve normative PAF during 2017-18 to 2022-23.
- Stage II of TPS-II was shut down due to fire in Unit-5 and Unit-6 with an outage of 7,700 hours and 4,560 hours (Total 12,260 hours) respectively in 2020-21. All three units of Stage I of TPS-II were shut down due to maintenance after fire incidents in Stage II units of TPS-II, tube puncture and electrical problems leading to total outages of 4,819.48 hours. TPS-II did not achieve normative PAF in 2020-21.
- In 2021-22, Stage II of TPS-II suffered outages of 1590.38 hours due to generator stator earth fault in Unit-5. TPS-II did not achieve normative PAF in 2021-22.
- In 2022-23, TPS-II had outages for 4,952.12 hours due to shortage and poor quality of lignite. TPS-II did not achieve normative PAF in 2022-23.
- TPS-IE could not achieve normative PAF in 2020-21 because of thrust collar and pad failure of turbine bearings in both Unit-1 and Unit-2 of TPS-IE leading to outages for 1,548 hours and 292.15 hours respectively.

Management and Ministry concurred (July 2023 and February 2024) with the reasons for non-achievement of normative PAF as mentioned above. Management highlighted the fact that TPS-II had achieved the PAF of more than 85 *per cent* in another period of Audit. This plant has already completed 30 years which is beyond its design life of 25 years.

Audit noted that the reasons attributed for forced outages were avoidable and discussed in detail in succeeding paragraphs.

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[33] ***Data provided by Management***

[34] ***In the FBHE the thermal content of the hot ash is put to the effective use for steam superheating, reheating and steam generation. The cooled ash is returned directly to the combustor.***

3.3 Forced Outages

Thermal power plants undergo periodic planned maintenance for which plants are shut down. This planned outage/shutdown is necessary for smooth functioning of a thermal power plant. However, sometime the plants may have to be stopped due to various unplanned and unknown reasons/ breakdowns. Such undesirable outages are forced outages. Forced outages reduce the plant availability for power generation as the plants are shut down for repairs.

Plant-wise detail of forced outages at TPS-IE, TPS-II and TPS-IIE during 2017-18 to 2022-23 is given below**.**

Table 3.2: Details of Forced Outages in Thermal power Stations

Year	No. of Forced Outages			Forced Outages Hours (in hrs.)			Loss of Generation (MUs)		
	TPS - IE	TPS - IIE	TPS-II	TPS-IE	TPS-IIE	TPS -II	TPS-IE	TPS- IIE	TPS-II
2017-18	9	44	56	112.72	5,353.72	1,217.35	23.67	1,338.43	255.64
2018-19	15	36	63	914.40	4,958.13	1,832.45	192.02	1,239.53	384.81
2019-20	13	52	58	220.37	8,253.63	1,330.93	46.28	2,063.41	279.50
2020-21	11	45	81	2,389.07	4,767.43	6,817.08	501.70	1,191.86	1,431.59
2021-22	13	35	75	218.21	5,196.97	5,240.47	45.83	1,299.24	1,100.50
2022-23	12	38	86	431.07	4,921.67	8,681.76	90.52	1,230.42	1,823.71
Total	**73**	**250**	**419**	**4,285.84**	**33451.55**	**25120.04**	**900.02**	**8,362.89**	**5,275.75**
Grand Total	**742**			**62,857.43**			**14,538.66**		

Source: Records furnished by Management

The major reasons for forced outages are given in Table below**.**

Table 3.3: Major reasons for forced outages in Thermal Stations

Sl. No.	TPS-IE		TPS-IIE		TPS-II	
	Reason	Outage hours (in *per cent*)	Reason	Outage hours (in *per cent)*	Reason	Outage hours (in *per cent*)
1.	Turbines Bearing failure	66.66	Coil puncture in FBHE coil/tube puncture	66.22	Tube Punctures	31.04
2.	Generator Transformer failure	10.00	Water wall Tube Puncture	12.48	Shortage of Lignite and Slag conveyor	22.50
3.	Lignite Shortage	3.90	Refractory	5.27	Safety reasons	11.12

Sl. No.	TPS-IE		TPS-IIE		TPS-II	
	Reason	**Outage hours (in *per cent*)**	**Reason**	**Outage hours (in *per cent)***	**Reason**	**Outage hours (in *per cent*)**
					(after fire incidents)	
4.	Ash Handling System problem	3.89	Steam cooled water wall hanger tube puncture	4.08	Electrical Problems (damage to the rotor)	12.11
5.	Others	15.55	Others	11.95	Wet Lignite	5.81
					Others	17.42

Source: Analysis based on data furnished by Management

Test check of some of the reasons for these forced outages are discussed below:

3.3.1 Coil puncture in FBHE of CFBC boiler

TPS-IIE has CFBC boiler in place of a conventional boiler. CFBC uses FBHE system for efficient heat exchange. NLC India selected BHEL to build their TPS-IIE with this technology. There were frequent FBHE failures in both the units since inception and modifications were carried out by BHEL or NLC India as per the BHEL recommendations to overcome the FBHE failures. However, the problems were persistent. This resulted in 22,152 outages hours (66.22 *per cent*) between April 2017 and March 2023. Besides this, water wall tube puncture, refractory, steam cooled water wall hanger tube puncture and other minor reasons caused 11,299.55 outages hours (33.78 *per cent*). These outages brought down the PAF of the TPS-IIE for the period 2017-18 to 2022-23**.**

Management accepted (July 2023) that there was persistent problem with TPS-IIE. Ministry stated (February 2024) that it was a conscious decision to accept CFBC technology. It also stated that after phased modification the PLF of the plant got improved. Additionally, NLCIL has represented to CERC regarding technical difficulties faced to operate CFBC boilers. CERC and CEA have reduced the Normative PAF from 80 to 50 *per cent* in the draft tariff order for the period 2024-29.

Reply need to be viewed in light of the fact that inherent design deficiencies in the CFBC boiler were confirmed by technical audit report[35] (August 2014) as the TPS-IIE could not be run continuously at full load even for a few days and was operating with plant availability factor of less than 50 *per cent* during the period 2017-18 to 2022-23. Further, though it was a conscious decision, CFBC boiler of 250 MW capacity was not widely used

[35] ***NLC India formed (June 2014) a team of external experts to do a technical audit for completion of TPS-IIE project.***

technology as only one unit in the world was operational as noted from revised feasibility report of TPS-II expansion (February 2002). Though, there was increase in PLF in 2023-24 (PLF- 49.00 *per cent*) as compared to 2022-23 (PLF- 45.03 *per cent*), the fact remains that the plant was not stabilized and Letter of Award (LoA) was issued (June 2023) to BHEL for major revamping of FBHE which was in progress. Further, CERC in their notification (15 March 2024) reduced the normative PAF to 70 *per cent* (not 50 *per cent*) for TPS-IIE for the tariff period 2024-29.

3.3.2 Thrust collar failure in turbine of TPS-IE (Unit-1 and 2)

In September 2019, NLC India decided to inspect the thrust cum journal bearing of turbine as the wear readings (-0.48 mm) parameter was nearing alarm value (±0.60 mm). Accordingly, a LoA (February 2020) was issued to a contractor (M/s. GE Power India Limited) for inspection of Thrust cum Journal bearing. NLC India shutdown (September 2020) Unit-1 of TPS-IE to carry out inspection of the Unit-1 which was running with excessive thrust wear value in thrust bearing of generator turbine. The inspection revealed scoring/rubbing marks with undulations up to 0.08 mm (Original Equipment Manufacturer (OEM) recommendation: 0.015 mm) in thrust collar of thrust bearing. However, the Unit-1 was restarted on 1 October 2020 without rectification of the problem and it tripped after ten days. NLC India resorted to in-situ machining by polishing the thrust collar by M/s. GE Power India Limited and re-started the Unit-1 after 23 days (10 October 2020 to 3 November 2020). The Unit-1 tripped immediately (4 November 2020) and could be made operational on 14 December 2020 after rotor replacement by the service arm of OEM[36].

Similarly, Unit-2 of TPS-IE tripped in February 2021 after which an inspection and rectification of Thrust cum Journal bearing was arranged (March 2021) by the service arm of OEM which revealed scoring/rubbing marks with undulations up to 0.08 mm (OEM recommendation: 0.015 mm) in thrust collar of thrust bearing. However, NLC India again resorted to temporary solution by polishing the thrust collar. The Unit-2 was restated on 19 March 2021 but the Unit-2 tripped immediately. It was made operational on 30 April 2021 after rotor replacement by the service arm of OEM.

The shutdown of Unit-1 and Unit-2 resulted in 2,536.41 hours of lost production. This brought down actual PAF of the units and normative PAF was not achieved in 2020-21.

Management in their reply (October 2023) confirmed the facts of the tripping. Ministry replied (February 2024) that though inspection revealed defects, machining of the thrust collar or replacement of spare rotor was not envisaged and it was decided to run the Unit-1 with the existing condition. After outage, in situ machining was a stop gap arrangement however the Unit-1 again tripped. In respect of Unit-2, Management stated that turbine thrust pad failure occurred due to sudden imbalance in thrust. Its unique design

[36] ***Asia Power Projects Private Limited***

makes it vulnerable to minor thrust variation. It was decided to engage OEM for rectification work by replacing IP-LP rotor after on-site machining.

The fact remains that the contractor who inspected Unit-1 recommended for machining thrust collar. However, in situ machining as stop gap arrangement was done instead of removal of rotor from its position and machining. Further, NLC India resorted to temporary solution by polishing the thrust collar though NLC India was aware of non-accuracy of in-situ machining/ polishing as a temporary solution.

3.3.3 Damage to the rotor of Generator turbine TPS-II Stage-I (Unit-3)

NLC India found (November 2021) that there was a damage to the rotor of generator turbine which resulted from a series of events that originated in the 230 KV circuit breaker of Unit-3 while attempting to shut down Unit-3 of TPS-II Stage-I due to wet lignite.

Audit noted that preventive maintenance of circuit breaker was scheduled on or before August 2021 which was not undertaken. Preventive maintenance of the same was carried out in December 2021. Audit observed that timely preventive maintenance and study of the problems with circuit breakers would have avoided the rotor breakdown and forced outage of Unit-3 of TPS-II for 716.03 hours.

Management did not reply on delay in conduct of preventive maintenance. However, Management replied (July 2023) that the contract was awarded (April 2021) to GE T&D India Limited (OEM) on nomination basis for conditional assessment of circuit breaker. The work could not be carried out due to COVID-19. Request for extension of time was not allowed as per the contract manual. The damaged rotor was sent to OEM works for refurbishment. Work is expected to be completed by November 2024. Insurance claim of ₹12 crore has been lodged with the insurer.

Ministry endorsed (February 2024) the Management reply.

The reply need to be viewed in the light of the fact that the damaged rotor was not fixed even after three years of assessing the problems. Moreover, the OEM recommended in maintenance plan of circuit breaker an annual visit to check that the circuit breaker and associated control circuits were working properly. This was also not done by NLC India.

3.3.4 Forced outages due to fire incidents in TPS-II (Unit-5 and 6)

NLC India had to shut down its Unit-5 and 6 of TPS-II due to two fire incidents on 7 May 2020 and 1 July 2020 respectively for 12,260 hours[37]. The fire incidents also resulted in plant shutdown for safety reasons in Unit-4 of TPS-II for 2,108.72 hours. Audit findings on the fire incidents are discussed in detail in Para 3.8.

[37] ***7,700 hours in Unit-5 and 4,560 hours in Unit-6***

Recommendation No. 3
NLC India should ensure timely preventive maintenance as per laid out SOP to reduce forced outage

3.4 Partial load loss operations

Partial load loss implied that units of a thermal power station were not able to operate at available capacity. Operations of thermal power plants at lower capacity stemmed from factors such as non-availability, inadequate quality of fuels for the plant, technical issues such as non-availability of systems to deliver the fuel, malfunctioning of equipment and inability to evacuate power. The reasons for partial load operations of NLC India's power stations are given in table below.

Table 3.4: Reasons for Partial Load Loss

TPS-IE		TPS-IIE		TPS-II	
Reason	***per cent***	**Reasons**	***per cent***	**Reasons**	***per cent***
Load Restriction	77.63	CFBC Technology related issues	40.70	Load Restriction	55.90
Lignite Shortage and Wet lignite	6.82	Load Restriction	14.85	Shortage/restricted supply and Variation in quality of lignite/Electro Static Precipitator	15.50
Lignite quality	5.51	Lignite Feeding System	10.08	Milling/Pulverising system	8.78
Start Up/Shutdown Loss	2.48	Start Up/Shutdown Loss	7.89	Electrical problem	6.68
Others	7.56	Back pass temperature restriction	3.17	Wet Lignite	3.94
		Others	23.31	Lignite Feeding trouble	3.80
				Others	5.40

Source: Analysis based on data furnished by Management

NLC India operated power stations TPS-IE, TPS-II and TPS-IIE at partial load due to operational inefficiencies and suffered generation loss of 1,594.77 MUs during 2017-18 to 2022-23 as test checked by Audit. Consequently, low generation of energy resulted in lower consumption of lignite from the mines and resulted in under recovery of annual extraction costs for lignite mines to the extent of ₹360.52 crore[38] **(Annexure-VI A to C)**. The various partial load loss operations test checked in audit are discussed in following sub-paragraphs.

[38] ***Based on the revenue loss due to non-consumption of lignite from linked mines as a result of partial load loss.***

3.4.1 Milling/Pulverising system of TPS-II

Mills were used to crush/pulverise lignite into fine particles to ensure smooth flow of lignite to Furnace for power generation. Performance of the Mills in TPS-II was affected due to aging of Mills, air ingress into Mills due to leakages/gaps in ducts, flow of lignite at elevated temperature and foreign material coming along with lignite. Management proposed (April 2023) to purchase Mill door seal collar assembly to resolve the leakages/gaps in ducts. However, the Mills performance was impacted continuously since 2017-18. This led to partial load operations of the plant with a loss of 650.88 MUs during 2017-18 to 2022-23 in TPS-II.

Management replied (October 2023) to take corrective action by purchasing mill door seal collar assembly. Ministry concurred (February 2024) with the reply of the Management.

3.4.2 Lignite Feeding System of TPS-IIE

TPS-IIE carried out major modifications/rectifications (2016 and 2017) to address the breakdowns in the lignite feeding system. However, despite carrying out such modifications/rectifications lignite supply was affected. Audit observed that Management did not take initiative to resolve the problem during 2017-18 to 2022-23. This led to partial load loss of 295.37 MUs during 2017-18 to 2022-23.

Management/ Ministry stated (February 2024) that they have taken steps to augment capacity of the lignite feeding system and purchase orders have been issued.

The proposal for upgradation of lignite feeding system was approved and contract was awarded in October 2023 and December 2023 respectively despite breakdown of lignite feeding system occurring since 2017-18.

3.4.3 Lignite Handling System of TPS-II

Lignite Handling System (LHS) is of prime importance to manage power generation in all Units of NLC India. Any breakdown in the system shall be rectified immediately to restore the transfer of lignite and sustain power generation

Audit noted that minimum of 2,700 meter belts (1800 mm width/5 ply) were urgently required to replace the existing belt in various conveyors before the monsoon[39] of 2018-19. However, NLC India had only 700 meters in stock in August 2018. Therefore 2,000 meters had to be purchased before the monsoon i.e. before October 2018. Audit reviewed and noted that at least six months were required to procure such belts through open tender. NLC India was also aware that the belts supplied by the previous vendors were of poor quality. Hence, NLC India decided (August 2018) to procure belts from the approved list of suppliers of NTPC Limited. Accordingly, NLC India invited (September

[39] ***Neyveli has monsoon during October to December from North-East monsoon i.e. retreating monsoon.***

2018) tenders from suppliers of NTPC Limited and the purchase order was issued (October 2018) for 2,000 meters of belts. Belts for 800 meters and remaining belts of 1200 meters were procured in March 2019 and March 2023 respectively.

Audit observed that the delay in procurement of belts resulted in loss of 281.53 MUs in TPS-II as LHS could not be operated in full capacity for the period 2017-18 to 2022-23.

Management accepted (October 2023) that there were partial loss due to repeated and frequent breakdown of conveyors during 2018 in view of shortage of belt and also replied that tender was floated for procurement of conveyor belts but none of the firms were found technically qualified. Subsequently limited tender proposal was initiated during 2018 to expedite the procurement of belts.

Ministry further added (February 2024) that the procured belts were used in phased manner for replacement of existing belts.

Though NLC India accepted that the partial load losses were due to shortage of conveyor belts, the power generation losses could have been avoided had NLC India taken timely action to procure good quality belts from reputed vendors.

3.4.4 Wet lignite issue in TPS-II and TPS-IE

Stock level of 15 days and 10 days of coal/lignite for TPS was required to be maintained as per the CERC (Terms and Conditions of Tariff) Regulations, 2014 and 2019, respectively. Further, to ensure uninterrupted supply of lignite and avoid the incidence of wet lignite, an internal committee of NLC India recommended (March 2016) to provide covered conveyor system and covered storage at mines and thermal stations.

Although CERC Tariff Regulations require that a stock level of lignite for 10/15 days for TPS was required to be maintained, however, the lignite storage capacity in TPS-II was 1,50,000 tonnes which was sufficient for about four days requirement[40] (1.5 lakh tonnes storage capacity/35000 tonnes per day requirement). Out of the lignite storage capacity of 1,50,000 tonnes in TPS-II, covered storage facility was available for only 20,000 tonnes. Thus, only a part of the storage yard is covered, and the remaining storage yard was not covered which resulted in wet lignite during monsoon[41]. Similarly, the storage capacity of TPS-IE was 10,000 tonnes (RCC Bunkers) which can meet the lignite requirements of only one day (9,000 tonnes).

[40] ***Storage capacity/Average requirement of seven units per day: 150000 tonnes/ (5000 ton*seven units)***

[41] ***October to December each year***

TPS-IE and TPS-II could not operate with full load as wet lignite could not generate sufficient energy for the boilers. This led to partial load loss of 366.99 MUs during 2017-18 to 2022-23.

Management replied (October 2023) that storage yard at TPS-IE was not envisaged due to proximity of mine to Units of TPS-IE. Management proposed to cover the conveyors transferring lignite from mine to TPS-IE.

Ministry replied (February 2024) (TPS-II) that storage facility of Mines was utilised to store lignite and adherence of CERC regulations was for Mine-II rather than TPS-II. Special task force was formed to obviate the condition.

CERC Regulations prescribed for maintaining lignite stock level at thermal power stations to ensure uninterrupted supply of fuel. Further, the recommendations of the internal committee (2016) to cover the conveyors supplying lignite from mines to TPS and building covered storage both at Mines and TPS was not implemented by the Company (March 2024).

Recommendation No. 4

NLC India should analyses the reasons to address the partial load operations and to minimize the loss to the extent possible

3.5 Excessive Auxiliary Power Consumption

Auxiliary Power Consumption (APC) is the amount of energy consumed within the plant for operation of various auxiliaries such as the equipment being used for the purpose of operating plant and machinery including switchyard of the generating station. It is expressed as a percentage of the sum of gross energy generated by the power station. CERC sets norms for auxiliary power consumption. High auxiliary power consumption reduces plant availability as the sent-out energy from the plant would be low. This in turn impacts a thermal power plant's ability to earn capacity charges. Additionally, because the auxiliary power is consumed by the power station itself, the cost of auxiliary power consumed beyond the normative value could not be recovered through energy charges.

As per the CERC tariff regulations 2014 and 2019, APC norm was 8.5 *per cent* of gross energy generated for TPS-IE and 10 *per cent* for TPS-II and TPS-IIE. APC data for selected TPSs during 2017-18 to 2022-23 is given below:

Table 3.5: Achievement of APC against CERC norms

(in per cent)

Year	TPS-IE		TPS-IIE		TPS-II		
					Norm	Actual	
	Norm	Actual	Norm	Actual		Stage-I	Stage-II
2017-18	8.5	8.45	10	16.06	10	9.87	9.89
2018-19	8.5	8.21	10	15.18	10	9.87	9.75
2019-20	8.5	8.44	10	16.77	10	9.89	9.93
2020-21	8.5	9.09	10	15.64	10	9.68	10.06
2021-22	8.5	8.65	10	15.46	10	9.70	9.56
2022-23	8.5	9.05	10	15.65	10	11.65	10.32

Source: CERC Tariff Regulations and Data furnished by Management

Audit reviewed the APC for selected TPSs and noted that TPS-IIE consistently had high APC ranging from 15 to 17 *per cent* during 2017-18 to 2022-23. TPS-IE had high APC for three years ranging from 8.65 to 9.10 *per cent* during 2020-21 to 2022-23. TPS-II (Stage-II) and TPS-II (Stage-I and Stage-II) had high APC in the year 2020-21 and 2022-23 respectively. Audit noted the following reasons for higher actual APC than normative APC for the power stations:

- NLC India did not have an adequate system to monitor power consumption for individual equipment like conveyor system, FD/ID Fan, Cooling tower, Boiler Feed pump etc. NLC India was only monitoring auxiliary energy consumption of the power station as a whole. Consequently, NLC India did not know which equipment consumed higher than expected energy and required action to reduce the energy consumption.
- No energy audit was conducted in respect of TPS-IIE. Energy Audit was conducted in TPS-IE and TPS-II in which recommendations were made. However, implementation of the recommendations were either delayed or not done.
- Auxiliary power consumption was higher because of partial load operations and forced outages since equipment had to be kept operational and energy was consumed even when power generation was low by the plant.

Management replied (October 2023) that the CFBC boiler of TPS-IIE required more energy as compared to conventional boilers for cooling.

Ministry stated (February 2024) that CERC increased the normative APC in the draft tariff order from 10 *per cent* to 12.5 *per cent* for the period of 2024-29 for TPS-IIE. Regular monitoring is ensured for equipment power consumption on a monthly basis. All operational parameters are reviewed daily by Unit head. Ministry added that Energy Management System audit was conducted in TPS-IIE on 16 March 2021 as per ISO 500001:2018 and statutory Energy Audit was proposed to be conducted in TPS-IIE following the major overhaul in FY 2024-25.

Replies may be viewed in light of the fact that APC of TPS-IIE was more than 15 *per cent* even exceeding the revised APC norms of 12.5 *per cent*. Moreover, Energy Management

System audit as per ISO 500001:2018 was different from the statutory Energy Audit that TPS-IIE was required to undertake. The statutory Energy Audit requires the auditor to point out technical steps to be undertaken for reduction in energy consumption, pointing out the required investment for energy saving and envisaged benefits from such investment.

3.6 High Station Heat Rate

Station Heat Rate (SHR) is the measure of performance of a TPS which signify the amount of thermal energy consumed for production of one unit of electricity. Lower the heat rate of a thermal power plant, better is the performance. Higher SHR implies that TPS consume excess fuel for power generation. Actual and normative SHR for TPS-IE, TPS-II and TPS-IIE of NLC India during 2017-18 to 2022-23 is given below**.**

Table 3.6: Achievement of Station Heat Rate against CERC norms

(in Kcal/KwHr)

Year	TPS-IE		TPS-IIE		TPS-II	
	Norm	Actual	Norm	Actual	Norm	Actual
2017-18	2,750	2,730	2,559.94	2,642.61	2,900	2,908
2018-19	2,750	2,714.9	2,559.94	2,589.4	2,900	2,893
2019-20	2,720	2,712	2,559.94	2,587.22	2,890	2,888
2020-21	2,720	2,712	2,559.94	2,565.42	2,890	2,885
2021-22	2,720	2,718.83	2,559.94	2,564.34	2,890	2,889
2022-23	2,720	2,711	2,559.94	2,568.22	2,890	3,071

Source: CERC Tariff Regulations and Data furnished by Management

Audit reviewed SHR of TPS-IE, TPS-II and TPS-IIE for the period 2017-18 to 2022-23 and observed that SHR of TPS-IIE was higher than the norm due to below par performance of the plant with adoption of CFBC technology. The plant was set up by BHEL without experience of setting up a plant of that given size and technology. In case of TPS-II, SHR was higher than norms in 2022-23 due to poor quality of lignite (high ash content and sand) which in turn reduced boiler efficiency and resulted in partial load operations. TPS-IE was within norms.

Management replied (July 2023) that higher SHR was due to non-stabilization[42] of TPS-IIE which could not operate at full load due to frequent FBHE tube failures. For TPS-II, Management stated that station could not achieve normative SHR due to low boiler and turbine efficiency which was affected due to frequent shutdowns and partial load operation.

Ministry concurred (February 2024) with the Management reply and added that there was notable reduction in the SHR of TPS-IIE in 2023-24 after phased modification in the TPS. Further, BHEL was engaged for major revamping of FBHE after which SHR was expected

[42] ***Stabilization is the stage wherein the power plant can be operated at its rated capacity/full load continuously.***

to be within norms. For TPS-II, Ministry stated that power surrender was high which resulted in partial load operation thereby the SHR was high. Moreover, TPS-II had already completed over 30 years which is beyond its design life of 25 years.

Management/Ministry's reply needs to be seen in light of the fact that SHR was fixed by CERC after considering all facts about a thermal power plant including its age. TPS-IIE was commissioned in 2015 and despite multiple modifications the plant was not stabilized and work was awarded (June 2023) to BHEL for further modification in FBHE which was in progress (February 2024).

Recommendation No.5
NLC India should ensure timely completion of FBHE modifications at TPS-IIE to reduce high Station Heat Rate and ensure good quality of lignite to its power stations.

3.7 High Specific Oil Consumption

Specific oil (High Speed Diesel and Furnace oil) is consumed in power plant at the time of start-up to quickly generate the required amount of heat for the plant's boilers to become operational. Specific oil is also used intermittently during operations when the primary fuel i.e. lignite is unable to generate required level of heat to sustain operations. However, specific oils are costlier than the primary fuel. There was consumption of specific oil each time the plants were re-started after the forced outages. CERC sets norms for specific oil consumption. Actual and normative specific oil consumption for TPS-IE, TPS-II and TPS-IIE of NLC India during 2017-18 to 2022-23 is given below:

Table 3.7 Achievement of Specific Oil Consumption against CERC norms
(in ml/KwHr)

Year	TPS-IE		TPS-IIE		TPS-II		
	Norm	Actual	Norm	Actual	Norm	Actual	
						Stage- I	Stage- II
2017-18	2	0.463	1	1.767	2	1.05	0.83
2018-19	2	0.726	1	1.942	2	0.93	0.79
2019-20	1	0.339	1	3.643	1	0.70	0.65
2020-21	1	0.447	1	1.591	1	1.09	1.35
2021-22	1	0.806	1	1.61	1	0.88	1.02
2022-23	1	0.720	1	2.28	1	1.71	1.26

Source: CERC Tariff Regulations and Data furnished by Management

Audit noted that there were 250 forced outages and 32 planned outages and consumption of specific oil was above the norm in TPS-IIE during 2017-18 to 2022-23. Similarly, there were 81 and 45 outages and consumption of specific oil was above the norm in TPS-II in the year 2020-21 and 2021-22 (Stage II units only) respectively. In 2022-23, specific oil consumption in TPS-II was high due to shortage and low quality of lignite. TPS-IE was within norms.

Management replied (July 2023) that oil consumption was high in 2020-21 and 2021-22 due to fire accidents in TPS-II. More oil consumption in 2022-23 was due to wet lignite during the monsoon and aging of TPS-II plant. For TPS-IIE, Management replied (July 2023) that CFBC boiler consumes more oil in comparison to conventional boiler during start up.

Ministry concurred (February 2024) with the reply of Management and added that frequent light-ups due to FBHE failures contributed to heightened oil consumption. After phased modification, the specific oil consumption showed a reducing trend in TPS-IIE. The net energy charge rate gain of ₹12.54 crore was achieved during 2020-21 and 2021-22.

Replies may be viewed in light of the fact that the higher oil consumption was not justified. CERC did not allow any exemption in norm to TPS-IIE. Ministry admitted frequent failure of FBHE resulted in high specific oil consumption. After phased modification, a LoA (23 June 2023) was placed on BHEL for major modification of FBHE which was in progress (February 2024). In TPS-II, higher consumption of oil was due to forced outages which could have been avoided. The issue of wet lignite could have been avoided by having adequate covered storage facility at TPS-II as recommended (March 2016) by an internal committee of NLC India. Further, the net energy charge rate gain could have been higher had TPS II achieved normative specific oil consumption.

Recommendation No. 6
NLC India should minimise forced outages to reduce high specific oil consumption. Adequate covered lignite storage should be ensured to prevent challenges associated with wet lignite.

3.8 Deficiency in safety measures in thermal power stations

Central Electricity Authority (Safety Requirements for Construction, Operation and Maintenance of Electric Plants and Electric Lines) Regulations, 2011 require that the owner shall make safety an integral part of work processes to ensure safety for employees including employees of contractor, sub-contractor as well as visitors.

There were four fire incidents (Two incidents each in case of Unit-5 and Unit-6) in TPS-II in the year 2001, 2016, 2017 and 2019 (details given in **Annexure-VII).** Incident/Trip Analysis Committee recommended for better housekeeping near boiler and fire prone areas, regular cleaning of lignite dust spread over boiler structures and to strengthen the structures.

Audit noted two fire incidents which occurred in 2020-21. A fire occurred (7 May 2020) in Unit-6 of TPS-II resulting in death of five workmen and injury to three workmen. Consequently, Unit was shut down for repairs and commenced operations in November 2020 after 4,560 outage hours. Another fire occurred (1 July 2020) in Unit-5 of TPS-II resulting in death of 15 workmen and 8 workmen got injured. Unit-5 was restored to

operation in May 2021. The shutdown resulted in outage for 7,700 hours. Disciplinary proceedings following these incidences resulted in imposition of minor penalties on 13 officials while proceeding for one case was pending (June 2021).

In both instances, internal and external committee enquiries concluded (May[43] 2020 and July-August[44] 2020) that the root cause of the accident was due to accumulation of hot lignite dust inside the girders over a period of time through the manhole opening and ignition of inflammable gases might have resulted in explosion. Audit observed that recurrence of fire incidents due to accumulation of lignite dust could have been prevented by regular cleaning of lignite dust by the Company.

Management replied (October 2023) that they had subsequently taken required remedial measures and have put in place (July 2020) a Standard Operating Procedure (SOP) for girder rectification work and cleaning work, boiler coil and furnace cleaning work.

Ministry replied (February 2024) that this type of explosion in Boiler Box Type Girder Structure was first of its kind in the history of coal/lignite fired Thermal Power Stations in India. Further, company had conducted safety study and structural stability tests after the accident in all seven units. Disciplinary action has been taken against employees held responsible for the accident.

The reply is not factual since there were previous occasions as given in **Annexure-VII** wherein explosion in girder had occurred and also in the Unit-6 fire incident (May 2020). Thus, it was not first of its kind. Further, the SOP for working inside confined spaces was not followed as reported by the Internal Committee report on the fire incident which occurred on 1 July 2020.

Recommendation No. 7
NLC India should avoid accumulation of lignite powder inside girder box by inspection of all manholes and ensuring that these are properly sealed.

3.9 Controllable costs incurred beyond CERC norms

Central Electricity Regulatory Commission (CERC) (Terms and Conditions of Tariff) Regulations dated 21 February 2014 and 7 March 2019 prescribed normative Operation and Maintenance (O&M) expense of thermal generating stations. As per these regulations, O&M costs include expenditure on manpower, maintenance, repairs and maintenance spares, consumables, insurance and overheads and fuel other than those used for generation of electricity.

[43] ***7 May 2020 incident***
[44] ***1 July 2020 incident***

Data of actual O&M expenses of NLC India and CERC norms for the period 2017-18 to 2022-23 is given in table below.

Table 3.8: Actual O&M Expenses against CERC norm

(₹ in crore)

Year	TPS-IE		TPS-II	
	Norm[45]	Actual	Norm	Actual
2017-18	120.54	123.57	421.89	556.48
2018-19	128.14	157.25	448.50	573.26
2019-20	138.43	125.63	484.51	462.18
2020-21	143.30	143.42	501.56	477.73
2021-22	148.30	176.12	519.06	543.58
2022-23	153.55	180.64	537.43	474.34
Total	**832.26**	**906.63**	**2,912.95**	**3,087.57**

Source: CERC Tariff Regulations and Data furnished by Management

During the review of cost statements of NLC India for the period 2017-18 to 2022-23, it was noted that TPS-IE did not achieve normative O&M expense except in 2019-20. Further, TPS-II also did not achieve normative O&M expense in 2017-18, 2018-19 and 2021-22. In respect of TPS-IIE, the O&M expenses were within norms.

Management replied (October 2023) that the increase in O&M expense in 2019-20 was due to increase in internal services because of entries made for Water, security and power surrender charges booked by Commercial division. Further in TPS-IE and TPS-II (2019-20) an amount of ₹84.52 crore and ₹464.65 crore was booked on account of water, security and power surrender charges by mines respectively and subsequently it was reversed in March 2023.

Ministry (February 2024) while concurring with the Management reply further stated that in TPS-IE manpower cost was higher (2021-22) due to redeployment of manpower from old TPS-I to TPS-IE and conversion of contract workman to regular employment of NLC India as per requirement of Rehabilitation and Resettlement Rules, increase in minimum wages, with respect to TPS-II and TPS-IE. Further, it was stated that actual deployment of manpower was less than the sanctioned strength and control measures are being taken up like periodical reviews and budgetary control with a view to contain expenditure. Moreover, due to Generator Turbine failure in 2018-19 the O&M cost has increased above normative.

The replies may be viewed in light of the fact that as excess O&M was arrived at after deducting water and security charges for respective TPS and the booking of security, water, and power surrender charges from mines. With respect to redeployment of TPS-I

[45] ***O&M norms (lakh/MW) for 2017-18: ₹28.70 lakh, 2018-19: ₹30.51 lakh, 2019-20: ₹32.96 lakh, 2020-21: ₹34.12 lakh, 2021-22: ₹35.31 lakh and 2022-23: ₹36.56 lakh***

manpower to TPS-IE it is to be noted that TPS-I was decommissioned during 2020-21 but O&M expense of TPS-IE was more than CERC norms in all six years except 2019-20. Further, though the actual deployment was less than the sanction there were increase in outsourcing expenses (₹47.58 crore in 2017-18 to ₹75.88 crore in 2022-23 in TPS-II and ₹25.66 crore in 2017-18 to ₹46.61 crore in 2022-23 in TPS-IE) and Audit also observed that TPS-IE and TPS-II had excess manpower against Manpower norms prescribed by Central Electricity Authority resulting in higher employee cost as detailed in paragraph 3.10.

The excess O&M expenditure of ₹248.99 crore incurred beyond CERC norms in TPS-IE and TPS-II during 2017-18 to 2022-23 were not recoverable through regulated tariffs and hence impacted the profitability of NLC India.

3.10 Excess deployment of manpower as against CEA norms

Manpower is an essential prerequisite and deployment of required quantity and quality of manpower would ensure efficient operational performance for an entity in long term. National Electricity Plan of Central Electricity Authority prescribed (January 2018 and March 2023) norms for manpower for power sector. The technical manpower requirement for a thermal power station was 0.486 man per MW capacity as per the norms. Technical manpower deployed[46] per MW capacity for TPS-IE and TPS-II of NLC India thermal stations was 1.87 and 1.64 man per MW capacity respectively. The manpower deployment was higher as compared to the norms prescribed in National Electricity Plan.

Management replied (October 2023) that CEA norms for manpower in thermal units are based on coal fired boilers and same norms could not be maintained by lignite fired boilers. Lignite calorific value is low compared to coal and therefore, more quantity of lignite was required to be handled which required more manpower.

Ministry (February 2024) stated that in TPS-IE manpower cost was higher (2021-22) due to redeployment of manpower from old TPS-I to TPS-IE and conversion of contract workman to regular employment of NLC India as per requirement of Rehabilitation and Resettlement Rules[47]. There was an increase in minimum wages, with respect to TPS-II and TPS-IE. NLC India further stated that actual deployment of manpower was less than the sanctioned strength and control measures are being taken up like periodical reviews and budgetary control with a view to contain expenditure.

Audit noted that, even though lignite fired boiler require more manpower, technical staff was high i.e. 3.5 times of the prescribed norms.

Recommendation No. 8
Employment of manpower should be within CEA norms. O&M costs should be restricted within CERC norms.

[46] ***Norm for manpower considered is including regular as well as contractual employment.***
[47] ***Applicable for land acquisition for Mining***

3.11 Power generation by TPS-I without Power Purchase Agreement during extended period

Section 62 read with Section 79 of the Electricity Act, 2003 empowers CERC to regulate electricity tariffs every five years for generation companies under its Tariff Regulations. These regulations apply to power generation companies with a Power Purchase Agreement (PPA) with DISCOMs and allow them to recover fixed costs (capacity charges) and variable fuel costs (energy charges). For NLC India, with integrated mines, its fuel cost recovery includes the fixed costs and profits from its mines.

NLC India operated TPS-I with a generation capacity of 600 MW[48], supplying electricity solely to TANGEDCO (Tamil Nadu Generation and Distribution Corporation Limited) under a Power Purchase Agreement (PPA)[49]. In March 2007, NLC India decided to replace TPS-I with the New Neyveli Thermal Power Station (NNTPS), with plans to commission the new plant by 2014. However, due to power shortage in Tamil Nadu, TANGEDCO and the State Government requested[50] NLC India to postpone the retirement of TPS-I.

Accordingly, the earlier decision (March 2007) to reduce generation of power in TPS-I by 2014 was revisited and NLC India decided (May 2016) to continue operations of TPS-I until the commissioning of NNTPS. NLC India also determined that TPS-I units could safely operate until March 2019 with periodic maintenance. NLC India obtained a confirmation from TANGEDCO (June 2016) that it would continue purchasing power from TPS-I until NNTPS was commissioned.

NNTPS project began in October 2013 with a scheduled completion in April 2018. However, construction of NNTPS faced delays[51] due to various force majeure events and technological issues[52]. Hence, NLC India requested (February 2019) TANGEDCO to extend the renewed PPA (renewed for a period of five years upto March 2019 or commissioning of NNTPS whichever was earlier) till September 2019 or until stabilization of the NNTPS units, whichever was earlier, stating that units of NNTPS (2 x 500 MW) would be commissioned by March 2019 and June 2019. TANGEDCO refused (March 2019) to renew the agreement, instead, agreed to buy power at the variable charge of ₹3.77/KWh through power exchange[53].

In April 2019, NLC India assessed that the total power tariff of TPS-I was ₹4.82/KWh, with capacity charges at ₹1.05/KWh and energy/variable charges at ₹3.77/KWh. NLC

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48 ***Six Units of 50 MW and three Units of 100 MW commissioned between 1962 and 1970***

49 ***PPA (March 2001) was effective for period from April 1997 to March 2014 which was renewed (March 2014) for a period of five years upto March 2019 or commissioning of NNTPS whichever was earlier.***

50 ***As noticed in NLC India Board Minutes of May 2016***

51 ***Unit 1 (500 MW) of NNTPS was completed in December 2019 and Unit 2 (500 MW) was completed in February 2021.***

52 ***Shortage of specialised steel, erection issues, Uniqueness of Boiler Circulation Water Pump etc.***

53 ***Trading platform for the physical delivery of electricity.***

India found that the fixed cost of TPS-I was not recovered on sale of power to TANGEDCO at variable charge. However, trading at the above-mentioned rate was justified in view of recovery of fixed costs and profit margin of the mines by consumption of lignite in operating the Units of TPS-I. NLC India sold 2,495.48 million units (99 *per cent* of which was sold to TANGEDCO) through the power exchange from April 2019 until Units of TPS-I were decommissioned in stages by September 2020.

Audit observed that NLC India did not take action till February 2019 to extend the renewal of existing PPA to purchase power from TPS-I until NNTPS was commissioned despite the TANGEDCO willingness (June 2016) to avail the power from TPS-I till commissioning of NNTPS. Audit further observed that after the first Unit of NNTPS was commissioned in December 2019 and it substituted the 500 MW capacity of TPS-I yet NLC India continued to operate TPS-I until September 2020. As a result, NLC India did not recover the fixed costs of TPS-I as per CERC regulations.

Management replied (October 2023) that it sought consent of TANGEDCO to extend the existing Power Supply Agreement in February 2019. However, TANGEDCO decided not to extend the PSA beyond the validity period of 31 March 2019. Being an integrated project, TPS-I power was sold through power trading to mitigate under-recovery of fixed cost of linked Mine-I.

Ministry concurred (February 2024) with the reply of the Management.

The reply is to be viewed in light of the fact that despite continuing to supply power from TPS-I through power exchange, NLC India incurred losses of ₹473.41 crore due to the inability to recover the cost of generation during 2019-20 and 2020-21 as noticed from the Cost Audit report of TPS-I. A profit of ₹216.33 crore was reported for Mine-I which was linked to TPS-I as per the Cost Audit report for the same period. Thus, the combined operation of TPS-I and Mine-I resulted in a net loss of ₹257.08 crore.

3.12 Delay in installation of Flue Gas Desulphurization system

The Ministry of Environment, Forests and Climate Change (MoEFCC), GoI directed (December 2015) that existing thermal power plants were required to comply with the new emission norms for Sulphur-dioxide (SO_2) i.e., 600 mg/Nm^3 within December 2017. This timeline was initially extended (March 2021) until December 2024 and subsequently (September 2022) to December 2026 by MoEFCC. TPSs which do not adhere to the revised timeline would be levied environment compensation at the rate of ₹0.40 per unit of electricity generated as per the amended (September 2022) Environment (Protection) Rules, 2022.

During the period 2017-18, the emission of SO_2 was 1104 mg/Nm^3 and 1244.29 mg/Nm^3 in TPS-IE and TPS-II respectively. As the SO_2 emission from TPS-IE and TPS-II were exceeding the norms, NLC India Board accorded (April and May 2018) to reduce the

emissions by installation of Flue Gas Desulphurization (FGD) system at these TPSs[54], with a completion period of 33 months, 37 months and 41 months for TPS-IE, stage I of TPS-II and stage II of TPS-II respectively. During the period from 2017-18 to 2022-23, the SO_2 emissions from TPS-IIE was within the norms except for 2022-23. Due to adoption of environment friendly CFBC technology, the requirement of installation of FGD plants for removal of SO_2 was not required.

NLC India floated tenders for installation of FGD system in January 2019 and June 2020 but these were cancelled due to high price and as per the NLC India Board's decision respectively. NLC India Board's decision was based on an internal committee's recommendation which advocated for installation of FGD system in TPS-I E. Installation of FGD system in TPS-II was recommended if TPS-II Second Expansion Project does not materialize.

Audit observed that there was delay in the installation of FGD system though the emission of SO_2 was very high in TPS-IE and TPS-II. The maximum SO_2 emission being 2842 mg/Nm^3 in 2019-20 and 3623.57 mg/Nm^3 in 2018-19 for TPS-IE and TPS-II respectively. The tender for FGD system was not finalised till February 2024. The delay in compliance to emission norms by December 2026 may lead to levy of environment compensation by MoEFCC.

Management (October 2023) replied that FGD installation was new to the country and little cost information was available for estimation of FGD system cost.

Ministry while concurring with Management reply added (February 2024) that tender for TPS-IE was floated and targeted to be awarded by March 2024 which will meet the deadline of December 2026. Decision for FGD of TPS-II will be based on the outcome of the decision for TPS-II Second Expansion Project.

The reply needs to be seen in view of the fact that Central Electricity Authority (CEA) as early as in December 2017 prepared standard technical specification of FGD system as a guiding document. Thus, FGD system was not new to country. Moreover, considering the lead time of 43 months required for installation of FGD as per CEA quarterly review report, completion of installation of FGD even by extended timeline of December 2026 may not be feasible.

Recommendation No. 9

NLC India should expedite the tendering process for FGD installation at TPS-IE and TPS-II to meet the December 2026 deadline. Streamlining internal approvals and improving cost estimation can prevent further delays.

[54] ***At a cost of ₹215 crore for TPS-IE and ₹742 crore for TPS-II***

Best practices as noted by Audit: As per MOEF notification dated 3 November 2009, thermal stations need to achieve 100 *per cent* utilization of ash generated during the operation. It further allowed sale of fly ash generated to manufacturing units as raw material. In line with the above notification, NLC India achieved 100 *per cent* fly ash utilisation since 2013 in respect of TPS-IE, TPS-II and TPS-IIE.

3.13 Specific Water Consumption at Thermal Plants

As per the Environment (Protection) Amendment Rules, 2015 (December 2015), all existing Cooling Tower (CT) based thermal power plants have to reduce Specific Water Consumption (SWC) up to a maximum of 3.5 Cu.m /MWhr within December 2017. Even though the SWC of TPS-IE[55] was within norms, the SWC of TPS-II[56] and TPS-IIE[57] were higher. Accordingly, NLC India awarded (April 2021) a contract for installation of water treatment plant for TPS-II to comply with SWC norms. The contract was completed and water treatment plant was commissioned (December 2022).

Audit observed that NLC India awarded the contract for installation of water treatment plant for TPS-II only in April 2021 as against the stipulated timeline for compliance of SWC norms by December 2017 and no such contract was awarded for TPS-IIE even though SWC was higher than the norms[58].

Management replied (October 2023) that procedural issues in the tender process delayed the award of contract for installation of water treatment plant in TPS-II. In TPS-IIE, no such contract was awarded as the plant was yet to be stabilized.

Ministry stated (February 2024) that there were cancellation of tenders and re-tendering which delayed award of contracts. In TPS-IIE, the proposal to overcome the issues related to SWC by recycle and reuse of effluent water was initiated and was in process.

The reply of Management and Ministry need to be seen in view of the fact that even after delayed installation of water treatment plant in TPS-II, the SWC remained higher than the norms. Hence, NLC India remained non-compliant to the SWC norms of Environment (Protection) Amendment Rules, 2015.

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55 ***2017-18: 3.45 Cu.m /MWh; 2018-19: 3.44 Cu.m /MWh; 2019-20: 2.97 Cu.m /MWh; 2020-21: 2.78 Cu.m /MWh; 2021-22: 2.94 Cu.m /MWh and 2022-23: 2.89 Cu.m /MWh***

56 ***2017-18: 5.17 Cu.m /MWh; 2018-19: 5.51 Cu.m /MWh; 2019-20: 5.15 Cu.m /MWh; 2020-21: 5.05 Cu.m /MWh 2021-22: 4.90 Cu.m /MWh and 2022-23: 4.97 Cu.m /MWh***

57 ***2017-18: 4.02 Cu.m /MWh; 2018-19: 3.32 Cu.m /MWh; 2019-20: 3.98 Cu.m /MWh; 2020-21: 4.00 Cu.m /MWh; 2021-22: 3.90 Cu.m /MWh and 2022-23: 3.97 Cu.m /MWh***

58 ***2017-18: 3.50 Cu.m /MWh; 2018-19: 3.50 Cu.m /MWh; 2019-20: 3.50 Cu.m /MWh; 2020-21: 3.50 Cu.m/MWh; 2021-22: 3.50 Cu.m /MWh 2022-23: 3.50 Cu.m /MWh***

3.14 Non-maintenance of records

3.14.1 Shift Engineer Trip Report

Shift Engineer Trip Report (SETR) is a basic document which records the specific conditions before tripping, time and date of trip, trip cause, sequence of activity before / during trip, conditions after tripping etc.

Audit observed that for TPS-II and TPS-IIE, NLC India did not prepare SETR during the period from 2017-18 to 2022-23. For TPS-IE, SETR were available only for 29 out of 73 trips during the above period. Without this basic document, it was not possible for NLC India to perform root cause analysis and prevent similar trips. Further, no Standard Operating Procedure/ guidelines were available for preparation of SETR, monitoring mechanism and compliance thereon until November 2022, February 2023 and June 2023 for TPS-IE, TPS-IIE and for TPS-II respectively and preparation of SETR was being done only as a practice.

NLC India replied (October 2023) that SETRs were being prepared and corrective action taken. It also stated that it had made guidelines and SOP for preparation of SETR.

Ministry stated (February 2024) that flash reporting system was followed in which the Shift Engineers furnish the preliminary report of Unit trips on the same day.

The reply is to be viewed in light of the fact that delay in preparation of SOP/Guidelines for preparation of SETR resulted in non-availability of SETR for all the trips that occurred during the period from 2017-18 to 2022-23. Non-availability of this basic document was an obstacle to perform root cause analysis and prevent similar trips.

3.14.2 Trip Analysis Report

Audit noted that NLC India formed a committee comprising of executives from different divisions of a TPSs (generally from boiler, electrical, C&I[59] and Turbine operations) for analysis of each trip, in order to determine its root cause, remedial measures and recommendation/action plan to prevent recurrence and the committee prepared a Trip Analysis Report (TAR).

Audit observed that TAR was available for only 304 out of 742 trips that occurred during 2017-18 to 2022-23 at all TPSs. It was also observed that only 165 out 304 TAR were authenticated by the committee. NLC India maintained records to ensure the compliance/implementation of the recommendations of trip analysis committee only for the year 2022-23 for TPS-II and TPS-IIE. Further no Standard Operating Procedure/ guidelines were available for preparation of TAR, monitoring mechanism and compliance thereon until November 2022, February 2023 and June 2023 for TPS-IE, TPS-IIE and for TPS-II respectively and preparation of TAR was being done only as a practice.

[59] ***C&I: Control and Instrumentation***

NLC India replied (October 2023) that TARs were being prepared, committee recommendations followed and corrective actions were taken. Management also stated that guidelines and SOP were made for preparation of TAR.

Ministry stated (February 2024) that Trip Committee analysed the root cause and submitted detailed reports to the Management with recommendation of remedial measures, which were implemented scrupulously.

Reply need to be viewed in light of the fact that availability of TARs for trips was necessary for identification of its origin and to prevent their recurrence. Authentication of TARs by the committee was required for compliance of the recommendations.

Recommendation No. 10

NLC India should ensure formulation of Standard Operating Procedure for preparation of SETRs and TARs, so that all trips have corresponding reports with root cause analysis and corrective actions. A monitoring mechanism should be established to ensure timely submission and follow-up for all trips, with regular internal audits to ensure compliance.

3.15 Conclusion

NLCIL's thermal power generation relies on lignite supplied from Neyveli mines, with four power stations using conventional boilers and one power station which uses a CFBC boiler. The company earns revenue from sale of electricity, which is regulated by CERC, with tariff recovery linked to operational factors like Plant Availability Factor (PAF), Auxiliary Power Consumption, Gross Station Heat Rate and Secondary Fuel Oil consumption.

Non-achievement of Normative PAF resulted in loss of ₹2,353.99 crore in capacity charges in view of outages at TPS-IIE due to faults in the Fluidized Bed Heat Exchanger (FBHE); multiple outages at TPS-II, including fire incidents and maintenance issues and Turbine bearing failure at TPS-IE. Operation of TPS at Partial Load resulted in loss of generation of 1,594.77 MUs and ₹360.52 crore in lignite extraction costs. The reasons for this loss include ageing mills, deficiencies in lignite handling system and supply of wet lignite due to inadequate storage facilities. Auxiliary Power Consumption exceeded CERC norms in TPS-IIE ranging from 15 to 17 *per cent* during 2017-18 to 2022-23. TPS-IE had high APC for three years ranging from 8.65 to 9.10 *per cent* during 2020-21 to 2022-23. TPS-II (stage-II) and TPS-II (Stage-I and Stage-II) had high APC in the year 2020-21 and 2022-23 respectively. High APC reduced plant availability and impacted earnings from capacity charges. Causes for higher APC included Lack of monitoring systems and non-compliance to energy audit recommendations. High Station Heat Rate above norms in TPS-IIE and TPS-II were caused due to underperformance of CFBC technology and poor-quality lignite respectively, which affected boiler efficiency. High Specific Oil Consumption at TPS-IIE and TPS-II were above the norms due to forced outages, shortage and poor quality of lignite.

Fire incidents at TPS-II resulted in the death of 20 workmen in May and June 2020 due to lignite dust accumulation in girder which could have been prevented by regular cleaning and periodic maintenance. Higher Operation and Maintenance Costs at NLC India exceeded CERC norms, with employee remuneration accounting for around 50 *per cent*, even though NLC India outsourced significant portion of maintenance works.

The delayed decommissioning of TPS-I, originally planned for replacement by NNTPS in 2014, continued operations until September 2020 due to the delay in NNTPS completion. Non-extension of the Power Purchase Agreement (PPA) with TANGEDCO led to power being sold at lower rates, incurring a ₹257.08 crore loss during 2019-21. Delay in implementation of new SO_2 emission norms and the installation of Flue Gas Desulphurization systems resulted in risk of non-compliance with the 2026 deadline. Similarly, regarding Specific Water Consumption (SWC) at thermal plants, NLC India delayed meeting the requirement under the Environment Protection Amendment Rules, 2015. Although, a water treatment plant was installed at TPS-II by December 2022, NLC India did not install a water treatment plant at TPS-IIE, which also exceeded SWC limits. Even after installation of water treatment plant at TPS-II, SWC remained above the prescribed norms. Additionally, NLC India did not maintain essential operational records like Shift Engineer Trip Reports and Trip Analysis Reports, hindering root cause analysis and corrective actions.

Chapter 4
Conclusion

Chapter 4

Conclusion

NLC India is a public sector company engaged in lignite mining and power generation. The electricity generated by NLC India at Neyveli is supplied to distribution companies in Tamil Nadu, Andhra Pradesh, Karnataka, Kerala, Telangana and Puducherry. The Performance Audit was conducted to assess the efficiency of production of lignite and operation of power generating stations at Neyveli.

Review of mining operations at lignite mines viz. Mine-I, Mine-IA and Mine-II at Neyveli brought out some flaws and non-compliances that affected the efficiency and financial performance of the organisation. The most significant concern was the delay in acquisition and taking possession of land, which directly impacted lignite production. Non-availability of land in Mine-II during 2022-23, resulted in short-supply to linked Thermal Power Stations and potential loss of mining revenue amounting to ₹338.62 crore. In another instance, NLC India had to remove previously dumped overburden in Mine-IA due to land acquisition issues, resulting in avoidable expenditure of ₹364.80 crore. Additionally, NLC India incurred ₹17.16 crore due to soil sliding and damage to agricultural lands, caused by violation of environmental norms in Mine-II regarding overburden dump height. Further, NLC India operated Mine-II without a valid Environmental Clearance (EC) which delayed the grant of lease for excavation of minor minerals in Mine-II, leading to loss of opportunity to earn revenue from the sale of minor minerals from 2018 to 2023. In respect of Mine-I and Mine-IA, delay in applying for separate lease resulted in dumping of extractable minor minerals along with overburden, making future recovery not feasible. NLC India also used outlived specialised mining equipment without periodic rejuvenation or mandatory structural stability tests, which posed safety risks and affected operational efficiency.

Audit also noticed significant inefficiencies in operations, safety and environmental compliance of NLC India's thermal power stations (TPS-IE, TPS-II and TPS-IIE) for the period from 2017-18 to 2022-23. The most significant issue was the consistent non-achievement of the required Plant Availability Factor (PAF), which caused a total loss of ₹2,353.99 crore due to under-recovery of capacity charges. This was mainly due to design flaws in CFBC boilers, turbine breakdowns, forced outages, fire incidents and inadequate maintenance practices. In addition, power stations suffered partial load loss due to issues like load restrictions, equipment breakdowns, poor quality of lignite and wet lignite due to lack of essential infrastructure like covered storage yards and conveyors. This

resulted in loss of 1,594.77 million units of electricity and under-recovery of lignite extraction costs for mines to the extent of ₹360.52 crore.

Other key problem noticed in Thermal Power Stations were high Auxiliary Power Consumption exceeding CERC norms, particularly at TPS-IIE. This was caused due to absence of equipment-wise monitoring of power consumption, partial load operations and delayed implementation of energy audit recommendations. Similarly, high Station Heat Rate and Specific Oil Consumption were persistent issues due to sub-optimal performance of CFBC boilers, poor lignite quality and frequent outages. On the safety front, serious lapses in housekeeping, lignite dust management and emergency preparedness led to two major fire incidents in 2020-21 that resulted in 20 fatalities and over 12,000 hours of outage.

Operation and Maintenance expenditure at TPS-IE and TPS-II exceeded CERC norms by ₹248.99 crore, impacting profitability as these costs were not recoverable through tariffs. This was largely due to excessive manpower deployment, more than three times of Central Electricity Authority norms, which highlighted the need for workforce optimization.

There was non-compliance to environmental norms also due to delays in installation of Flue Gas Desulphurization systems to contain the sulphur dioxide emissions within the permissible limits. Delayed action to reduce Specific Water Consumption also showed lack of urgency in complying with environmental mandates.

Despite the abovementioned operational issues, good practices were also noted by Audit. NLC India has undertaken several commendable environmental and sustainable mining practices. NLC India reclaimed over 2,188 hectares of mined-out land and planted over 27.96 lakh saplings. It successfully improved infertile soil through scientific methods, enabling cultivation in 100 hectares. The creation of 52 water bodies and promotion of eco-tourism and biodiversity conservation reflect a strong commitment to sustainable development. NLC India has achieved 100 *per cent* fly ash utilization at all its power stations since 2013, which aligns with environmental standards and promotes sustainability.

Thus, NLC India need to overcome operational issues both in mining and thermal power operations though it has demonstrated commendable efforts in areas like land reclamation and fly ash utilization. Key issues pointed out by Audit include delay in land acquisition for mining, delay in obtaining environmental clearance, compliance to the norms for dumping of overburden, design deficiencies in CFBC boilers, inadequate preventive and breakdown maintenance procedures, lignite quality and non-compliance with

environmental and safety regulations. These shortcomings exposed NLC India to operational and financial losses, environmental non-compliances and safety risks. NLC India must expedite and complete land acquisition, ensure mine safety systems, strengthen internal maintenance procedures and fulfil environmental compliance requirements to ensure efficient, reliable and sustainable operations.

(Anand Mohan Bajaj)
Deputy Comptroller and Auditor General
(Commercial & Report Central) and
Chairman, Audit Board

New Delhi
Dated: 12 DECEMBER 2025

Countersigned

(K. Sanjay Murthy)
Comptroller and Auditor General of India

New Delhi
Dated: 15 DECEMBER 2025

Annexures

Annexure-I
(Referred in Para 2.3)
Targets and Actual Production of Lignite in Neyveli Mines

(in Million Tonnes)

Year	Targets				Production			
	Mine-I	Mine-IA	Mine-II	Total	Mine-I	Mine-IA	Mine-II	Total
2017-18	9.1	2.69	13.15	24.94	8.15	2.75	12.67	23.57
2018-19	7.81	2.75	12.6	23.16	7.4	2.99	12.64	23.03
2019-20	8.6	2.99	12.5	24.09	7.98	2.97	12.57	23.52
2020-21	8	2.99	12.8	23.79	6.29	2.57	9.16	18.02
2021-22	7.8	3.5	12.5	23.8	7.01	4.08	12.55	23.64
2022-23	8	4	13	25	7.14	5.05	9.32	21.51
Total	**49.31**	**18.92**	**76.55**	**144.78**	**43.97**	**20.41**	**68.91**	**133.29**

Annexure-II
(Referred in Para 2.4)
(A) Status of Land availability in Neyveli Mines as on March 2023

(in Hectares)

Mines	Mining Project Area	Area already acquired	Area to be acquired	Area in possession	Area yet to be taken possession	Area mined-out of lands in possession	Area occupied by external dump, safe zones and infrastructure	Balance Area available for mining in possession
Mine-I	3,635	3,123	512	3,122	1	2,579.34	536.47	6.19
Mine-IA	2,006	1,109	897	1,091	18	770	291	30
Mine-II	7,194	5,528	1,666	4,967	561	2,531	2426	10
Total	**12,835**	**9,760**	**3,075**	**9,180**	**580**	**5,880.34**	**3,253.47**	**46.19**

(B) Lignite Reserves Status as on March 2023

(in Million Tonnes)

Mines	Total Lignite Reserves in Project Area	Lignite Excavated in Area under possession	Balance Lignite Reserves in Project Area	Balance Lignite Reserves in Area under possession
Mine-I	463.92	387.41	76.52	2.49
Mine-IA	218.74	61.78	156.96	40
Mine-II	621	347.87	273.13	1.61
Total	**1,303.66**	**797.06**	**506.61**	**44.10**

Annexure-III
(Referred in Para 2.4)
Calculation of lignite requirement based on normative Plant Availability Factor

Thermal Power Station	Capacity (MW)	PAF norm (*per cent*)	Generation at normative PAF (million units)	Lignite requirement of 1.02 Kg per kWh on average basis (million tonnes)
A	B	C	D	E
			(B*C)*24* 365/1000	D*1.02 /1000
TPS-IE	420	85	3,127.32	3.19
NNTPS	1000	85	7,446.00	7.59
TPS-II	1470	85	10,945.62	11.16
TPS-IIE	500	80	3,504.00	3.57
Sub-total	**3,390**	**--**	**25,022.94**	**25.51**
Minimum Annual Aggregate Quantity to be supplied to TAQA Neyveli Power Limited	250	--	--	1.15
Total	**3,640**	**--**	**--**	**26.66**
Note	**1 MWH =1000kWh= (1000/1000000) million units**			
	1 unit = 1kWh			

Annexure-IV
(Referred in Para 3.2)

Loss of revenue i.e. under recovery of capacity charges (fixed cost) due to non-achievement of normative Plant Availability Factor during 2017-18 to 2022-23

(₹ in crore)

Year	Thermal Power Station				Total
	TPS-IE	TPS-IIE	TPS-II		
			Stage-I	Stage-II	
2017-18	0	286.17	0	0	286.17
2018-19	0	317.77	0	0	317.77
2019-20	0	381.22	0	0	381.22
2020-21	22.43	287.04	40.03	182.98	532.48
2021-22	1.12	305.94	6.79	38.33	352.18
2022-23	0	294.31	95.75	94.11	484.17
Total	**23.55**	**1,872.45**	**142.57**	**315.42**	**2,353.99**

Annexure-V
(Referred in Para 3.2)
Normative plant availability factor and actual plant availability achieved at Neyveli plants (2017-18 to 2020-21)

(As percentage of installed capacity)

Thermal Power Station	Parameters	2017-18	2018-19	2019-20	2020-21
TPS-I Expansion	Normative	80	80	85	85
	Actual	95.06	81.59	96.16	78.07
TPS-II Expansion	Normative	75	78.7	80	80
	Actual	48.21	44.35	38.11	48.42
TPS-II	Normative for both Stage I & II	75	75	85	85
Stage I	Actual	84.17	87.57	93.38	76.07
Stage II	Actual	92.51	90.56	89.93	44.86

Normative plant availability factor and actual plant availability achieved at Neyveli plants (2021-22 to 2022-23)

(As percentage of installed capacity)

Thermal Power Station	Parameters	2021-22		2022-23	
		HDS	LDS	HDS	LDS
TPS-I Expansion	Normative	85	85	85	85
	Actual	83.62	94.91	95.05	86.46
TPS-II Expansion	Normative	80	80	80	80
	Actual	48.22	45.77	49.21	46.22
TPS-II	Normative for both Stage I & II	85	85	85	85
Stage I	Actual	95.37	82.21	73.38	56.64
Stage II	Actual	73.21	77.78	79.51	64.13

Note: *High demand season (HDS) (period of three months, consecutive or otherwise) and Low Demand Season (LDS) (period of remaining nine months, consecutive or otherwise) in a region shall be declared by the concerned Regional Load Despatch Centre.*

The HDS as declared by Southern Regional Load Despatch Centre (SRLDC) was April, February and March months during 2021-22 and 2022-23. The LDS as declared by SRLDC was from May to January months during 2021-22 and 2022-23. The concept of Peak/Off Peak Operation as provided under Regulation 42 of CERC Tariff Regulations 2019 has been made effective from 3 February 2021.

Annexure-VI
(Referred in Para 3.4)
Under recovery of annual extraction cost for lignite mines

A. Various reasons of partial loss in TPS-II

Year	Reasons for Partial Loss (MUs)			Total (MUs)	Quantity of Lignite required (in Kg) to produce one unit (Kwh)	Lignite Transfer Price per tonne (₹)	Under recovery of annual extraction cost for lignite (₹ in crore)
	Milling/Pulverising system (Para 3.4.1)	Lignite Handing system (Para 3.4.3)	Shortage of Lignite and wet Lignite (Para 3.4.4)				
				(A)	(B)	(C)	(A)*(B)*(C)/10000
2017-18	75.05	26.96	--	102.01	1.09	1,983.00	22.05
2018-19	39.81	226.63	11.54	277.98	1.097	2,021.00	61.63
2019-20	15.14	6.61	39.94	61.69	1.1	2,072.54	14.06
2020-21	238.09	0.24	48.43	286.76	1.1	2,125.39	67.04
2021-22	85.81	2.20	180.53	268.54	1.1	2,179.58	64.38
2022-23	196.98	18.89	11.46	227.33	1.09	2,202.00	54.56
Total	**650.88**	**281.53**	**291.90**	**1,224.31**			**283.72**

B. Lignite feeding system in TPS-IIE (Para 3.4.2)

Year	Partial loss (in MUs)	Quantity of Lignite required to produce on unit (Kwh of power)	Lignite Transfer Price per tonne (₹)	Under recovery of annual extraction cost for lignite (₹ in crore)
	(A)	(B)	(C)	(A)*(B)*(C)/10000
2017-18	106.44	1.02	1,983.00	21.53
2018-19	37.91	1.02	2,021.00	7.81
2019-20	6.56	1.02	2,072.54	1.39
2020-21	33.66	0.91	2,125.39	6.51
2021-22	35.64	0.97	2,179.58	7.53
2022-23	75.16	0.97	2,202.00	16.05
Total	**295.37**			**60.82**

C. Shortage of Lignite and wet Lignite in TPS-IE (Para 3.4.4)

Year	Partial loss (in MUs)	Quantity of Lignite required to produce on unit (Kwh of power)	Lignite Transfer Price per tonnes (₹)	Under recovery of annual extraction cost for lignite (₹ in crore)
	(A)	(B)	(C)	(A)*(B)*(C)/10000
2017-18	30.14	1.02	1,983.00	6.10
2018-19	3.77	1.03	2,021.00	0.78
2019-20	3.13	1.02	2,072.54	0.66
2020-21	8.18	1.02	2,125.39	1.77
2021-22	18.43	1.02	2,179.58	4.10
2022-23	11.44	1.02	2,202.00	2.57
Total	**75.09**			**15.98**

Annexure-VII
(Referred in Para 3.8)
Trip Analysis Committee's recommendations and root cause analysis of fire incidents

Unit and Fire accident date	Incident in brief	Root cause analysis	Recommendations
Unit-5 21 July 2001	Fire leaping out of furnace causing localized fire	One of the causes of local fire was identified as accumulation of lignite in girders and surrounding area at 32 ML	Structural Engineering Research Centre" (SERC, CSIR-Chennai), recommended to take measures to strengthening the structural
Unit-5 24 July 2016	Heavy smoke with flame, fire particles and abnormal notice was noticed at local outside the furnace	Fire/lignite particles with hot gas came through opening of manholes, peep holes, soot blower, subsequently might have initiated secondary/rapid combustion with the lignite dust already deposited inside boiler box beam, boiler lift and surrounding area, in turn caused explosion in boiler lift and boiler box beam	One of the recommendations was lignite dust spread over on boiler structures/backstays from 15.0 to 38.0 Metre level etc are to be cleaned regularly which may cause fire hazards during such furnace pressure pulsation, Mill buffing.
Unit – 6 03 December 2017	Heavy explosion, smoke and fire	One of the causes was identified as sudden spread of lignite dust accumulated in boiler structure and ducts. The smoulders which exist around the boiler ignited the lignite dust and caused spontaneous ignition and explosion.	One of the recommendations was better housekeeping to be maintained near boiler and other fire prone areas to avoid dust particles accumulation.
Unit -6 9 June 2019	Fire and then smoke around the boiler above 44 ML	Hot gases from furnace have seeped into box girder causing bursting of the box girders	Structures- box girders are to be strengthened based on structural specialist recommendation.

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