CHAPTER-II

2 Performance Audit on Coal Management in Thermal Power Stations of Tamil Nadu Generation and Distribution Corporation Limited

Executive Summary

As on 31 March 2019, Tamil Nadu Generation and Distribution Corporation Limited (TANGEDCO) owns and operates five Coal based Thermal Power Stations (TPS) (two TPS at Mettur, two TPS at North Chennai, and one TPS at Tuticorin) with a total installed capacity of 4,320 MW. The cost of coal constituted 95.54 to 98.41 per cent of the total cost of generation of TANGEDCO during 2014–19 and has a significant impact on power tariff on consumers. The performance audit on coal management was conducted covering the period 2014–2019 to ascertain economy in procurement and transportation, effectiveness of assessment of quality and quantity of coal procured, and efficiency of consumption of coal in TPS against norms. The audit findings are summarised below:

Planning and procurement of coal

Coal is procured domestically through long term coal linkages from subsidiary companies of Coal India Limited (CIL) at the notified prices. Against linkage of 106.97 Million Metric Tonnes (MMT), TANGEDCO could secure receipt of 71.82 MMT of coal during 2014–19. Even though TANGEDCO resorted to procurement of 22.76 MMT of imported coal to offset the short supply, it did not levy any penalty for short supply from CIL.

Based on the advice of GOI, CIL requested (June 2016) TANGEDCO to stop importing coal and substitute it with high grade indigenous coal available from its sources. However, coal supplied under import substitution scheme was to the extent of 31 per cent of agreed quantity. But, TANGEDCO did not prefer any claim of penalty with the coal companies as per clause 3 of FSA for the short supply.

GOI introduced (June 2016) a scheme of "Flexibility in utilisation of domestic coal for reducing the cost of power generation" which provided for consolidation of Annual Contracted Quantity of coal of all TPS within the State. Due to non-inclusion of coal allotment made for one of the Joint Venture power company i.e., NTECL which is having TPS within the State, TANGEDCO lost the central allocation of coal to the extent of 6.239 MMTPA.

Coal supply management

TANGEDCO allowed its JV partner NTPC Tamil Nadu Energy Company Limited (NTECL) to use its own coal terminal without any commitment for upgradation of unloading facilities. In the meantime, it used a private coal terminal for unloading of coal which resulted in avoidable extra expenditure of ₹41.68 crore.

Even though TANGEDCO suffered excess transit loss over the norm of 1.50 per cent for the coal transported from North Chennai to Mettur by railways in 47 out of 60 months (78 per cent) valuing ₹58.37 crore, it did not fix any accountability on the contractor for the loss.

The coal handling contracts at TPS suffered from deficiencies such as non-adoption of uniform contractual terms, method of contract, etc. In addition, TANGEDCO erroneously fixed lower quantity of Minimum Guaranteed Quantity (MGQ), resulting in avoidable payment of incentive of ₹10.61 crore for handling additional quantity over and above MGQ.

Failure to load coal up to the permissible carrying capacity of wagons resulted in idle freight charges of ₹101.35 crore.

Assessment of quality and quantity

As against the normative loss of calorific value of 120 kcal/kg, the actual loss of calorific value during transportation from mines to discharge ports ranged between 140 to 2,256 kcal/kg resulting in wasteful expenditure of ₹2,012.65 crore. Even though there were instances of drop in Gross Calorific Value (GCV) during consumption immediately upon its receipt on the same day, TANGEDCO had not analysed the reasons for the same.

The systems adopted by TANGEDCO for assessment of quality of coal was deficient as (i) at coal mines there was no mechanical sampling as prescribed by GOI which was continued to be carried out manually, (ii) TANGEDCO accepted 13.79 lakh MT of coal valuing ₹411.63 crore without testing, (iii) the test results of samples to be received within 30 days were delayed beyond two to three months in case of MCL and more than one year in case of ECL, (iv) TANGEDCO used formula method for determination of calorific value though it was mandatory to use bomb calorimeter for testing, and (v) there was no coal Quality Monitoring Wing at Headquarters of TANGEDCO.

In five TPS studied in audit, the energy charges computed by TANGEDCO for billing were based on 'As Fired GCV' and higher by ₹1,805.35 crore during 2014-19 compared to the energy charges to be billed based on 'As Received GCV' as per CEA/CERC recommendations.

There is no periodical physical verification system in load ports and TANGEDCO has not determined transit loss for the past 18 years citing a pending legal case.

Coal consumption at power stations

Operational efficiency of TPS is regulated through Station Heat Rate (SHR), which depends on the quantity and quality of coal. The actual SHR was in excess of norm stipulated by TNERC in all TPS, which resulted in excess consumption of 56.85 lakh MT of coal valuing ₹2,317.46 crore throughout 2014–19. Moreover, TANGEDCO could not reduce specific coal consumption despite usage of higher proportion of imported coal having high calorific value in all TPS.

TANGEDCO suffered generation loss of 844 MU valued at ₹171.57 crore due to poor quality of coal during 2014–19.

TANGEDCO did not adhere to GOI guidelines for phasing out of accumulation of ash on land and had accumulated 62.15 MMT of ash in ash dykes in three TPS as on March 2019. The continued dumping of ash on land resulted in contamination of ground water, Buckingham canal and Kosasthalaiyar river.

Conclusion

The performance audit revealed TANGEDCO's failure to secure balanced coal linkage, tardy implementation of import coal substitution scheme. There were several instances of avoidable expenditure and undue benefit to coal handling contractors while transporting coal from mines to power stations. There was huge drop of GCV up to 2,256 kcal/kg during transportation of coal. The computation of energy charges adopted by TANGEDCO for billing was higher by ₹1,805.35 crore. Despite use of higher quality imported coal in TPS, the specific coal consumption was not reduced. Thus, TANGEDCO did not take appropriate measures to avoid the inefficiencies in coal management.

Recommendations

Audit recommends that TANGEDCO reviews its fuel supply agreements to ensure that the financial interests of TANGEDCO are protected by ensuring that there are no monthly shortages of coal, and levy penalty where provided for in the agreement. The existing coal handling contracts may be reviewed to ensure standardisation and incorporate best and economical practices and amend the contracts which are leading to undue benefit to the contractors. The reasons for excess loss of GCV over and above the CEA norms need to be analysed and effective measures be taken to control the loss of GCV during transit and at power stations. TANGEDCO may explore the adoption of "As Received GCV" instead of "As Fired GCV" for tariff fixation as recommended by CERC. An effective control mechanism may be established to cross check the quality and quantity of coal at load ports and at power stations.

Introduction

2.1 Tamil Nadu Generation and Distribution Corporation Limited (TANGEDCO) is engaged in generation and distribution of electricity within Tamil Nadu. As on 31 March 2019, TANGEDCO had five Coal based Thermal Power Stations[38] (TPS) with a total installed capacity of 4,320 MW. TANGEDCO additionally planned five[39] coal based thermal stations with a capacity of 5,700 MW to be implemented during 2019-23.

In TPS, Coal is used as a primary fuel and Oil (Heavy Furnace Oil and High Speed Diesel) is used as secondary fuel in boiler for generating steam. TANGEDCO meets its requirement of coal from four subsidiaries[40] of Coal India Limited (CIL), Singareni Collieries Company Limited (SCCL) and through import options. The cost of coal constituted 95.54 to 98.41 *per cent* of the total cost of generation of TANGEDCO during 2014–19 and has significant impact on cost of supply of power to consumers. Details of fuel cost in thermal generation in TANGEDCO during 2014-19 are given in **Table 2.1.**

Table 2.1: Details showing the cost of generation of power *vis-à-vis* cost of coal

Sl. No.	Particulars	2014-15	2015-16	2016-17	2017-18	2018-19
1	Targeted Thermal Power Generation (MU)	31,333	32,158	32,144	31,064	29,892
2	Actual Thermal Power Generation (MU)	27,380	28,375	25,009	22,869	25,978
3	Cost of Coal (Primary fuel)(₹ in crore)	9,151	8,004	7,436	6,613	8,369
4	Cost of generation of power (TPS)(₹ in crore)	9,436	8,201	7,556	6,921	8,666
5	Percentage of coal cost to total cost of generation	96.98	97.60	98.41	95.54	96.57

Source: Annual Reports of TANGEDCO

It could be seen from above that the actual generation of TPS was lower than the generation targeted during the five years from 2014-15 to 2018-19. The total shortfall in actual generation *vis-à-vis* targeted generation was 26,980 Million Units (MU). The reasons for this shortfall was shortage of coal, planned and forced outages, running of plants at partial load due to shortage and poor quality of coal *etc*.,

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38 Comprising 3x210 MW North Chennai Thermal Power Station-I (NCTPS-I), 2x600 MW North Chennai Thermal Power Station-II (NCTPS-II), 4x210 MW Mettur Thermal Power Station-I (MTPS-I), 1x600 MW Mettur Thermal Power Station-II (MTPS-II), and 5x210 MW Tuticorin Thermal Power Station (TTPS).(2x60 MW + 2x110 MW) Ennore Thermal Power Station (ETPS) was decommissioned in March 2017.

39 Ennore Expansion TPS (1x660 MW), North Chennai TPS Stage-III (1x800 MW), Ennore SEZ TPS (2x660 MW), Udangudi TPP Stage I (2x660 MW), Uppur Thermal Power Project (2x800 MW).

40 Eastern Coalfields Limited (ECL), Mahanadi Coalfields Limited (MCL), Central Coalfields Limited (CCL), and Western Coalfields Limited (WCL).

This performance audit was carried out considering the significance of coal cost in generation of electricity and weak financial position of TANGEDCO as detailed in Chapter I of this Audit Report.

Organisation Structure of TANGEDCO

2.2 TANGEDCO is functioning under the administrative control of Energy Department of Government of Tamil Nadu (GOTN). The overall management of TANGEDCO is vested in the Board of Directors. The activities relating to generation of power is vested with Director (Generation). The matters relating to procurement, transportation and monitoring of coal movement are dealt by the Chief Engineer (Coal). At the field level, each TPS is headed by a Chief Engineer under the overall supervision of Director (Generation) and account for the receipt and consumption of Coal.

Audit Objectives

2.3 The objectives of performance audit were to assess whether:

- Planning for procurement of coal and procurement process was carried out economically and efficiently;
- Coal Supply Management (including logistic and handling) was economical and efficient;
- Quality and quantity of Coal procured were in accordance with the terms of Fuel Supply Agreements (FSAs) / Memorandum of Understandings (MoUs) /Relevant Quality Standards;
- Management of coal consumption at TPS was efficient and coal consumption was as per the Central Electricity Regulatory Commission (CERC)/Tamil Nadu Electricity Regulatory Commission (TNERC)'s norms; and
- Internal control system with reference to coal management was effective.

Scope and Methodology of Audit

2.4 This Performance Audit was conducted between June 2019 and February 2020 covering the activities relating to planning and procurement, transportation and handling, quality and quantity assessment, efficiency in consumption of coal and internal control system in TANGEDCO during 2014–2019. The entry conference with TANGEDCO and Energy Department, GOTN was conducted on 14 August 2019. The compliance audit observations relating to import of coal by TANGEDCO covering the period 2014–17 was included in the Report of the Comptroller and Auditor General of India (Public Sector Undertakings) for the year ended March 2017. Therefore, issues relating to import of coal were not covered in the present Audit. The exit conference was conducted on 29 May 2020 in which the Principal Secretary of Energy Department, GOTN and the CMD of TANGEDCO participated. Views expressed by the officials of TANGEDCO and GOTN in the exit conference, the replies furnished by TANGEDCO (May 2020) and the response of the

Government (September/October 2020) have been considered and incorporated in the report appropriately.

Audit Criteria

2.5 The sources of audit criteria are:

- New Coal Distribution Policy, 2007 (NCDP) issued by the Government of India / Standing Linkage Committee Meetings' minutes;
- Regulations/Guidelines/Orders issued by the Central Electricity Authority (CEA) and TNERC;
- Norms of Consumption of Coal as fixed by TNERC;
- Coal sampling and testing standards of Bureau of Indian Standards (BIS); and
- Provisions contained in FSAs/MoUs/Contracts with coal companies, Railways, transport agencies and other contractors.

Audit Sample

2.6 During the present audit, all the five functional TPS of TANGEDCO were selected for audit and all 31 contracts each valuing more than ₹one crore entered into by TANGEDCO head office for procurement, logistic and coal quality testing were taken up for detailed examination. In addition, 55 contracts each valuing more than ₹one crore and 254 coal handling contracts[41] each valuing less than ₹one crore executed by TPS were selected for detailed examination on the basis of stratified random sampling method.

Acknowledgement

Audit acknowledges the co-operation and assistance extended by the Management of TANGEDCO at various stages of conducting of this Performance Audit.

Audit findings

2.7 Planning and procurement of Coal

2.7.1 Coal is procured domestically through long-term coal linkages from subsidiary companies of CIL at notified rates. For all other procurements, such as procurement through MOU and import, the rates are higher. Coal linkage for TPS was granted by Standing Linkage Committee (Long Term) of Ministry of Coal (MoC) based on recommendation of CEA and inputs from the generating companies and coal companies. The FSAs between coal companies and power generating companies stipulate contracted quantity and quality of coal, procedure for checking quality of coal, source of supply, commercial terms *etc*. The details of the installed capacity, targeted generation, and contracted quantity as per the coal supply agreements, coal requirement *vis-à-vis* actual supply, *etc*., are given in **Annexure–2**.

[41] Out of 16,923 coal handling contracts.

As per the New Coal Distribution Policy (NCDP), 2007 of GOI, 100 *per cent* of the normative[42] requirement of coal of the power utilities would be considered for supply through FSA. Two versions of FSA[43] were signed by TANGEDCO with 20 years' validity. Under NCDP, four stations of TANGEDCO commissioned prior to 31 March 2009 were named as existing consumers and another two stations[44] commissioned after 31 March 2009 were named as new consumers. The rates for supply of coal under FSAs were notified by CIL. Additional quantities of coal (over and above FSA quantities) would be available to the TPS at a higher rate, fixed at 40 *per cent* above the notified rates.

Based on the maximum annual consumption during 2005–08 in ETPS, MTPS–I, NCTPS–I, and TTPS, TANGEDCO estimated the combined normative coal requirement as 16.20 Million Metric Tonnes *per annum* (MMTPA) which is sufficient for operation of all TPS at a PLF of 84.78 *per cent.* However, CEA allotted 13.50 MMTPA to TANGEDCO which is sufficient for operation of four[45] TPS at a PLF of 70.65 *per cent*. Accordingly, TANGEDCO entered into 20 years' long-term FSA (June 2009), for the TPS commissioned prior to 2009, with subsidiaries of CIL.

For the TPS[46] commissioned after 2009, TANGEDCO entered into FSA (PLF 65 *per cent* as per NCDP) with MCL for 2.315 MMTPA and 4.63MMTPA for MTPS–II (December 2012) and NCTPS–II (June 2013) respectively. Further, TANGEDCO entered into (October 2016) an agreement with ECL for supply of additional quantity of 2.50 MMTPA. Thus, as on 31 March 2019, TANGEDCO had net Annual Contracted Quantity (ACQ) of 22.60 MMTPA[47], after surrendering ACQ of 0.35 MMTPA of imported coal procurement through CIL sources. Details of the requirement of coal and the procurement during 2014-19 are given in **Annexure – 2**.

42 As per CEA norms, calculated based on maximum consumption in any of the past three years

43 First version of FSA entered into with MCL and ECL in June 2009 and the second version of FSA with MCL in December 2012 and June 2013

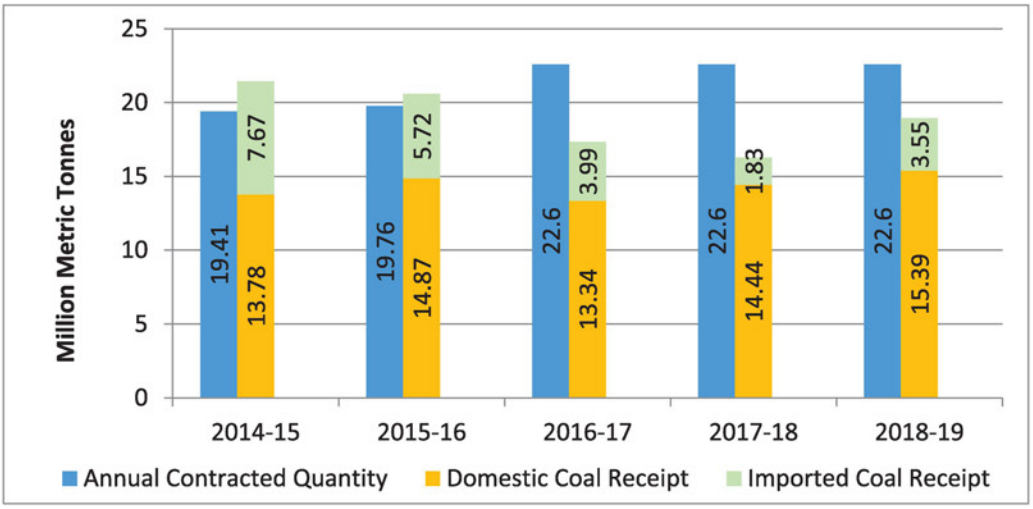
44 NCTPS–II, MTPS–II

45 ETPS, NCTPS–I, MTPS–I, and TTPS

46 Commissioned in October 2013 and May 2014 (MTPS II & NCTPS II)

47 FSA with MCL (June 2009) for 11.575 MMTPA, ECL (June 2009) for 1.425 MMTPA, MCL (December 2012) for 2.199 MMTPA, MCL (June 2013) for 4.399 MMTPA, CCL (November 2016) for 0.5 MMTPA and ECL (October 2016) for 2.50 MMTPA totaling 22.598 MMTPA.

Chart 2.1: Total Requirement of Coal and Supply of Indigenous and Imported Coal



The **Chart 2.1** indicates total coal receipt (both indigenous and imported) against the ACQ of indigenous coal under FSAs. The actual supply of indigenous coal was less than total ACQ. As per the FSA, the purchaser can claim penalty[48] for short supplied quantity of more than 25 *per cent* in a year. The short fall against the contracted quantity was in the range of 4.89 to 9.26 MMTPA (representing 25 to 41 *per cent* of ACQ) during 2014–19. Even though TANGEDCO resorted to procurement of imported coal to off-set the short supply, it did not levy any penalty for short supply from CIL. When audit called for the reasons for short supply of coal, the Chief Engineer (Coal) replied that reasons for shortfall in supply of coal by coal companies to TANGEDCO is not available or informed by the coal companies.

Government in its reply (September/October 2020) attributed the short supply of wagons and movement restriction imposed by Railways as reasons for short supply of coal. However, independent audit verification with South Eastern Railways and South East Central Railways revealed that there was no scarcity of railway wagons during 2014-19. Government also confirmed that TANGEDCO was forced to procure imported coal to meet its generation requirement due to shortfall in domestic coal supply by CIL.

TANGEDCO must evolve a system for recording reasons for short supply of coal on monthly basis and levy penalty as per contractual provisions in order to protect its financial interests and generation requirements.

Deviation in monthly and quarterly scheduled quantities

2.7.2 Continuous supply of coal is a prerequisite to run the TPS. The ACQ was divided into quarterly quantities[49] and further into monthly quantities[50]. As per FSA, total variation in coal supply in any month shall not exceed 10 *per cent* of monthly agreed quantity. Audit noticed that during 2014-19, in 199 out of 240 months (83 *per cent* instances) the deviation in coal supplies were beyond

48 Penalty – Ranging from 5 to 40 *per cent* of the basic price of indigenous coal for the short supplied quantity ranging from 25 to 50 *per cent*.

49 25 *per cent* each of ACQ in first and third quarter, 22 *per cent* in second quarter and 28 *per cent* of ACQ in the fourth quarter

50 One third of quarterly quantity

the permitted level in all the TPS as detailed in **Annexure–3**. Moreover, Audit noticed that FSAs provided for monetary compensation only for annual short supply and not for monthly or quarterly short supply by coal companies. Inclusion of an enabling provision in the FSAs for levy of penalty in case of shortage in monthly supplies, would protect the financial interest of TANGEDCO. Audit observed that incentive claimed by Coal Companies for excess supply to a particular TPS was not stopped although there was short supply of coal to other TPS under the same FSA. For instance, during 2015–16, MCL supplied only 84 *per cent* of combined ACQ to TTPS, MTPS–I and NCTPS–I put together under same FSA but MCL claimed incentive of ₹18.55 crore for additional supplies (110 *per cent* over ACQ) to TTPS during the same year. Even though the claim was yet to be paid by TANGEDCO, the same indicated that the terms of FSA were not balanced and not protecting TANGEDCO in cases of short supplies.

Government in its reply (September/October 2020) stated that the incentive bills for ₹18.55 crore submitted by MCL were not accepted by TANGEDCO. However, Audit is of the view that mere non-acceptance of claim would not absolve TANGEDCO from the liability in the absence of final withdrawal of the incentive claim by MCL.

Tardy implementation of import coal substitution scheme

2.7.3 As per the import policy of GOI, coal is kept under Open General License and coal consumers are free to import coal from the source of their choice. However, based on the advice of GOI, CIL requested (June 2016) TANGEDCO to stop importing coal and substitute it with high grade indigenous coal available from CIL/SCCL sources and entered into agreements for supply of 5.0 MMTPA as detailed in **Table 2.2** below:

Table 2.2: Agreed Quantity (AQ) and Supply Quantity (SQ) under import substitution

(In MMT)

Coal Company	Agreement Date	2016–17		2017–18		2018–19		Total	
		AQ	SQ	AQ	SQ	AQ	SQ	AQ	SQ
ECL–Side Agreement	October 2016	1.04	0.39 (38%)	2.50	0.35 (14%)	2.50	0.49 (20%)	6.04	1.23 (20%)
CCL–FSA	November2016	0.36	0.04 (11%)	1.00	0.45 (45%)	0.66	0.55 (83%)	2.02	1.04 (51%)
SCCL–MoU	November 2016	1.00	0.49 (49%)	---	0.22	---	---	1.00	0.71 (71%)
WCL–FSA	May 2017	---	---	0.42	0.01 (2%)	0.16	--- (0%)	0.58	0.01 (2%)
Total		2.40	0.92	3.92	1.03	3.32	1.04	9.64	2.99 (31%)

Source: Agreements/MOU with coal companies and coal data book of TANGEDCO

It could be seen from **Table 2.2** above, that the coal supplied under import substitution scheme was to the extent of 31 *per cent* of agreed quantity. Even though the agreements with CCL and WCL provided for claim of penalty (except ECL and SCCL) for short supply exceeding 25 *per cent* of the agreed quantity, TANGEDCO neither analysed the reasons for short receipt of agreed quantity nor preferred any claim of penalty with the coal companies as per clause 3 of FSA for the short supply of 6.65 MMT. ECL initially agreed to

supply high grade coal for import substitution without performance incentive for supplies exceeding quantity of 2.50 MMTPA. ECL imposed add-on price and performance incentive of 15 *per cent,* which was not a part of the agreement and raised a claim on TANGEDCO for an amount of ₹65.43 crore during 2017–19, despite ECL failing to supply the agreed quantity during the same period.

Government in its reply (September/October 2020) stated that based on the directions of GOI, fresh tender for import of coal was not invited after February 2016 and import of coal was stopped since June 2017. TANGEDCO (October 2020) clarified that no payments with respect to performance incentive has been paid to ECL during 2017-19. It also stated that the shortfall of indigenous coal was being reviewed up to 2016-17 and the compensation has been communicated to coal companies and recovered by TANGEDCO in the coal bills. However, Audit is of the view that mere non-acceptance of claim would not absolve TANGEDCO from the liability in the absence of final withdrawal of the incentive claim by ECL. TANGEDCO needs to pursue withdrawal of the claim with the ECL.

Flexible utilisation of coal

2.7.4 As per FSA, the coal allocation was to be utilised only by the respective TPS and the allocation cannot be diverted to other TPS. The GOI introduced (June 2016) a scheme of "Flexibility in utilisation of domestic coal for reducing the cost of power generation". The scheme provided for consolidation of ACQ of coal of all thermal generating stations in a State and Aggregated ACQ (AACQ) would be arrived for each State instead of individual FSA for each generating station. The State/Central Generating companies have the flexibility to utilise their coal in most efficient and cost effective manner in their own power plants as well as by transferring coal to other TPS owned by State/Central Government for generation of cheaper power.

For TPS owned by TANGEDCO, the total ACQ was worked out to 20.445 MMTPA[51] and the ACQ of 9.11 MMTPA was for TPS owned by Joint Venture (JV) power companies of TANGEDCO (2.87 MMTPA of NTPL[52] and 6.239 MMTPA of NTECL[53]). Audit noticed that both NTPL and NTECL are Central Generating Stations which are also JV companies of TANGEDCO and have their TPS located within Tamil Nadu. Out of these two JV companies of TANGEDCO, CIL has aggregated only the ACQ of NTPL with TANGEDCO, but the ACQ of NTECL was not included with TANGEDCO. When TANGEDCO raised (April 2017) this issue, CIL had requested to settle the same by addressing NTPC, since it had made only a provisional aggregation of ACQ with NTPC. It is pertinent to note that TANGEDCO agreed (January 2018) to the proposal of inclusion of the ACQ of NTECL with NTPC without the approval of its Board of Directors. Due to this omission, TANGEDCO had lost the central allocation of coal to the extent of 6.239 MMTPA.

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51 Additional FSA with ECL for 2.5 MMTPA and the ACQ foregone due to surrender of import coal option from MCL of 0.35 MMTPA was not considered for arriving at the figure of 20.445 MMTPA.

52 NLC Tamil Nadu Power Limited, a joint venture power company between TANGEDCO and NLC India Limited

53 NTPC Tamil Nadu Energy Company Limited, a joint venture power company between TANGEDCO and NTPC Limited

Government in its reply (September/October 2020) stated that NTPC did not accept the above proposal and hence NTECL's allocation was not pooled with TANGEDCO's allocation. The reply is not convincing because

- ACQ of each individual coal linkages (as per FSA) of the purchaser, shall be aggregated as consolidated ACQ for the purchase along with its JVs and subsidiary companies, instead of individual Thermal Power Stations. Further, in NTECL, TANGEDCO has 50 *per cent* shareholding and has 71 *per cent* power allocation to Tamil Nadu. Therefore, pooling of NTECL allocation with TANGEDCO would have been more appropriate, as it was done in case of NTPL another JV of TANGEDCO.
- The TPS of NTECL and TANGEDCO's NCTPS-I and II are located at the same place and coal is unloaded at the same Kamarajar Port. Further, in case of technical problem in conveyor system for transporting of coal to TPS or during critical[54] stock level of coal, coal meant for TANGEDCO may be used at NTECL and vice-versa. Therefore, it would have ensured better flexibility of utilisation of coal between these two TPS.

In view of the above, ACQ of NTECL should have been incorporated in the AACQ of State of Tamil Nadu for achieving better flexibility in utilisation of domestic coal as envisaged by the CEA or else the very purpose of flexibility in utilisation of domestic coal for reducing the cost of power generation will be defeated.

2.7.5 Impact of short supply of Coal

One of the important functions in operating a TPS is to ensure uninterrupted supply of coal so that generation loss due to coal shortage does not arise. It is pertinent to note that the short supply of coal led to coal stock reaching critical levels as detailed below in**Table 2.3**:

Table 2.3: Instances of Super critical and Critical level stock position at TPS

Station	2016-17		2017-18		2018-19	
	Critical	Super critical	Critical	Super critical	Critical	Super critical
TTPS	9	---	32	9	85	13
NCTPS	34	---	125	84	59	303
MTPS–I	31	---	31	25	135	36
MTPS–II	---	---	23	25	55	18

Note: As per CEA norms Supercritical means number of days of coal stock is less than 4 days and Critical means number of days of coal stock is less than 7 days.
Source: CEA daily coal stock reports

[54] coal stock is for less than 7 days

Audit observed that:

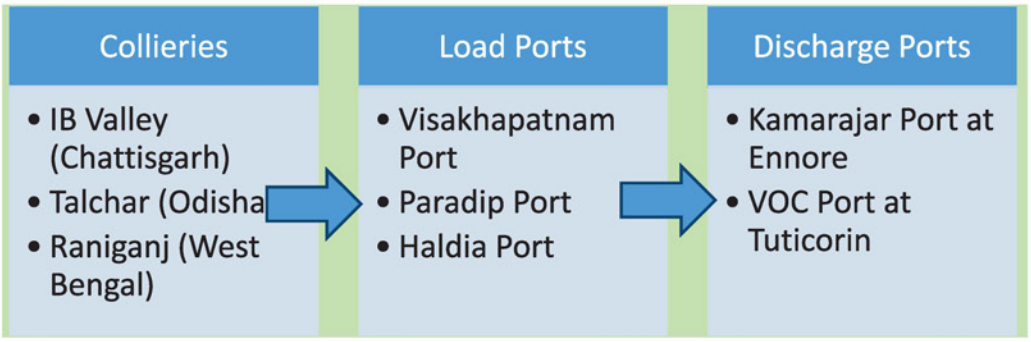
- In NCTPS, there was supercritical[55] level of coal stock position for 84 days (23 *per cent*) and 303 days (83 *per cent*) during 2017-18 and 2018-19 respectively.
- There was loss of generation to the extent of 243.45 MU in TTPS (150.75 MU) for 2017-18 and 2018-19, MTPS–I (56.18 MU) for 2017-18, and MTPS–II (36.52 MU) for 2014-15 and 2018-19 on account of want of coal.

Government in its reply (September/October 2020) stated that the short supply was due to coal allocation by GoI as well as the provision of railway rakes based on the average consumption and not for the total normative consumption. It also stated that GoTN had approached concerned authorities to supply 72,000 MT of coal per day to State of Tamil Nadu. However, the fact remains that TANGEDCO had suffered loss of generation during the review period for want of coal. TANGEDCO needs to take up the matter at appropriate level to avoid instances of supercritical levels of coal and consequent loss of generation.

Coal Supply Management

2.8 TANGEDCO received 71.82 Million Metric Tonnes (MMT) of indigenous coal during 2014-19 from Coal companies and transported 70.12 MMT through rail-sea-rail route from mines to discharge ports *viz*., Kamarajar Port at Ennore and Tuticorin Port for further transportation to TPS located at North Chennai, Mettur, Ennore and Tuticorin. Out of remaining 1.70 MMT, one MMT of indigenous coal from IB Valley (Chhattisgarh) of MCL during 2017-19 and 0.70 MMT of indigenous coal procured from Singareni Collieries Company Limited during 2016-18 was transported through rail route to MTPS I & MTPS II, Mettur.

Coal Movement for Thermal Power Plants, TANGEDCO



Audit assessed the economy and efficiency of transportation of coal from Collieries to load port, discharge port and Power Plant. The audit examination revealed the following lapses in coal transportation management.

[55] coal stock is for less than 4 days

Movement of coal up to load ports

Undue benefit to handling contractors

2.8.1. As per the Schedule II of the coal handling contracts (February 2001), the contractors were required to pay Wagon Haulage Charges[56] (WHC) to Haldia Dock Complex under Kolkata Port Trust (KPT), Visakhapatnam Port Trust (VPT), and Paradip Port Trust (PPT) at the rate notified by the Indian Railways on "rate per wagon" basis. However, TANGEDCO reimbursed the WHC to its contractors on "rate per MT" basis using a formula considering carrying capacity at 60.50 MT per wagon for both Haldia and Visakhapatnam Ports, and 65 MT[57] per wagon for Paradip Port.

Audit observed that even though the carrying capacity of wagon was enhanced by Railways from 60.50 MT/65 MT to 68 MT per wagon from August 2011 onwards, the rate per MT computed by TANGEDCO was not correspondingly reduced resulting in undue benefit to the contractors. Based on the available information only for one year *i.e.*, 2017-18, audit worked out the undue benefit to the contractors in respect of all three load ports as ₹2.55 crore approximately. Government in its reply (September/October 2020) stated that following the change in the carrying capacity of the wagon from 58.5 MT to 60.5 MT from 01 April 2009, the Board had approved (August 2009) the revision of WHC till the end of the contract and accordingly the WHC was amended with mutual agreement with the contractor. The reply is not acceptable, as the contract which started in 2001, has been renewed every three months, therefore to protect TANGEDCO's financial interests, the rate per MT could be revised in the contract.

Coal handling at discharge ports

2.8.2 At Kamarajar Port at Ennore, coal is unloaded and moved through conveyors to NCTPS I & II. A portion of the coal is further transported to MTPS through rail route. At VOC Tuticorin Port (VTP), coal was unloaded at Coal Jetty–I and II and directly moved to TTPS through conveyors. The examination of unloading activities revealed the following deficiencies.

Extra expenditure due to belated upgradation of coal berth

2.8.3 In Ennore Port, TANGEDCO developed two dedicated Coal Berths (CB), *viz.*, CB–1 and CB – 2 having capacity of 9 MMTPA and 6 MMTPA respectively. From November 2012, TANGEDCO allowed NTECL to use CB–2 for discharging coal for their plants. Due to lesser handling capacity at CB–2 as compared to CB–1 coupled with longer time taken by NTECL for discharging coal from geared vessels, TANGEDCO was forced to utilise (September 2013), another private coal terminal at Ennore for unloading coal for its TPS.

The details of coal handled by TANGEDCO at CB–1, CB–2 and the private terminal during 2014–19 are given in the **Table 2.4** below.

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[56] Being charges payable to Port Trust at the rates determined by railways for movement of wagons in port area

[57] December 2013 – 65 MT per wagon

Table 2.4: Details of coal handled at CB–1, CB–2 and a private coal terminal during 2014–19

(in MMT)

Coal Berth	Capacity	2014–15	2015–16	2016–17	2017–18	2018–19
CB1	9 MMTPA	11.03	11.66	10.06	10.16	9.97
CB2	6 MMTPA[58] till May 2016 / 9 MMTPA from June 2016	4.10	5.34	6.30	6.55	7.40
Private terminal[59]	10 MMTPA	3.96	4.07	2.52	0.56	0.85
Total		**19.09**	**21.07**	**18.88**	**17.27**	**18.22**

Source: KPL website & Coal Data MIS of TANGEDCO

Audit observed that:

- The cost of operation of unloading of coal from ship to the private terminal was costlier by ₹5.60 per MT to ₹71.17 per MT as compared to the same at CB–2 during 2014–19. However, TANGEDCO used the private terminal only because of sharing of CB–2 with NTECL without any formal agreement which resulted in extra expenditure of ₹41.68 crore.
- After installation (June 2016) of shore unloaders at CB–2 by NTECL, usage of the private terminal by TANGEDCO was considerably reduced.

Government in its reply (September/October 2020) stated that due to stringent financial position of TNEB, the work of providing the shore unloaders at CB-2 was handed over to NTECL with the request to complete the work at the earliest. Due to delay in erection of shore unloaders at CB–2 and to avoid loss of generation, the third party berth had been utilized beneficially. The reply confirms that it was a forced situation due to delay in erection of shore unloaders by NTECL, which could have been avoided had TANGEDCO analysed the implication of sharing of the facility with NTECL and executed a suitable agreement specifying the obligations and time limit for erection work.

Non recovery of transit loss beyond permissible limit

2.8.4 After movement of coal from load ports at Vishakhapatnam and Paradip through sea, the same is unloaded in Chennai at Kamarajar port. This coal is moved through conveyor system to the NCTPS–I & II and further transported to MTPS–I & MTPS-II by Railways. Audit noticed that for railway movement of coal to MTPS, TANGEDCO had engaged (December 2012) the services of a private contractor, M/s. Chennai Radha Engineering Works (CREW).

CERC's norm for transit loss is 0.8 *per cent* of the total quantity moved. However, TANGEDCO issued guidelines for movement of coal up to Mettur

[58] Including Mobile Hoppers

[59] Coal Handled for TANGEDCO at Common User Coal Terminal (CUCT) owned by Chettinad International Coal Terminal Private Limited

which *inter-alia* included the maximum permissible transit loss at 1.5 *per cent* of the quantity despatched. Audit noticed that during the period 2014-19, NCTPS despatched 175.57 lakh MT of coal through 4,773 rakes to MTPS. Audit analysis of the month-wise despatch and receipt of coal at MTPS revealed that the actual transit loss exceeded the permissible limit as laid down by TANGEDCO (1.5 *per cent)* in 47 out of 60 months (78 *per cent*) to the extent of 3.85 lakh MTs of coal valued at ₹58.37 crore. In this connection, audit observed that:

- In 11 months, the transit loss ranged between 3 *per cent* and 4.40 *per cent* as against the TANGEDCO's norms of 1.5 *per cent*. TANGEDCO neither analysed the reasons for excess transit loss nor fixed any accountability on the contractor as the contract did not have any clause for recovering the same from the contractor despite knowing the quantity short delivered.
- For the transportation of coal from Chettinad International Coal Terminal Private Limited (CICTPL) to MTPS I and II, the coal handling contract was awarded to a contractor. It is also pertinent to mention that TANGEDCO had withheld the value of the transit loss amounting to ₹108.50 crore during 2014–19 from a contractor. However, the contract with CREW did not contain any enabling clause for recovery of transit loss beyond the permissible levels. Government in its reply stated (September/October 2020) that the contract with CREW was finalized by NCTPS-I office and NCTPS-I office was not aware of the recovery provisions for excess transit loss included in the contract entered into by the Head office of TANGEDCO with the contractor. It was further stated that the contract with the contractor provided for tarpaulin cover and hence recovery clause had been incorporated in the contract. However, since there is no clause requiring the tarpaulin cover for the transport of coal loaded rakes in the contract with CREW, no such recovery clause had been incorporated for NCTPS I. The reply is not acceptable as it is a matter of financial prudence that suitable clauses should have been incorporated in the contract to safeguard the financial interests of TANGEDCO. This also indicated lack of coordination between TANGEDCO's Head office and NCTPS I, and non-standardisation of terms of coal handling contract which resulted in non-recovery of excess transit loss of ₹ 58.37 crore.

This pointed to lack of internal control in disseminating economically prudent and beneficial practices by TANGEDCO Headquarters to TANGEDCO's field offices. It is, therefore, recommended that the responsibility may be fixed on the officials for not incorporating the clause for recovery of excess transit loss as was done in another contract finalised by the Headquarters.

Coal handling at power stations

2.8.5 Unproductive expenditure

(i) The work of operation and maintenance of internal coal handling from coal yard to bunker is undertaken departmentally in TTPS and MTPS–I, but the same is outsourced through private contractors in MTPS–II

and NCTPS–I & II. The method of contracting was not uniformly followed across all TPS. For example, the NCTPS–I adopted rate contract method whereas NCTPS–II and MTPS–II adopted fixed lump sum method for coal handling work. Audit analysis of total quantity of coal handled by the contactor revealed that the contractor had handled only 53 *per cent* of the contracted quantity (11,000 MT per day) for MTPS–II and 57 *per cent* of the contracted quantity (22,000 MT per day) for NCTPS–II during 2013–19 whereas they were paid fixed lump sum charges on monthly basis which aggregated to ₹53.99 crore throughout the contract period. Had TANGEDCO adopted rate contract as was done in NCTPS–I, it could have paid only ₹31.16 crore during the same period. Thus, non-adoption of the most economical method of contracting across the TPS resulted in avoidable extra expenditure of ₹13.44 crore and ₹9.39 crore for MTPS–II and NCTPS–II respectively for the period from July 2017 to March 2019.

(ii) The method adopted for determination of Minimum Guaranteed Quantity (MGQ) for fixed monthly lump sum contract in NCTPS-I and MTPS-II was different. In NCTPS-I & II, MGQ was fixed based on coal handled during the previous years whereas in MTPS- II, MGQ was determined based on the full load operation *i.e.*, the installed capacity of the plant. Further, it was seen that the contracts required payment based on lump sum basis without taking into account the actual quantity handled. Due to this lacuna, the MGQ was fixed at higher level resulting in unproductive expenditure as detailed below.

Table 2.5: Details of unproductive expenditure

TPS	MGQ (in lakh MT)	Actual handled quantity (in lakh MT)	Payment made for MGQ (₹ crore)	Amount payable[60] for actual quantity (₹ crore)	Unproductive expenditure (₹ in crore)
(1)	(2)	(3)	(4)	(5)	(6)=(4) – (5)
NCTPS–I	611.00	420.07	25.54	17.43	8.11
NCTPS–II	257.40	146.11	37.66	21.43	16.23
MTPS–II	140.03	76.61	56.42	25.42	31.00
Total	1,008.43	642.79	119.62	64.28	55.34

Source: Data provided by TANGEDCO

As seen from the above **Table 2.5**, TANGEDCO made payment for MGQ of 1,008.43 lakh MT against the actual quantity of 642.79 lakh MT, thereby incurred an unproductive expenditure of ₹55.34 crore.

TANGEDCO replied (May 2020) that the handling of quantity lower than MGQ was due to the then requirement of coal on daily basis for generation of power. Government (September/October 2020) in its reply stated that as per the contract clauses, full applicable O&M charges were payable even if the MGQ was not achieved by the contractor. The reply is not acceptable as the payment made on the basis of MGQ was higher than the amount which would have been payable if the contract was for the actual quantity handled in all the three power stations which is evident from column 4 and 5 respectively in the Table 2.5

[60] Arrived at considering the total lump sum O&M charges divided by MGQ

above. Further, as the rate contract was advantageous over lump sum contract, TANGEDCO may review the payment terms and adopt suitable clauses which are more beneficial to TANGEDCO across the TPSs, as already elucidated in the para above.

Incorrect criteria for payment for handling additional quantities in excess of contracted quantity

2.8.6 The contract for handling of coal in external coal handling system consists of two distinct works *viz.*, (1) moving coal from port to coal yard at NCTPS–I (MGQ 7.5 lakh MT *per month*) and (2) loading of coal in railways for further transportation to MTPS–I & II (MGQ 6.0 lakh MT *per month*). For this purpose, TANGEDCO awarded (August 2010) a contract to a private party (CREW) on payment of lump-sum amount of ₹0.81 crore for handling MGQ of 13.50 lakh MT *per month*. For handling quantities over the MGQ of 7.50 lakh MT *per month*, the contractor was paid extra amount on tonnage basis considering quantities of coal moved from port to coal yard. The same contractor was again selected in the next tender and awarded (January 2013) with the same terms and conditions for five years upto January 2018[61]. Accordingly, the contractor was paid a sum of ₹22.19 crore during August 2010 to June 2017 for handling additional quantities in excess of MGQ.
In this connection, Audit observed that:

- Since the MGQ was fixed as 13.50 lakh MT per month in all the contracts entered into during the period from August 2010 to January 2018, the contractor was eligible for additional amount only for the quantity handled over and above 13.50 lakh MT per month. However, TANGEDCO paid considering the MGQ of 7.50 lakh MT[62], being the MGQ for movement of coal from port to coal yard. Due to erroneous consideration of MGQ for payment for handling additional quantity in the contract, TANGEDCO incurred erroneous extra expenditure of ₹10.61crore. TANGEDCO may initiate steps for recovering the above amount.
- Incidentally, it is pertinent to note that a Technical Committee formed by TANGEDCO for rationalisation of terms of coal handling contracts recommended (July 2009), inter-alia, that rate of payment for handling additional quantity should be arrived at by considering the combined MGQ quantity *i.e.*, 13.50 lakh MT, being the quantity of coal moved from port to yard and the quantity loaded in railway wagons. Though the Committee's recommendation was also approved by Chairman of TANGEDCO in July 2009 for incorporating them in all future contracts, the reasons for not considering this recommendation was not on record. Apart from the above, it was also approved to increase the MGQ to 14.50 lakh MT instead of 13.50 lakh MT to attract competitive offer from the bidders. However, while awarding contract in 2010 and 2013, the approved clauses, which were financially beneficial, were ignored.

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61 The contract was foreclosed in July 2017 citing budgetary constraint

62 Increased from 7.50 lakh MT to 10.50 lakh MT from 13.08.2016 due to the commissioning of 2 shore unloaders

Thus, lowering the MGQ for incentive much below the combined MGQ of 13.50 lakh MT was not rational and resulted in an erroneous excess expenditure of ₹10.61 crore, which is recoverable.

Government in its reply (September/October 2020) stated that the tender specifications prepared based on the recommendations of the Committee was not approved by the Board and hence the existing successful awarded tender specifications were adopted. The reply is not acceptable for the reason that the Committee was formed to analyse all the O&M activities involved to optimise the estimated cost which recommended, *inter alia* increase of MGQ and non-adoption of such specific recommendations in the subsequent tenders lacked justification.

Under loading of coal in railway wagons

2.8.7 The contract for transportation of coal from Ennore port to NCTPS–I Coal yard and further despatch of coal from NCTPS–I Coal yard to MTPS–I & II was awarded (December 2012) to CREW. As per Railway rules, wagons are to be loaded up to 68 MT each and freight charges will be levied for 68 MT per wagon even if loaded quantity is below 68 MT. Audit analysis revealed that average quantity of coal loaded per wagon ranged between 60.42 and 65.57 MT for indigenous coal and 55.18 to 64.16 MT for imported coal. Thus, failure to load the coal up to the permissible carrying capacity resulted in payment of freight of ₹101.35 crore (15.74 lakh MT) without beneficial use. But the contract with CREW did not contain any provisions for recovering freight for under loading. Incidentally, in a similar contract awarded by TANGEDCO to another contractor for movement of coal from CUCT at Ennore to MTPS, TANGEDCO recovered freight for under loading.

Government in its reply (September/October 2020) stated that necessary provision of recovery for under loading will be included in the ensuing contract which is due for renewal during next year. This corrective action was proposed after being pointed out in Audit. Similar contracts should be reviewed across TANGEDCO and the terms of contract revised to enable financial prudence in the expenses of TANGEDCO and improve its Operating Profit.

Assessment of Quality and Quantity of Coal

Quality Assessment of Coal

2.9 The most important quality parameter for coal is its heat value referred to as 'Gross Calorific Value' (GCV). The GCV in relation to thermal generation has been defined in the tariff regulations issued by TNERC (June 2005), as "the heat produced in kcal by complete combustion of one kilogram of solid fuel".

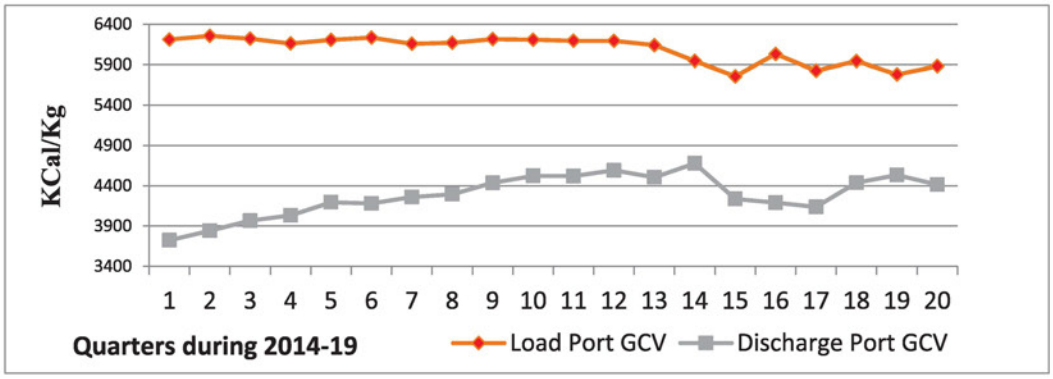
During Audit, it was found that the quality of coal as reflected by GCV at loading end, unloading end, and at TPS had gradually deteriorated due to many systematic lapses as detailed below:

Quality Assessment of indigenous coal at loading port, discharge port and bunker

(a) Reduction in GCV between Loading end at mines and Discharge Port

2.9.1 Since GCV was one of the key factors used for energy billing, Audit compared the GCV 'as billed' by coal companies for coal loaded on to wagons at mines end and GCV of coal 'as received' at the unloading point of the TPS. Audit observed that GCV of coal decreased from the 'as billed' stage to the 'as received' stage, though as per CEA, the GCV values, *i.e.*, GCV 'as billed', 'as received' and 'as fired' should be approximately same barring minor losses due to storage. As per CEA norms, the drop in GCV shall not exceed maximum of 120 kcal/kg within a transit period of 30 days. However, Audit verification of 'as billed GCV' at ECL and CCL at mines end and 'as received GCV' at discharge port at Tuticorin during 2014–19, both measured in Equilibrated Method[63], revealed that the GCV drop (after allowing GCV drop of 120 kcal/kg) ranged between 1,422 kcal/kg to 2,256 kcal/kg valuing[64] ₹910.43 crore in Haldia–Tuticorin sector as depicted in **Chart 2.2**. In addition, the drop in GCV ranged between 257 kcal/kg to 549 kcal/kg valuing ₹147.64 crore in Vizag/Paradip–Tuticorin sector and between 140 kcal/kg and 290 kcal/kg valuing ₹954.58 crore in Haldia/Vizag/Paradip–Ennore sector.

Chart 2.2 : GCV drop during transit between loading end at ECL/CCL mines and discharge port at Tuticorin



As a particular grade of coal (having bandwidth of 300 Kcal/Kg) cannot change or convert into different grade within a short period of 30 days of transportation, the above position required in-depth analysis of the reasons for vast drop in GCV. Audit found that TANGEDCO did not establish a robust mechanism to cross check the quality of coal on rake to rake basis at load ports, although GOI permitted (June 2016) power producers to engage CIMFR[65] for sampling and analysis of coal at load ports. Consequently, the issue persisted during the entire period of 2014-19.

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63 In 'Equilibrated Method', the GCV is obtained by measuring the equilibrated moisture of coal and applying it on GCV (Air Dried Basis) which is determined by using bomb calorimeter. The equilibrated moisture is determined under laboratory conditions of 60 *per cent* relative humidity and 40° C temperature

64 Being the difference in price paid for higher grade against lower grade received at discharge port

65 Central Institute of Mining and Fuel Research (CIMFR) is a constituent laboratory of Council of Scientific and Industrial Research (CSIR) and autonomous body under GOI

Government in its reply (September/October 2020) stated that, to sort out the above issues, TANGEDCO will consider establishing a suitable control mechanism to cross check the quantity and quality of coal on rake to rake basis for coal received at load ports from mines by forming a Coal Quality Monitoring Wing.

(b) Reduction in GCV between receipt point at power station and at Bunkers

2.9.2 As per CEA, the GCV of coal 'as received' at the unloading point of TPS and 'as fired' at the boilers shall approximately be the same barring minor variations up to 120 Kcal per Kg for shorter period of 30 days. Audit compared the GCV of coal at these two stages during 2014–19 in all TPS. It was observed that the decrease in GCV from 'as received' stage to 'as fired' stage was more than the CEA permitted level. The drop in GCV within the TPS premises, after considering normative loss is given in **Annexure-4.**

It can be seen that drop in GCV within the station was much higher than CEA's permitted drop of 120 kcal/kg for storage period of 30 days. For Indian coal, the drop prevailed in 22 to 38 months in different TPS. In 12 months, the drop in GCV of Indian coal was in the range of 481-720 Kcal/kg, much above the permissible maximum drop in GCV. In case of imported coal, the GCV drop was much higher than indigenous coal. The drop in GCV of more than 120 kcal/kg prevailed in 40 to 51 months. In 31 months, GCV drop of imported coal was even more than 960 Kcal/kg against the maximum limit of 120 Kcal/kg. However, TANGEDCO has not analysed the reasons for drop in GCV within the TPS. The drop in GCV led to increased energy charges and higher burden on the consumers as mentioned in Paragraph 2.9.10.

Government in its reply (September/October 2020) stated that the reduction in GCV was due to moisture, ash content, and different methods adopted for determination of GCV at receipt end of TPSs and bunker. The reply is not acceptable as Audit observed that the drop in GCV were also on account of determination of GCV at power stations without testing coal and other organisational weaknesses in assessment of quality of coal which are discussed in detail in Para no 2.9.7 and 2.9.9.

(c) Drop in GCV even during direct feeding on the same day

2.9.3 In addition to the above, audit analysed the GCV difference in case of coal being fed into the bunkers during the same day of receipt without routing through stock yard. As the coal was fed on the same day, there should not be any drop in GCV, but audit analysis revealed that there were huge differences in GCV ranging from (–) 800 kcal/kg to (+) 800 kcal/kg even when coal was consumed on the same day as detailed in **Table 2.6**.

Table 2.6: Station-wise incidences of GCV difference during direct firing

(Figures in number of days)

Range of difference in GCV during consumption of coal on the same day of receipt	MTPS – I		MTPS – II		Total
	Imported coal	Indigenous coal	Imported coal	Indigenous coal	
Below (–) 800	3	---	---	1	4
Between (–) 800 to (–) 400	42	18	4	2	66
Between (–) 400 to (–) 200	84	71	24	15	194
Between (–) 200 to 0	66	172	18	29	285
Between 0 to (+) 200	37	74	7	14	132
Between (+) 200 to (+) 400	2	30	1	11	44
Between (+) 400 to (+) 800	---	1	---	---	1
Above (+) 800	---	---	---	---	---
Total	234	366	54	72	726

Source: Audit workings based on Laboratory Register and Coal Feeding Data of MTPS – I&II

As can be seen from the above **Table 2.6**, the difference in GCV between 'as received' and 'as fired' was prevailing on 600 days in MTPS-I and 126 days in MTPS-II during 2014–19. Further, there were huge drop in GCV even in respect of coal directly fed into the bunker.

Government in its reply (September/October 2020) stated that during unloading of coal, water is sprayed for avoiding spread of coal dust and hence increase in moisture content decreases GCV. The reply is not correct as the above para highlights the variation in GCV only on air dried basis *i.e.*, determining the GCV of coal by excluding the surface moisture.

The unjustified loss of GCV during transportation, storage, and usage at power stations indicated negligence and lackadaisical approach on the part of TANGEDCO authorities to control losses which have an impact on the efficient operation of the Company. Hence, there is a compelling need to analyse the reasons for the loss in GCV and take corrective measures.

Audit further noticed that the reduction in GCV at various stages as mentioned above was not analysed by TANGEDCO due to deficiencies in the system of assessment of quality of coal as detailed below:

Absence of mechanical sampling at mines end and at power stations

2.9.4 As per BIS, the coal sample should be collected up to the depth of 1.5 metre from the wagon top. As per GOI directive (August 2015), real time monitoring using auto mechanical sampling (online) from moving streams shall be used by coal companies with effect from 01 September 2016. However, TANGEDCO did not insist on the coal companies for installing such mechanical sampling, despite the fact that it would be advantageous for it as the moisture content at 1.5 metre depth would be higher than the moisture on the surface and consequently lead to lesser GCV and lesser price.

Government in its reply (September/October 2020) stated that the above issues will be sorted out after formation of a separate Coal Quality Monitoring Wing. The reply confirms the absence of internal control in collection of sample to assess the quality of the coal and such basic corrective action was proposed only after being pointed out in Audit.

Acceptance of untested coal

2.9.5 As per GOI decision, TANGEDCO entered into (November 2016) Tripartite Agreements for Third Party Sampling and Testing with CSIR–CIMFR and coal companies whereby CSIR–CIMFR were wholly responsible for collection, preparation and analysis of coal as per FSAs. As per the Tripartite Agreement, CSIR–CIMFR would start coal sampling and testing from 28 November 2016. However, audit observed that TANGEDCO received 13.79 lakh MT of coal valuing ₹411.63 crore without testing during the period December 2016 to March 2017. The reason for acceptance of untested coal was not on record. Thereby, TANGEDCO deprived itself an opportunity to raise the quality issue during the above period.

Government in its reply (September/October 2020) stated that the receipt of untested coal was on account of delayed start of sampling activity by CIMFR and the matter has been taken (September 2019) up in the Apex Committee to resolve the issue. The final outcome is still awaited.

Belated testing and reporting of test results by third party agencies

2.9.6 As per the Tripartite Agreement, the coal sample shall be kept in the custody of CIMFR for 30 days. During this time, CIMFR shall complete the test and communicate the test result to both TANGEDCO and coal company. Audit noticed that during the period from November 2016 to December 2017, CIMFR belatedly submitted test results to TANGEDCO after 2 to 3 months in case of coal received from MCL and had not submitted test results for more than a year for coal supplied from ECL from March 2017 to April 2018. In view of lapse of 30 days period for sample preservation, TANGEDCO lost the opportunity to lodge a complaint with coal companies for grade slippages.

Audit further observed that no penalty clause was provided in the tripartite agreement for delayed / non-communication of test results. Further, TANGEDCO did not pursue through the Executive/Apex Committee as envisaged in the Tripartite Agreement for redressing delayed/non-submission of test results by CIMFR.

Government in its reply (September/October 2020) had accepted the fact and stated that it would insist for incorporation of a penalty clause for belated submission of test results by CIMFR through an amendment to the tripartite agreement. The reply confirms the lacunae in the tripartite agreement and the corrective action was proposed only after being pointed out in Audit.

Determination of GCV at power stations without testing coal

2.9.7 As per the FSA and GOI notification (December 2011), GCV of coal should be determined as per the method laid down by BIS. However, Audit noticed that TANGEDCO did not test the GCV of coal using bomb

calorimeter[66] as per BIS and instead arrived at the GCV using a mathematical formula (excepting at NCTPS I & II). It is pertinent to note that as per CIMFR report, the variation between formula based GCV against bomb calorimeter based GCV was about 191 kcal/kg. Further, testing of GCV at TANGEDCO laboratory[67] also reported variation[68] in GCV up to 294 kcal/kg compared to the formula method. Thus, determination of GCV based on formula is not fool proof and will not rule out the possibility of inaccurate computation of plant efficiency for tariff calculation.

Government in its reply (September/October 2020) stated that the usage of empirical formula for determination of GCV of coal would be stopped and it would switch over to GCV testing by bomb calorimeter in TPSs like TTPS, MTPS-I and MTPS-II.

Acceptance of lower grade of coal

2.9.8 As per clauses 11.1.2 (a) and 11.2.2 of the FSA, the coal purchaser should make advance payment to the coal companies based on the declared grade of coal subject to adjustment to the quantity and quality of coal analysed. The coal companies should give regular credit note on account of grade slippage to the extent of difference in the base price of declared grade and analysed grade of coal. Audit noticed that the test results furnished by CIMFR, during March to December 2017, revealed the supply of lower grade of coal by ECL compared to the declared grade of coal with a drop in GCV ranging from 140 to 3,610 kcal/kg. The supply of lower grades of coal was also confirmed by the test results[69] of TANGEDCO's own laboratories. However, ECL did not accept the test results of CIMFR in 90 *per cent* cases and approached the referee laboratories for re-testing. The referee test results were in favour of ECL in 96 *per cent* cases which forced TANGEDCO to pay as per the referee results. However, based on the grade enhancement by the referee laboratories, TANGEDCO was forced to forgo its claim for the differential amount of ₹153.43 crore being the difference between CIMFR determined grade and the declared grade, already paid to the coal companies. On the other hand, TANGEDCO was made liable to pay a sum of ₹117.61 crore based on the referee test results which showed higher grade of coal than the declared grade of coal which is an additional liability to TANGEDCO.

The position of declared grade, CIMFR grade and referee grade in respect of coal supplied during November 2017[70] by ECL is depicted in the **Chart 2.3** below.

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66 A bomb calorimeter is a closed, rigid (constant volume) vessel that can be used to determine the heat of reaction of a liquid or solid fuel sample

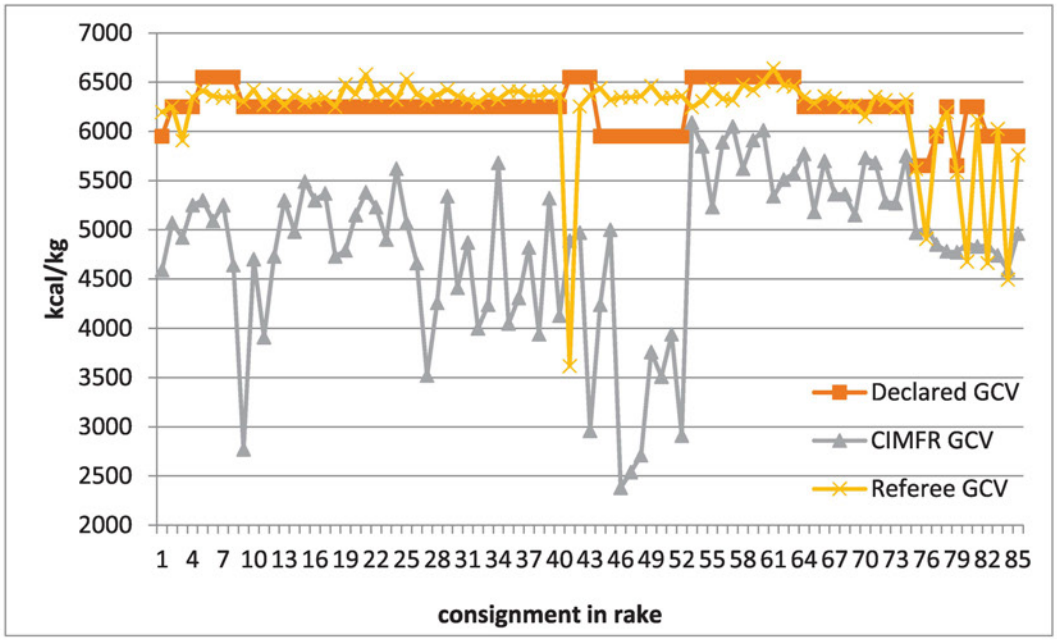
67 NCTPS-I laboratory

68 Ranged from 50 to 68 kcal/kg during April 2014 to July 2017 and from 194 to 294 kcal/kg during August 2017 to March 2019

69 Weighted average monthly figures

70 Similar trend was prevailing during entire period from March 2017 to December 2017

Chart 2.3: GCV differences among CIL, CIMFR and Referee



Although the tripartite testing agreement with CIMFR provide for resolving disputes through Apex Committee, TANGEDCO did not take up the issue to the Apex Committee as provided.

Government in its reply (September/October 2020) stated that the issue has been raised by TANGEDCO in the Apex Committee in September 2019 and further stated that TANGEDCO has not paid any amount to coal companies towards differential cost arising out of coal grade upgradation determined by testing referee sample. The fact, however, remained that advance payments of ₹153.43 crore was already made on the basis of declared grades against which TANGEDCO had received lesser grade. Moreover, the decision of TANGEDCO for non-payment of the differential cost arising due to upgradation of coal grade by Referee was one sided and in the absence of confirmation from coal companies, the said liability persists. TANGEDCO needs to pursue with coal companies for final withdrawal of the claim.

2.9.9 Organisational weaknesses in assessment of quality of Coal

Audit observed following weaknesses in TANGEDCO's coal quality assessment system:

(i) TANGEDCO has not carried out any scientific study for deciding number of personnel required for witnessing and recording the sampling and testing, considering the factors such as (a) loading during night, (b) number of railway sidings, (c) distance between various railway sidings, (d) bunching of rakes at the same location, *etc*.

(ii) In Head Office of TANGEDCO, there was no scientific duty allocation, considering increasing volume and complexity, among the personnel who look after coal procurement, coal handling and quality monitoring.

(iii) TANGEDCO has no separate "Quality Assurance Wing" to cover the entire gamut of coal quality activities and the quality issues are dealt by

only one official, which shows lack of monitoring of procurement activities valuing above ₹4,000 crore *per annum*.

(iv) In order to examine the capabilities of officials involved in supervision of sampling and testing, Audit issued[71] questionnaires with the cooperation of TANGEDCO's management. The responses to the questionnaires indicated that TANGEDCO has not given due importance to the capabilities of personnel deputed for sampling and testing. Some of the major deficiencies are detailed below:

- About 81 *per cent* of personnel were not aware of how many wagons should be selected as sub-lots for sampling a rake (a lot) consisting of above 50 wagons.
- About 96 *per cent* of personnel were not aware of how much kilograms of Coal should be collected from each wagon for sampling.
- About 92 *per cent* of personnel were not aware of the depth up to which Coal sample should be collected from a wagon.
- About 79 *per cent* of Chemists were not aware of the relevant BIS procedure applicable for sample collection and testing.

The above analysis revealed the urgent need for training and educating staff involved in sampling and testing to enhance their capabilities otherwise TANGEDCO may continue to face sampling errors leading to increased expenditure.

Government in its reply (September/October 2020) stated that to rectify the above infirmities pointed out by Audit, formation of a separate Coal Quality Monitoring Wing is under scrutiny.

Impact of GCV differences on efficiency and energy charges

2.9.10 The normative energy consumption admissible per unit of electricity generated has been specified by TNERC in the Tariff Regulations, 2005 as normative Station Heat Rate (SHR) in terms of kcal/kwhr. The GCV being used as the value of energy input, which determines the SHR. Therefore, any increase/decrease in GCV affects the cost of power.

GCV measured upon its receipt at TPS is known as "As Received GCV" and the GCV measured before feeding the coal into the boiler is known as "As Fired GCV". Audit compared[72] the reported SHR using 'As Fired GCV' with 'As Received GCV' during 2014–19 and found that SHR worked out on 'As Received GCV' was significantly higher indicating lower efficiency as shown in **Table 2.7** below.

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71 Questionnaires issued to Chemists (50 Nos.) and Engineers (68 Nos.) of TANGEDCO who were involved in sampling and testing of indigenous coal

72 Both "As Received GCV" and "As Fired GCV" were compared on "Total Moisture Basis" as per BIS

Table 2.7: Comparison of SHR based on 'As Fired GCV' Vs. 'As Received GCV'

TPS	Range of SHR reported by stations using 'As Fired GCV' (Kcal/kwhr)	Range of SHR worked out in Audit using 'As Received GCV' (Kcal/kwhr)	Range of difference (Kcal/kwhr)
MTPS–I	2269 to 2727	2292 to 3163	(-) 67 to 474
MTPS–II	2062 to 2730	2057 to 3050	(-) 167 to 445
NCTPS–I	2440 to 2555	2343 to 3226	(-) 105 to 680
NCTPS–II	2376 to 3089	2410 to 3562	(-) 217 to 643
TTPS	2431 to 2599	2228 to 3193	(-) 360 to 656

Source: SHR as reported by TPS and Audit workings based on Laboratory Registers of TPS

From the above **Table 2.7**, it could be seen that:

- In five TPS studied in audit, the energy charges proposed by TANGEDCO for billing were based on 'As Fired GCV' and were higher by ₹1,805.35 crore during 2014-19 compared to the energy charges to be billed based on 'As Received GCV'.
- Even though TANGEDCO purchased power from Central Generating Stations based on 'As Received GCV', it had not adopted the same for selling the power resulting in over burdening the consumer.
- CEA had observed (2014) that use of 'As Fired GCV' for SHR computation without proper guidelines was arbitrary and would lead to inflated claim of coal consumption.

CERC and other State Electricity Regulatory Commissions (Rajasthan, Uttar Pradesh, Karnataka, Kerala and Punjab *etc.*) had shifted from 'As Fired GCV' to 'As Received GCV' on the ground that loss of GCV due to inefficient stacking/handling of coal within the TPS should not be passed on to the consumers. However, TANGEDCO failed to adopt the best practice and continued to over burden the consumer.

Government in its reply (September/October 2020) stated that based on TNERC Regulations (2005) 'As Fired GCV' is considered for calculation of Energy Charges. It further stated that calculation of energy charges based on 'As Fired GCV' will only reflect correct SHR whereas 'As Received GCV' would not account for storage loss of coal.

The reply of the Government does not hold good as the CERC in its order dated 25 January 2016 clarified that the GCV of coal on as received basis is the most appropriate and transparent method for computing energy charges as the inefficiency of the generating companies in handling of coal between the point of unloading at the boundary of the generating station and the point of feeding to the bunkers should not be allowed to be passed on to the consumers.

Quantity of Coal

2.10 Weighment of domestic coal

2.10.1 As per FSA, payment for the coal supplies was made as per the weighment carried out at the delivery/loading point at mine end and TANGEDCO has right to witness the weighment of wagons. Further, proper

weighment of coal at loading port and discharge port and within TPS would control transit and handling losses. Audit examination revealed that:

- TANGEDCO has not documented or created any logbook for witnessing and recording weighment of coal at mines end by its employees/ contractors.
- TANGEDCO has not ensured the installation/utilisation of weighbridges at all the load ports of Visakhapatnam, Paradip and Haldia to cross verify the quantity of coal sent by coal companies.
- The quantity of coal unloaded from ship at the discharge ports at Ennore and Tuticorin are accounted on the basis of draft survey[73] reports without cross verifying actual quantity delivered at coal yard. It is pertinent to note that VOC Tuticorin Port Trust estimated coal spillage of 12,000 MT of TANGEDCO's coal into sea during unloading in coal jetty during 2015–19. But this shortage was not reflected in TANGEDCO's books of accounts.
- The stock of coal was being verified periodically by TANGEDCO, but it has not prescribed method for calculating the volume and bulk density for the coal stacked at coal yard in order to arrive at the actual coal stock position. Moreover, it was seen that the formula for computing the volume was not applied as per the advice (July 2017) of Head Office stock verification team leading to variation in computation of stock in TPS. In its reply, TANGEDCO agreed to frame standard operating procedure for the measurement of volume and density of coal.

During the exit conference, TANGEDCO assured to improve the monitoring mechanism including maintenance of logbook for weighment at mines end, weighment of coal receipt at load ports on rake to rake basis and cross verification of discharged quantity by conveyor measurement at discharge ports and formulating Standard Operating Procedure for determining coal stock verification in TPS.

Government in its reply (September/October 2020) stated that there was no provision in the contract for weighment at the loading point. The reply confirms the lacuna in the agreement with the coal handling contractors and the corrective action was proposed only after being pointed out in Audit. Further, TANGEDCO needs to initiate credible actions and incorporate suitable clauses by amending existing contracts on priority in order to safeguard its financial interests.

Transit loss for handling coal at load ports

2.10.2 For movement and handling of coal from the collieries to the load ports, TANGEDCO placed (February 2001) work orders on handling agencies which were extended periodically for more than 18 years (March 2019). As per the work orders, the coal handling contractors were accountable for shortage of coal

[73] A draft survey is a calculation of the weight of cargo loaded or unloaded to or from a ship from measurements of changes in its displacement. The technique is based on Archimedes' principle.

between quantities loaded at the collieries as per the railway receipt and the quantities as per the Bill of Lading of ships loaded at ports.

In this connection, Audit observed that TANGEDCO did not record the shortage of coal from the collieries to the load ports. The contracts provided for recovery of coal shortages only at the time of expiry of the contract and there was no provision for periodical assessment of coal shortages and recovery thereof. As a result of this, the coal shortages occurring during the past 18 years (2001–19) were not recorded, thereby TANGEDCO was unable to assess the shortage of coal. On the contrary, the contracts, however, allowed the contractors to claim shortage cover at fixed rates for minimizing the shortages at the load ports. It is pertinent to note that the contractors were paid ₹68.88 crore[74] as 'shortage cover' to compensate for coal shortage during transportation of coal from mines to load ports at Visakhapatnam, Haldia and Paradip during 2001-19. Even as coal shortage was not determined in any of the Ports by TANGEDCO, shortage cover was, however, continued to be paid without any recovery towards actual shortage of coal faced by it.

Government in its reply (September/October 2020) stated that at the time of closing the work order, the shortage quantity would be recovered from the contractor. The fact, however, remained that though one of the contractors stopped (March 2019) the execution of the work, TANGEDCO was yet to determine the shortage of coal faced by it and recover the same from the contractor (June 2020). TANGEDCO should ensure that coal shortages are recorded at regular intervals and recoveries be effected before closure of contract to protect financial interest. TANGEDCO may prioritise the reconciliation of transit loss, as it is pending for more than 19 years.

Coal consumption and management at power stations

2.11 Station Heat Rate and Specific Coal Consumption in excess of the norms

2.11.1 Operational efficiency of TPS is regulated through SHR[75], which depends on the quantity as well as quality of coal used by the TPS. Coal used to produce one unit of energy is termed as SCC[76]. The norm fixed by TNERC and actual SHR and SCC achieved by TPS during 2014-19 are given in **Table 2.8**.

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74 Visakhapatnam ₹21.72 crore (2001-19), Haldia ₹9.47 crore (2004-19) and Paradip ₹37.69 crore (2001-19).

75 Station Heat Rate = (Quantity of coal x Gross Calorific Value) / No. of units of energy generated

76 Specific Coal Consumption = Quantity of coal / No. of units of energy generated

Table 2.8: SHR and SCC norms fixed by TNERC and actual SHR and SCC achieved

TPS	SHR norm	SCC norm	Actual SHR (kcal/kwhr) and SCC (kg/kwhr)									
			2014-15		2015-16		2016-17		2017-18		2018-19	
			SHR	SCC	SHR	SCC	SHR	SCC	SHR	SCC	SHR	SCC
MTPS–I	2500	0.70	2541	0.75	2472	0.70	2485	0.71	2452	0.70	2482	0.70
MTPS–II	2450	0.69	2483	0.71	2517	0.63	2390	0.66	2345	0.68	2403	0.69
TTPS	2453	0.71	2560	0.83	2559	0.74	2528	0.73	2497	0.77	2497	0.72
NCTPS–I	2393	0.66	2512	0.75	2466	0.66	2462	0.68	2452	0.73	2450	0.70
NCTPS–II	2450	0.67	2843	0.78	2609	0.67	2609	0.72	2644	0.76	2560	0.75

Source: TNERC Reports and Performance Reports of TPS

It may be seen from the **Table 2.8** that the actual SHR was in excess of norm stipulated by TNERC in all TPS (except MTPS–I in 2015–16 to 2018-19 and MTPS II in 2016-17 to 2018-19). Due to excess consumption of 56.85 lakh MT of coal over the norm, TANGEDCO incurred extra expenditure to the tune of ₹2,317.46 crore during 2014–19.

An internal committee on 'Merit Order Despatch[77]' of TANGEDCO advised (November 2016) the Chief Engineer (Thermal Stations) to study about SHR, GCV of coal and coal mixture ratio in all TPS and to file a petition, before the TNERC to revise / enhance the average SHR in the Tariff regulation. However, no such petition was filed by TANGEDCO till date (June 2020).

Government in its reply (September/October 2020) stated that the SHR could not be achieved due to ageing of power plants, receipt of poor quality of coal and non-operation of plant at full load due to load restrictions. The reply is not convincing because the norm for SHR was fixed by TNERC only after considering the above parameters.

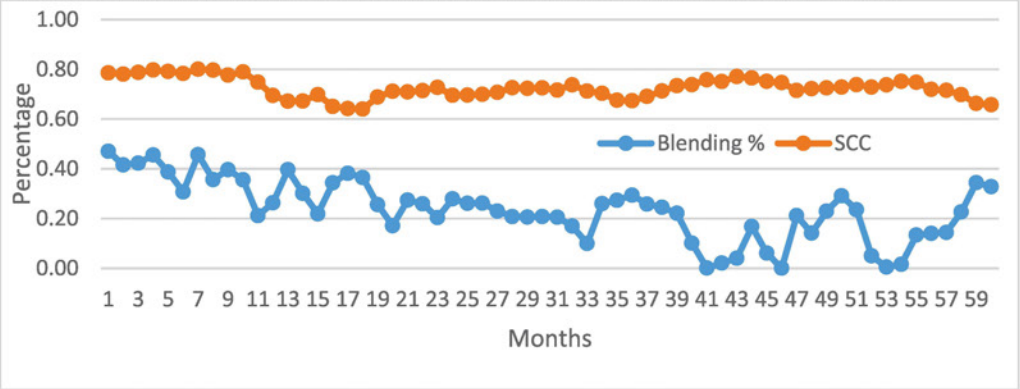
Blending of imported coal with indigenous coal

2.11.2 TANGEDCO fixed (2007) the optimum blending ratio, of imported coal with indigenous coal, for MTPS–I and NCTPS–I at 20 *per cent* and for TTPS at 32 *per cent.* CEA fixed (2012) norms for blending of imported coal with indigenous coal for existing and future power stations at 15 *per cent* and 30 *per cent* respectively. TANGEDCO was yet to fix norms for blending ratio for MTPS–II and NCTPS–II. Audit noticed that maximum permissible blending ratio exceeded the norms in four TPS, *viz.,* MTPS–I (50 *per cent*), MTPS–II (55 *per cent*), NCTPS–I (35 *per cent*), NCTPS–II (47 *per cent*).

Since the GCV of imported coal procured was higher than indigenous coal, the blending of imported coal with indigenous coal should have reduced the SCC for the same amount of energy generated. However, as seen from the **Chart 2.4** below, the SCC remained the same in all thermal stations for all 60 months during 2014–19, irrespective of whether imported coal was blended to a lesser or greater extent.

[77] As per this practice, the generation will be preferred according to the ascending order of cost of generation

Chart 2.4: Trend in SCC *vis-a-vis* imported coal blending ratio during 2014–19



The SCC did not improve despite blending of higher GCV imported coal in the TPS. The average "As Fired GCV" of imported coal was 4,786 kcal/kg against the procured GCV of 6,000 kcal/kg. Similarly, the "As Fired GCV" of indigenous coal was 3,149 kcal/kg against the procured GCV of 4,058 kcal/kg (average) during 2014–19.

Lack of improvement of SCC, despite blending higher GCV imported coal, is indicative of other operational deficiencies which need to be analysed by TANGEDCO, as it continues to incur higher cost for procuring imported coal.

It may also be mentioned that though TANGEDCO was aware (June 2014) that its TPS could achieve full load by using indigenous coal rather than the blended coal, no action was taken for analysing the reasons behind the fall in GCV and non-improvement of SCC.

Government in its reply (September/October 2020) stated that all the thermal stations do not always receive a proportionately regulated supply of indigenous and imported coal to enable firing in the stipulated ratio. It further stated that since the power stations do not have control over the supply of quality coal, the stations are always forced to fire in a ratio only in accordance to the proportion of availability / stock of indigenous and imported coal and hence, the normative blending ratio are not achieved due to feeding of imported coal through dedicated bunkers. The reply confirms the absence of compliance with standardised blending norms. TANGEDCO therefore needs to ensure effective management of quality coal and also examine the reasons for non-improvement of SCC and fall in GCV despite blending imported coal of higher GCV, as this has an impact on its operational efficiency.

Loss of generation due to poor quality of coal

2.11.3 TANGEDCO reported that targeted generation could not be achieved due to reserved outage based on the advice of load dispatch center, forced outage due to equipment failures and partial load[78] due to coal related issues. TANGEDCO suffered generation loss of 844 MU in MTPS–I, NCTPS–I, TTPS due to coal quality issues during 2014–19 as detailed in **Table 2.9** below.

[78] Generation loss due to partial load arises when a power plant unable to achieve full load due to coal quality issues and equipment problems

Table 2.9: Generation loss due to poor quality of coal

TPS[79]	Year	Loss of generation (MU)				Loss of revenue (₹ in crore)
		Coal Mill System	Coal Quality Variation	Other coal related issues[80]	Total loss	
MTPS–I	2014–17	1.91	118.96	2.09	122.96	12.84
	2017–19	1.40	5.64	16.93	23.97	4.41
NCTPS–I	2014–17	215.67	374.94	7.63	598.24	123.69
	2017–19	6.39	121.80	1.32	129.50	18.04
TTPS	2014–17	1.27	158.29	31.54	191.10	10.56
	2017–19	8.35	4.26	0.63	13.24	2.03
Total		234.99	783.89	60.14	1,079.01	171.57

Source: Performance Review Book of TPS

It may be seen from **Table 2.9** that quality of coal and mill related issues accounted for 78 *per cent* and 22 *per cent* of generation loss resulting in loss of revenue of ₹171.57 crore during 2014–19.

Government in its reply stated that use of indigenous coal with lower GCV and high ash content and imported coal with low GCV and high moisture content were the major reasons for the loss of generation in TPS. The reply is not tenable because the normative operational performance was fixed by TNERC taking into account of coal quality issues. Therefore, loss of generation with reference to norms fixed by TNERC was not justified.

Ash Disposal

2.11.4 Ministry of Environment, Forest and Climate Change (MoEFCC), GOI directed (September1999) gradual phasing out of dumping of fly ash on land and 100 *per cent* disposal of the ash to be achieved by the year 2009.

The details of the generation and utilisation of fly ash is shown below:

Table 2.10: Fly Ash generated and utilised

Year	TTPS			MTPS-1			MTPS-II			NCTPS-1			NCTPS-II			Total	
	Ash Generated (MMT)	Ash Utilised (MMT)	Ash utilised (*per cent*)	Ash Generated (MMT)	Ash Utilised (MMT)	Ash utilised (*per cent*)	Ash Generated (MMT)	Ash Utilised (MMT)	Ash utilised (*per cent*)	Ash Generated (MMT)	Ash Utilised (MMT)	Ash utilised (*per cent*)	Ash Generated (MMT)	Ash Utilised (MMT)	Ash utilised (*per cent*)	Ash Generated (MMT)	Ash Utilised (MMT)
2014-15	1.09	1.09	100	0.98	0.77	78.57	0.42	0.35	83.33	0.61	0.27	44.26	0.88	0.53	60.23	3.98	3.01
2015-16	0.98	0.98	100	1.04	0.59	56.73	0.58	0.49	84.48	0.58	0.14	24.14	1.02	0.45	44.12	4.20	2.65
2016-17	0.66	0.66	100	1.06	0.59	55.66	0.62	0.45	72.58	0.52	0.21	40.38	1.18	0.51	43.22	4.04	2.42
2017-18	0.63	0.63	100	0.78	0.58	74.36	0.51	0.38	74.51	0.68	0.29	42.65	1.27	0.62	48.82	3.87	2.50
2018-19	0.69	0.69	100	0.81	0.57	70.37	0.61	0.49	80.33	0.61	0.32	52.46	1.43	1.06	74.13	4.15	3.13
Total	**4.05**	**4.05**	**100**	**4.67**	**3.10**	**66.38**	**2.74**	**2.16**	**78.83**	**3.00**	**1.23**	**41.00**	**5.78**	**3.17**	**54.84**	**20.24**	**13.71**

Source: Data furnished by TANGEDCO

As seen from the above table in case of NCTPS I and II, only 4.40 MMT out of 8.78 MMT (50 *per cent*) was utilised in the five years ending 2018-19. The

[79] Loss of generation owing to partial load due to coal quality issues was not reported by MTPS-II & NCTPS-II

[80] Wet coal, coal feeder issue, and coal bunker choking up

balance quantity of fly ash (4.38 MMT[81]) together with the quantum of unlifted bottom ash and wet ash was transported to the ash dyke[82]. This was in violation of the MoEFCC's Notification S.O.763 (E) dated 14th September, 1999, direction for gradual phasing out of dumping of fly ash on land and 100 *per cent* disposal of the ash to be achieved by the year 2009.

According to the notice issued by TNPCB, the TPS at North Chennai, Mettur, and Tuticorin generated 28.19 MMT of bottom ash and disposed 20.20 MMT during the period 2014-19. A quantum of 62.15 MMT of ash remained in the ash dykes in the three plants as on 31 March 2019. Thus, the continued dumping of ash in dyke resulted in contamination of ground water in Buckingham Canal and Kosasthalaiyar river.

TNPCB, based on the study conducted by its technical committee, directed NCTPS to furnish a time bound action plan and mechanism to be adopted to address, *inter-alia*, the following pollution control issues:

(i) The power plant should remove 3.96 lakh MT fly ash deposited inside NCTPS, 0.93 lakh m^3 tonnes of ash from Buckingham canal, and 7.93 lakh MT of ash from Kosasthalaiyar river

(ii) The power plant should replace the existing ash slurry pipe lines for the length of 20.52 kms.

(iii) The plant should also provide 6,000 numbers of trees in and around ash dyke so as to prevent dust emission from the ash dyke.

(iv) Electro Static Precipitator should be modified to achieve the norm for emission level.

However, TANGEDCO was yet to comply with the above directions (June 2020). There was no time bound action plan for the removal of fly ash deposited in the land, as required under the Notification (No S.O.763 (E) dated 14th September, 1999) of MOEFCC. Besides the above, the committee[83] had evaluated the environmental compensation of ₹16.46 crore to be levied on NCTPS for the period November 2004 to November 2019 on account of damage caused to the environment which was yet to be paid (June 2020). Continued dumping of fly ash in the ash ponds, entailed a risk of cutting down the generation of power to keep the ash within the capacity of ash ponds.

Government in its reply (September/October 2020) stated that the disposal of fly ash was satisfactory as per MoEFCC stipulations. The fact, however, remained that TANGEDCO was yet (June 2020) to dispose-off fly ash and bottom ash as mentioned in the paragraph besides unaddressed pollution control issues in NCTPS. Though TANGEDCO had assured (February 2016) the COPU that usage of imported coal by way of blending would address the issue of excess ash content, however, it was seen that despite blending, the ash content could not be reduced. Thus, the pollution control measures taken by TANGEDCO largely were inadequate in all TPS.

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81 Excluding bottom ash in TTPS

82 Ash pond where ash is dumped/stored

83 Appointed by TNPCB, IIT Madras and Central Pollution Control Board

Internal control

2.12 Internal control gives an assurance that the operations are carried out effectively. However, Audit noticed that the internal control mechanism was poor as detailed in the following paragraphs:

Lack of integrated online coal management system

2.12.1 TANGEDCO envisaged (February 2001) computerisation of coal management connecting all TPS and the Coal Wing at Head Office of TANGEDCO at Chennai. The data would include wagon loading / arrivals, unloading, *etc*. and loading of coal into vessels, coal stock, *etc*., as required by TANGEDCO. Even after a lapse of 19 years, TANGEDCO's Coal Wing at Head Office was yet to implement the same, although other wings in TANGEDCO had implemented separate packages without waiting for integrated ERP system. TANGEDCO has not prioritised the computerisation plan for coal management, though the procurement, logistics management and stock management are critical for power generation of the State.

Government in its reply (September/October 2020) stated that it is proposed to implement ERP in Coal Management.

Inadequate Coal Bill Management System

2.12.2 A computerised Coal Bill Management System (CBMS) was developed in-house in December 2013 to process only the indigenous coal bills submitted by the Indian coal companies (CIL). The CBMS is not capable for processing imported coal bills, railway payments and payments to coal handling contractors. Audit observed that CBMS has not been audited by information system audit experts for validating its data reliability and security so far.

Government in its reply (September/October 2020) stated that the Chief Engineer/Information Technology have been addressed to take necessary action in this regard.

Variation in quantity of indigenous coal moved

2.12.3 The movement of indigenous coal by sea is carried out through Poompuhar Shipping Corporation (PSC). The cross verification of the quantity moved as per the Annual Reports of PSC *vis-a-vis* TANGEDCO Coal Data Book (CDB) and the data in its CBMS revealed variations in all the years during 2014–19 as detailed below.

Table 2.11: Variation in quantity of indigenous coal moved

(In Lakh MT)

Year	Quantity moved as per PSC record	Quantity moved as per Coal Data Book	Quantity moved as per CBMS	Difference between PSC and Coal Data Book	Difference between PSC and CBMS	Difference between Coal Data Book and CBMS
(1)	(2)	(3)	(4)	(5)=(2)-(3)	(6)=(2)-(4)	(7)=(3)-(4)
2014–15	138.33	138.39	115.95	(-)0.06	22.38	22.44
2015–16	159.02	159.05	157.91	(-)0.03	1.11	1.14
2016–17	125.44	125.19	124.38	0.25	1.06	0.81

Year	Quantity moved as per PSC record	Quantity moved as per Coal Data Book	Quantity moved as per CBMS	Difference between PSC and Coal Data Book	Difference between PSC and CBMS	Difference between Coal Data Book and CBMS
2017–18	134.56	134.51	134.23	0.05	0.33	0.28
2018–19	153.62	151.30	154.79	2.32	(-)1.17	(-)3.49
Total	710.97	708.44	687.26	2.53	23.71	21.18

Source: PSC Annual Reports and TANGEDCO records

From the above **Table 2.11**, the difference in the quantity moved as per the PSC records and TANGEDCO's CDB was marginal to the extent of 2.53 lakh MT whereas the difference between CBMS and CDB was significant to the extent of 21.18 lakh MT. Even though the differences persisted in all the five years, TANGEDCO was yet to reconcile these figures and reasons of these discrepancies resulting in reporting of inaccurate data on coal movement. Prompt and periodical reconciliation of CBMS and CDB with the PSC records would ensure correctness of the quantity moved, and timely action if any on the variation in quantity could be taken.

Conclusion

The cost of coal constituted 95.54 to 98.41 *per cent* of the total cost of generation at TANGEDCO during 2014–19. The cost of coal plays a key factor in the fixation of tariff. The audit of coal management in TANGEDCO's TPS revealed that:

- Against the linkage of 106.97 Million Metric Tonnes (MMT), TANGEDCO received 71.82 MMT of coal during 2014–19 (25 to 41 *per cent* of Annual Contracted Quantity). To offset the short supply, TANGEDCO resorted to import of coal but did not impose penalty on coal companies as per FSA.
- The execution of import coal substitution scheme was tardy and benefited TANGEDCO only to the extent of 31 *per cent* of the agreed quantity of high grade indigenous coal. No penalty was levied, however ECL claimed extra-contractual performance incentive to the extent of ₹65.43 crore.
- While moving the coal from North Chennai to Mettur by railways, the actual transit loss exceeded the permissible limit in 47 out of 60 months (78 *per cent*) to the extent of 3.85 lakh MTs of coal valued at ₹58.37 crore. But TANGEDCO could not recover the excess transit loss from the contractor due to non-availability of enabling provisions in the Agreement with the coal handling contractor.
- TANGEDCO made payment for minimum guaranteed quantity of 1,008.43 lakh MT of coal against the actual moved quantity of 642.79 lakh MT of coal, thereby incurring an unproductive expenditure of ₹55.34 crore.
- The failure of the coal handling contractors to load coal upto the permissible carrying capacity of Railway wagons resulted in payment of freight of ₹101.35 crore (15.74 lakh MT of coal) without beneficial use.

- Huge drop in GCV up to 2,256 kcal/kg during transit of indigenous coal and more than 960 kcal/kg inside the power stations in various instances test checked by Audit.
- In five TPS studied in Audit, the energy charges proposed by TANGEDCO for billing were based on "As Fired GCV" and was higher by ₹1,805.35 crore during 2014-19 compared to the energy charges which should have been billed based on "As Received GCV", overburdening the consumers to that extent.
- No significant improvement in specific coal consumption in power stations despite blending high quality imported coal with domestic coal.

Thus, TANGEDCO did not take appropriate measures to avoid the inefficiencies in procurement, handling, quality assessment, and consumption of coal, which resulted in increased expenditure to TANGEDCO and consequent higher energy charges to consumers.

Recommendations

TANGEDCO may:

- Review all provisions of FSAs to protect the financial interests of TANGEDCO. A specific provision in FSAs may be incorporated for levy of penalty on coal companies for monthly shortage of coal.
- Review coal handling contracts across TPSs to ensure standardisation and incorporate best and economical practices, record and determine transit loss as well as coal shortages periodically, to avoid undue benefits to contractors. Faulty contracts may be reviewed and short closed if the revised contractual terms are not mutually acceptable.
- Responsibility may be fixed on the officials for not incorporating the clause for recovery of excess transit loss while awarding the contract to CREW for transportation of coal from Kamarajar Port to MTPS I & II.
- Establish an effective control mechanism to cross check the quality and quantity of coal at load ports and at power stations.
- Analyse the reasons and take steps to control the loss of GCV during transit and at power stations.
- Analyse the reasons for non-reduction in SCC despite blending with imported coal and take required measures to improve the same.
- Adopt "As Received GCV" instead of "As Fired GCV" for tariff fixation as recommended by CERC.
- Ensure disposal of fly ash and bottom ash as per the GOI norms.

लोकहितार्थ सत्यनिष्ठा

Dedicated to Truth in Public Interest

This Paragraph is an excerpt from the Audit Report No. 2 of 2021 - Public Sector Undertakings, Government of Tamil Nadu. The full Report can be accessed through https://cag.gov.in/en/audit-report/details/113964