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**Report of the
Comptroller and Auditor General of India
on
Fuel Management of Coal Based Power Stations
of NTPC Limited**



**Union Government (Commercial)
Ministry of Power
Report No. 35 of 2016
(Performance Audit)**

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Comptroller and Auditor General of India**

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Preface

The Performance Audit Report has been prepared under the provisions of Section 19-A of the Comptroller and Auditor General's (Duties, Powers and Conditions of Service) Act, 1971, as amended in 1984. The audit has been carried out in line with the Regulations on Audit and Accounts, 2007 and Performance Audit Guidelines, 2014 of the Comptroller and Auditor General of India.

Coal cost constitutes 60 to 70 *percent* of the total generation tariff of coal based power stations and has significant impact on cost of supply of power to consumers. Keeping this in view, a performance audit of fuel management in coal based power stations of NTPC Limited was taken up. The performance audit covers fuel management of 13 out of 26 coal based power stations of NTPC Limited and its Joint Ventures during the period from April 2010 to March 2016.

Audit wishes to acknowledge the co-operation received from NTPC Limited and Ministry of Power, Government of India at each stage of the audit process.

Executive Summary

INTRODUCTION

The installed electricity generation capacity in the country as on 31 October 2016 was 307278 MW out of which coal based capacity was 186493 MW (60.69 percent). NTPC Limited is the largest power utility in the country, its coal based capacity being 40084 MW (October 2016).

Coal cost constitutes 60 to 70 percent of the total generation tariff of a coal based power station and has a major impact on cost of supply of power to consumers. Inefficiencies in fuel management would increase the energy charges for the stations and cost of power to the ultimate consumer. Keeping in view the significance of fuel management to affordable power, the performance audit on fuel management of coal based power stations of NTPC Limited was carried out. The performance audit covers fuel management of 13 out of 26 coal based power stations of NTPC Limited and its Joint Ventures during the period from April 2010 to March 2016.

MAJOR AUDIT FINDINGS

Procurement of Domestic Coal

Coal is primarily procured domestically through long term coal linkages from subsidiary companies of Coal India Limited (CIL) and Singareni Collieries Company Limited (SCCL) at notified rates. For all other procurements, such as procurement through MOU, e-auction and import, the rates are higher.

Stations having inadequate fuel linkage

Examination of fuel linkages revealed that two power stations, viz., Barh-II and Kahalgaon-II, were operating without long term fuel linkage while Ramagundam-III was operating with reduced linkage. The three stations incurred an extra expenditure of ₹2483.39 crore due to procurement of coal through costly sources during the period from 2010-11 to 2015-16. Fuel Supply Agreement (FSA) on cost-plus basis was agreed to for Mouda station though New Coal Distribution Policy did not mandate it. Coal supplied under cost-plus agreement was costlier than notified rates and resulted in extra fuel cost for Mouda station to the extent of ₹31.11 crore from February 2015 to March 2016.

(Para 3.1.1 and 3.1.2)

Delay in signing FSA

There were significant time gaps between Commercial Operation Date and signing of FSA in five stations, viz., Sipat-I, Rihand-III, Farakka-III, Vindhyachal-IV and Korba-III, which forced these stations to procure coal under 'Performance Incentive' provision of the FSA of older units, incurring additional fuel cost of ₹323.37 crore.

(Para 3.1.3)

Performance Incentive paid under FSA

As per New Coal Distribution Policy, 100 *percent* of the Annual Contracted Quantity (ACQ) as per the normative requirement of the consumers would be supplied through FSA at notified prices. However, NTPC agreed to pay performance incentive for supplies above 90 *percent* of ACQ. This increased fuel cost of 10 stations by ₹558 crore.

(Para 3.1.4.1)

FSA for stations commissioned after 31 March 2009 provided for payment of performance incentive on Deemed Delivered Quantity, which included imported coal not actually delivered to the station. The payment of performance incentive for such notional deliveries increased the outgo of two power stations (Vindhyachal and Rihand) by ₹18.43 crore for the year 2013-14 without any commensurate benefit.

(Para 3.1.4.2)

As per the FSA (both old and new), the trigger level for performance incentive was 90 *percent* of ACQ. The new FSA (applicable for units commissioned after 31 March 2009) introduced compensation payable by coal companies in case supply falls below 80 *percent* of ACQ. In six stations, both the old and new FSAs with the same coal companies were in operation. NTPC and CIL arrived at an understanding regarding apportionment of supply against old and new FSAs; - CIL would consider supply of coal up to 90 *percent* of the ACQ in respect of old FSA and after fulfilling minimum commitments (80 *percent* of ACQ) under new FSA, the balance supply, if any, would be considered for incentive against old FSAs. This meant that NTPC paid additional performance incentives for supplies beyond 80 *percent* of ACQ in new FSAs. Audit noticed that the extra incentive payment by the stations on this account was ₹32.65 crore for the period 2013-14 and 2014-15.

(Para 3.1.4.3)

Deviation in supplies vis-a-vis scheduled quantity

The Annual Contracted Quantity was divided into quarterly scheduled quantities and further sub-divided into monthly scheduled quantities. FSAs provided that a deviation in monthly scheduled quantity up to 5 *percent* can be made with the written consent of both parties, but total variation in any month shall in no case exceed 10 *percent* of the scheduled quantity. For quarterly scheduled quantities, old FSA did not permit any excess supplies, while new FSA permitted deviation with the written consent of both parties. Examination of data regarding actual supplies vis-à-vis scheduled supplies revealed that deliveries to stations were rarely as per schedule. Since FSA provided for calculation of performance incentive/disincentive on annual basis, intra-year short supplies did not impact the earning of incentive by coal companies so long as there was no annual shortfall. This led to a paradoxical situation where the stations suffered generation loss due to coal shortage, while they paid incentives for additional supplies made over the year.

(Para 3.1.5.1)

Non recovery of compensation for short supplies under FSAs

The FSAs provided monetary compensation for short delivery by coal companies as well as short lifting by power stations. Performance incentive was also payable by power stations for annual supplies above 90 percent of ACQ. In the case of three stations, viz., Badarpur, Jhajjar and Ramagundum, though these stations paid incentive of ₹128.08 crore, compensation amounting to ₹114.68 crore could not be recovered from coal companies. In the case of Vallur station, though there was significant short supply, compensation was not even claimed.

(Para 3.1.5.2)

Rationalisation of quantities under FSAs

Badarpur station had two FSAs, one with Eastern Coalfield Limited for an Annual Contracted Quantity (ACQ) of 2 lakh tonne and another with CCL for ACQ of 40 lakh tonne. CCL had consistently short supplied coal over 2011-2015 (except in 2012-13) which had attracted compensation of ₹21.23 crore. This was claimed, but not received. On the other hand, ECL had been supplying more than the ACQ in all the five years and the station paid performance incentive of ₹47.06 crore. NTPC did not address this situation by re-appropriation of the quantity among ECL and CCL.

(Para 3.1.5.3)

Procurement of coal through MOUs

In addition to FSAs, power stations entered into Memoranda of Understanding (MOUs) with coal companies to supplement coal supplies. Procurement of coal through MOUs was not mandated under New Coal Distribution Policy. High premium was being paid for MOU procurements, even compared to maximum incentive of 40 percent over notified rates under FSA. Premium agreed to by NTPC under MOU with Singareni Collieries Company Limited was higher than FSA rates by ₹1600.64 crore while the premium agreed to under the MOU with ECL was higher by ₹1433.19 crore.

(Para 3.2)

Procurement of coal through e-auction

NTPC procured coal through e-auction to supplement FSA supplies using the price of imported coal (GCV 5700 kCal/kg) as benchmark for bidding. Since there were significant differences between the bid price and the actual import price for the grade of coal on offer in e-auction, two scenarios could occur: (i) where the import price for the grade of offered coal is lower than the derived price, the bid amount would be on the higher side and the Company would win the bid by quoting a higher amount for an inferior quality of coal and (ii) where the import price is higher than the derived price, the Company may be losing the bid.

(Para 3.3)

Import of coal

Policy framework for import of coal

NTPC did not lay down a specific policy for importing coal. In the absence of a comprehensive policy, different approaches to key decisions such as splitting of quantity

among bidders, qualification requirements, type/GCV of coal to be procured, retendering/annulment, negotiation with bidders *etc.* were noticed. During the period from April 2011 to March 2016, 36 of the 40 packages, worth ₹ 22796.91 crore (approx.), for 36.79 million tonnes of coal accounting for over 75 percent of the procurement by value, were awarded to a single entity, Adani Enterprises Limited. In order to enhance participation level, though splitting was introduced, the splitting ratio was modified subsequently, which had the effect of awarding more quantity to L1 bidder.

(Para 4.1)

Source verification of quantity and quality of coal

To ensure quality of supply, the Qualification Requirement for bidders provided for tying up with mine owner(s) through a 'Letter of Authority' from them. Since the bid prices obtained with this condition were higher than cost estimates, the requirement regarding 'Letter of Authority' was relaxed and the bidders were asked to furnish list of mines from which supply would take place. Since the bidders submitted a large list of mines (from 33 to 740 mines), the source and quality of coal being imported was not assured.

(Para 4.2)

Incorrect adoption of index of coal for import

NTPC imported coal from Indonesia under 15 packages involving 14.6 MMT during February 2012 to February 2013. NTPC indicated in the contract documents that the requirement was for GCV of 6300 kCal/kg (on Air Dried Basis-ADB) while the payment would be based on the index for GCV of 6500 kCal/kg on Gross As Received-GAR basis instead of 5800 kCal/kg, which was the appropriate index. GCVs worked out on ADB and GAR basis are considerably different; the GCV being higher on ADB basis compared to GAR. Difference in price per tonne of Indonesian coal, as per 6500 GAR and 5800 GAR ranged from 11.97 USD to 18.75 USD

(Para 4.3)

Assessment of Quality and Quantity of coal

Pricing of coal by coal companies and pricing of energy by generating companies depends significantly on its heat value referred to as 'Gross Calorific Value (GCV)'.

Sample collection and methods of measurement for coal quality

Measurement of GCV depends on the location from which samples are collected and the method used to measure GCV. Different methods of measuring GCV were used for different purposes, *viz.*, GCV was reported on 'Air Dried basis' (ADB) for payment of imported coal, GCV on 'Equilibrated basis' (EB) for payment to domestic coal companies and GCV on 'Total Moisture basis' (TMB) for energy billing.

GCV on ADB basis gave undue advantage to the supplier since moisture present in the sample was dried in order to ascertain the GCV for payment. TMB method gives the lowest GCV and the same is used by stations for billing. As energy tariff is inversely proportional to GCV, this would lead to higher burden on consumers. Similarly, the method of estimation of quantity of coal did not provide adequate assurance regarding its accuracy.

(Para 5.1)

Reduction in heat value (Gross Calorific Value) of coal

Audit compared the GCV 'as billed' at mine end, GCV 'as received' at the unloading point of the power station and GCV 'as fired' in the boilers for a year (from October/November 2012 to September 2013). It was observed that GCV of coal progressively decreased from 'as billed' stage to 'as fired' stage, though as per Central Electricity Authority, the three GCV values should be approximately same, barring minor losses due to storage. More particularly, the difference in GCV between 'as received' and 'as fired' values was attributable entirely to the power stations. Audit ascertained the impact of GCV difference on efficiency and energy charges. The Station Heat Rate (SHR) ascertained using GCV 'as received' indicated that the power stations were inefficient though SHR as per GCV 'as fired' was within the norm fixed by Central Electricity Regulatory Commission (CERC). The difference in energy charges considering the 'as received' and 'as fired' stage for the one year period was ₹0.03 to ₹0.96 per unit of electricity for the different stations.

(Para 5.2.1)

Weighment of domestic coal

As per Fuel Supply Agreements (FSA), payment for the coal supplies was made as per weighment carried out at the delivery/loading point at mine end. The FSAs also provided for weighment at unloading point (power station) in order to ensure recalibration of weigh bridges at loading point. However, stations did not regularly weigh domestic coal, though in-motion weigh bridges were installed in the stations. Due to this, stations lost an opportunity to cross verify the quantity of coal received and ascertain the resultant transit loss.

(Para 5.3)

Assessment of transit loss through indirect method

CERC Tariff Regulations provided normative transit and handling loss of 0.8 and 0.2 percent for non-pit head stations and pit head stations respectively. Assessment of actual transit loss was carried out by way of physical verification of closing stock of coal stored in the yard and bunker at the end of every quarter using an indirect method called 'volumetric method'. Inaccuracy of the transit loss ascertained using this method was evidenced by the fact that quantity of coal as per the physical verification reports was one to 114 percent more than the storage capacity of the yards in eight power stations.

(Para 5.5)

Coal Supply Management

One of the important functions in operating a power station is to ensure uninterrupted supply of coal so that generation loss due to coal shortage does not arise.

Generation Loss due to coal shortage

During 2012-13, the stock level was at super critical position in seven stations for more than six months and similar situation prevailed in four stations during 2013-14. There was some improvement in 2014-15, but three stations reported super critical stock levels. Further, domestic coal stock dropped to *zero level* at stations during 2012-13 to 2014-15. There were instances of units being taken out of operation or being operated at partial load in view of

coal shortage. During 2010-11 to 2015-16, 11 out of 13 stations covered in audit reported a generation loss of 19546.26 million units of electricity with potential revenue loss of ₹4299.80 crore. Further, Due to unduly positive presumption regarding coal receipt, four power stations incurred generation fault penalty in the form of Unscheduled Interchange charges amounting to ₹101.41 crore during the period from 2010-11 to 2015-16.

(Para 6.1, 6.2 and 6.3)

Storage capacity of coal yards at power stations

Storage capacity of six stations was less than the space required to store the normative quantity for 15/30 days' requirement prescribed under CERC Tariff Regulations. Shortage in capacity as a percentage of requirement ranged from 2.60 percent (Rihand) to 53.62 percent (Farakka). Further, imported coal warranted earmarking specific area for its storage limiting the space for domestic coal.

(Para 6.4)

Storage of domestic coal along with imported coal

As per Local Management Instructions issued by stations, imported coal was to be stacked separately in earmarked area in the yard. Physical verification reports (April 2010 to March 2016) of coal stock were reviewed in audit and it was observed that domestic and imported coal were stored in the same yard. Availability of imported coal in excess of earmarked capacity for it ranged between 6 and 158 per cent indicating that domestic and imported coal were being mixed at the yard itself before they were actually blended.

(Para 6.5)

Railway logistics

The coal supplied through railway rakes was required to be unloaded within a stipulated period known as 'free time', beyond which demurrage was levied by Railways. Stations covered in audit had to incur demurrage of ₹129.67 crore on account of inefficiencies in unloading coal within stipulated time during the period from 2010-11 to 2015-16.

Railways routinely divert rakes of coal consigned for one consumer to another, due to congestion on a particular line or route. Audit noticed that the diversion was not always between power stations of NTPC. In cases where rakes were 'diverted in' or 'diverted out' between stations of NTPC and other companies, there would be an adverse impact on NTPC when high GCV coal of NTPC stations were being 'diverted out' and low GCV coal of other companies were 'diverted in'.

(Para 6.6.1 and 6.6.2)

Consumption of coal

Although yearly average Specific Coal Consumption of stations remained below 1 kg per unit of power, Audit noticed significant monthly variations. Notably, the maximum SCC in some cases was very high, at 3.21 kg in Mouda and 1.02 kg in Badarpur.

(Para 7.1)

Blending of imported coal with domestic coal

Imported coal was blended with domestic coal and fired in the boilers. GCV of imported coal ranged from 5700 to 6300 kCal/kg while that of domestic coal ranged from 2900 to 4200 kCal/kg. Given the very high difference of GCV between domestic and imported coal, it is expected that blending of imported coal would result in lower consumption of the blended coal. Audit, however, noticed that the coal used to produce one unit of energy remained the same, irrespective of whether imported coal was blended to a lesser or greater extent. This raises doubts whether imported coal was indeed superior to domestic coal even though NTPC incurred higher cost for procuring it.

(Para 7.2)

Use of washed coal to reduce environmental pollution

Ministry of Environment and Forests stipulated that raw coal has to be cleaned to reduce ash content to less than 34 *percent*, if coal is transported beyond 1000 kms or if burnt in environmentally sensitive areas. As per this, the entire coal to be used should be washed coal. However, at Dadri station, percentage of washed coal showed a declining trend during the period from 2010-11 to 2014-15, though the situation was slightly improved in 2015-16. In the case of Badarpur station, procurement of washed coal, on an average, during 2010-11 to 2015-16 was over 16 *percent* only.

(Para 7.3)

RECOMMENDATIONS

Based on the audit findings discussed in the report, the following recommendations are made for efficient fuel management practices in NTPC coal based power stations.

For NTPC

1. The Company may review the procedures for procurement of coal above notified rates such as incentive procurement, MOU, e-auction and imports.
2. The Company may invoke, wherever feasible, provisions in the existing Fuel Supply Agreements for inter-station transfer of coal to tide over temporary coal shortages.
3. The Company may formulate a policy for import of coal. Action may also be taken to ensure source and quality of imported coal.
4. Methods for measurement of GCV for procurement of coal and billing of energy may be standardized in coordination with competent authorities.
5. Weighment of coal may be carried out at the time of receipt of coal at unloading point to ascertain the actual transit loss and take remedial measures.

For Ministry of Power

6. Pricing of energy is based on Station Heat Rate, which, in turn, is based on quantity and quality of coal (GCV) consumed by the stations. While quantity of coal received is not weighed by the stations, quality assessment of coal has inherent as well as manmade infirmities due to heterogeneous nature of coal and sampling errors. There

is a need to appropriately review the method for energy pricing. Ministry may coordinate with Central Electricity Regulatory Commission to examine this aspect in the light of the audit findings.

7. The commercial terms in FSAs were not in accordance with New Coal Distribution Policy and FSAs did not have safeguards for intra-year shortfall in deliveries. Ministry may, therefore, review the terms of FSAs in consultation with Ministry of Coal/ Coal India Limited to rectify these inadequacies.

The above recommendations were discussed in the Exit Conference held in October 2016 and the Ministry/NTPC Limited were generally in agreement with the recommendations.

Chapter 1

Introduction

1.1 Background

Electricity features in the concurrent list of the Constitution of India. Both the Central and State governments are vested with the responsibility for development of power sector. In the 1970s, Central Sector Generating Stations (CSGS) were established to accelerate power development in the country. The capacity of the CSGS was 'shared' among Beneficiary States¹, which were given allocations from the CSGS. The installed capacity in the country as on 31 October 2016 was 307278 MW out of which coal based capacity was 186493 MW (60.69 percent). The XII Five Year Plan document noted that, while the pace of addition to generating capacity was commendable, there had not been comparable progress in delivering fuel. Availability of both coal and gas to the new power stations was not assured. Resolution of this problem was accorded high priority in the XII Plan.

1.2 Profile of the Company

NTPC Limited (Company) was one of the CSGS incorporated in November 1975 to plan and promote development of thermal power in the country. The first station (200 MW) built by the Company was commissioned in 1982 at Singrauli. The Company became a listed company in November 2004. It became a 'Navratna' company in 1997 and a 'Maharatna' company in May 2010. The Company has five subsidiaries and 21 Joint Ventures (JVs) as on 31 March 2016. The Government of India holds 69.74 percent (as on 31 March 2016) of the total equity of ₹8245.46 crore of the Company.

The Company is the largest power utility in the country with 15.37 percent of the total installed capacity. The number of power stations of the Company including its JVs and installed capacity as of October 2016 were as follows:

¹ Installed capacity of power stations under the Central Sector Generating Stations is shared among individual States and these States are referred as 'Beneficiary States'.

Table-1.1: Types of generation facilities commissioned as of October 2016

Generation facility type	No. of stations	Installed Capacity (MW)
A. Owned by NTPC		
Coal	18 ²	35,085
Gas/Liquid Fuel	7	4,017
Hydro	1	800
Renewable energy projects	9	360
Total (A)	35	40,262
B. Owned by JVs/Subsidiaries		
Coal	8	4,999
Gas	1	1,967
Total (B)	9	6,966
Grand Total (A+B)	44	47,228

1.3 Organisational Structure

The Board of Directors of the Company comprised seven functional Directors including the Chairman and Managing Director (CMD), two Government nominee Directors and nine independent Directors. The Company has eight regional offices located at Dadri (Dadri, Badarpur and Faridabad), Lucknow (Northern Region), Mumbai (Western Region-I), Raipur (Western Region-II), Patna (Eastern Region-I), Bhubaneswar (Eastern Region-II), Secunderabad (Southern Region) and Dehradun (Hydro). The Company also has 26 project offices/power stations spread across the country.

1.4 Fuel Arrangements

Coal based capacity of the Company (including JVs/subsidiaries) was 40084 MW (October 2016), which constituted 85 *percent* of installed capacity of the Company, and 21 *percent* of coal based capacity in the country. Long term fuel supply agreements (FSA) entered into with subsidiary companies of Coal India Limited (CIL) and Singareni Collieries Company Limited (SCCL) were the main source of coal for the coal fired power stations of the Company. To meet the shortfall of domestic coal, the Company participated in e-auctions conducted by CIL and its subsidiaries since 2009-10. Domestic coal was also being procured through Memorandum of Understanding (MOU) with coal companies. Imported coal was also procured and blended with domestic coal. The Company was allocated eight captive coal blocks with estimated geological reserves of 7 billion tonnes but production from these blocks has not yet started (March 2016)

Details of coal procurement by the Company from different sources during the last six years (2010-11 to 2015-16) are tabulated below:

² Out of the 18 coal stations, nine are pit-head stations and nine are rail-fed (non-pit head) stations.

Table-1.2: Details of coal procurement from different sources

Year	Total coal procured from all sources	Coal imported	Coal procured through e-auction	Imported coal to total coal procured	Coal through e-auction to total coal procured
	(in Million Tonnes)			In percentage	
2010-11	137.30	10.5	0.08	7.65	0.06
2011-12	140.99	12.0	0.38	8.51	0.27
2012-13	155.00	9.1	2.28	5.87	1.47
2013-14	160.63	10.8	3.20	6.72	1.99
2014-15	167.40	16.4	0.94	9.80	0.56
2015-16	161.80	9.70	0.29	6.00	0.18

1.5 Performance Audit

Fuel management is an area of concern for the operational performance of the Company as coal stock fell to critical and supercritical levels³ at coal fired stations during the period from 2012-13 to 2015-16. Coal cost constitutes 60 to 70 percent of the total generation tariff of a coal based power station and has a major impact on cost of supply of power to consumers. Operational efficiency of power stations is regulated through a parameter called 'Station Heat Rate' (SHR)⁴, which denotes the input heat value incurred by the station to produce one unit of energy. SHR depends on the quantity as well as quality/grade of coal used by the station. Inefficiencies in fuel management would increase the energy charges for the stations and cost of power to the ultimate consumer. The performance audit was carried out keeping in view the significance of fuel management in power stations to affordable power.

³ Critical level – Coal stock above four days, but below seven days. Supercritical level – Coal stock below four days.

⁴ Station Heat Rate = $\frac{\text{Quantity of coal} \times \text{Gross Calorific Value}}{\text{No. of units of energy generated}}$



Chapter 2

Audit Framework

2.1 Scope of Audit

The performance audit covers fuel management of 13 out of 26 coal based power stations of the Company and its Joint Ventures (JV)/subsidiaries (18 stations of NTPC and 8 stations of subsidiaries and JV companies). Audit examination covered the period from April 2010 to March 2016.

2.2 Audit Sample

13 power stations were selected for detailed examination comprising a mix of new and old power stations of NTPC. The sample included seven stations that were built during the XII Plan period, while the remaining six stations were selected based on their geographical location.

Table-2.1: Stations selected for audit

Sl. No.	Name of station	Sl. No.	Name of station
1	Dadri	8	Mouda
2	Badarpur	9	Farakka
3	Jhajjar (JV) ⁵	10	Barh
4	Vindhyachal	11	Talcher Thermal
5	Korba	12	Ramagundam
6	Sipat	13	Vallur (JV) ⁶
7	Rihand		

In addition, 36 out of 40 imported coal packages awarded during the period from April 2011 to March 2016 were examined. In respect of examination of coal linkages and monitoring of coal stock including storage capacity, stations not included in the sample were also covered.

2.3 Audit objectives

The objectives of this performance audit were to assess whether:

- (i) All stations had fuel security through long term fuel linkages;
- (ii) Procurement of coal and inventory management were carried out economically, efficiently and effectively;
- (iii) Proper controls existed for monitoring consumption of coal by stations;
- (iv) Proper procedures were followed for assessing quality and quantity of coal; and
- (v) Billing of energy charges was done in compliance with the Tariff Regulations issued by Central Electricity Regulatory Commission (CERC).

⁵ Indira Gandhi Super Thermal Power Station of Aravali Power Company Private Limited, Jhajjar, Haryana (JV of NTPC, Indraprastha Power Generation Company Limited and Haryana Power Generation Company Limited with shareholding of 50 percent, 25 percent and 25 percent respectively).

⁶ Vallur Thermal Power Station of NTPC Tamil Nadu Energy Company Limited (JV of NTPC and Tamil Nadu Electricity Board with shareholding of 50 percent each)

2.4 Audit criteria

Audit criteria for the performance audit were drawn from:

- (i) Tariff Policy, 2006 issued by Ministry of Power.
- (ii) New Coal Distribution Policy issued by Government of India (Ministry of Coal).
- (iii) CERC (Terms and Conditions of Tariff) Regulations, 2009 and 2014.
- (iv) Petitions filed by the Company before Regulatory and judicial fora and documents relating to the petitions.
- (v) Central Electricity Authority norms for long term coal linkages.
- (vi) Fuel Supply Agreements and Memoranda of Understanding with coal companies.
- (vii) Minutes of meetings of Board of Directors and Board level sub-committees.
- (viii) Contract packages for import of coal.
- (ix) Local Management Instructions issued by stations.

2.5 Audit Methodology

Prior to commencement of audit, an entry conference was held with the Management of NTPC on 02 September 2015 where the audit scope, objectives, criteria and sample were discussed. Audit of the selected stations was carried out between September 2015 and January 2016 and the draft Performance Audit report was issued to NTPC on 26 February 2016. The replies of NTPC were received on 27 April 2016 and an exit conference was held with them on 16 May 2016. The responses of the Management were incorporated in the report and the revised draft report was issued to Ministry of Power on 01 September 2016. An exit conference was held on 24 October 2016 with Ministry of Power to discuss the report and responses of the Management. Subsequently, on 10 November 2016, detailed replies of Ministry of Power were received which have also been considered while finalizing the report.

2.6 Acknowledgement

Audit acknowledges the cooperation extended by Ministry of Power and the Management of NTPC and its JVs in smooth conduct of this performance audit.

2.7 Audit Findings

Audit findings are grouped under the following Chapters:

- Chapter 3 - Procurement of Domestic Coal
- Chapter 4 - Import of Coal
- Chapter 5 - Assessment of Quality and Quantity of Coal
- Chapter 6 - Coal Supply Management
- Chapter 7 - Consumption of Coal by Power Stations
- Chapter 8 - Conclusion and Recommendations

Chapter 3

Procurement of Domestic Coal

Coal is primarily procured by NTPC domestically through long term coal linkages from subsidiary companies of Coal India Limited (CIL) and Singareni Collieries Company Limited (SCCL). Any shortfall is met by domestic procurement through Memorandum of Understanding (MOU) or e-auction and also by import. Coal is generally procured through long term linkages at CIL/SCCL notified rates. For all other procurements (through MOU, e-auction and import), the rates are higher.

Audit examined supplies through both domestic and imported sources. Observations regarding procurement of domestic coal are summarized in this Chapter while those relating to imported coal are at Chapter 4.

3.1 Fuel Supply Agreements (FSA)

Coal linkage for power stations was granted by Standing Linkage Committee (Long Term) (SLC-LT) of Ministry of Coal (MoC) based on recommendation of Central Electricity Authority (CEA) and inputs from the generating and coal companies. MoC notified the New Coal Distribution Policy (NCDP) in October 2007, outlining the policy framework for distribution of coal to various categories of coal consumers including power stations. Execution of Fuel Supply Agreements (FSA) between coal companies and consumers of coal became mandatory under NCDP. FSAs lay down conditions regarding contracted quantity, quality of coal to be supplied, procedure for checking quality of coal, source of supply, commercial terms *etc.* Two versions of FSA were signed, one for stations commissioned prior to 31 March 2009 (regarded as existing consumers under NCDP) and another for stations commissioned after 31 March 2009 (called new consumers under NCDP).

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 power stations at a higher rate, fixed at 40 *percent* above the notified rates. Audit noticed shortcomings in implementation of FSAs to the detriment of the power stations of NTPC.

3.1.1 Stations having inadequate fuel linkage

The Company had 34 FSAs (21 for stations commissioned prior to 31 March 2009 and 13 for stations commissioned after 31 March 2009) for its coal fired power stations (March 2016). Total Annual Contracted Quantity (ACQ) under these FSAs was 164.17 MTPA (million tonnes per annum). Audit examination on the adequacy of coal linkages in power stations revealed the following:

3.1.1.1 Barh-II power station

Coal requirement of Barh-II (2 x 660 MW) power station was to be met from the captive coal blocks allocated to the Company, but production from these coal mines was delayed. Though the scheduled Commercial Operation Date (COD) of first unit of Barh-II was in January

2013, the Company took up the matter regarding tapering linkage⁷ for Barh-II only in April 2013. In September 2015, Ministry of Coal decided to supply coal at notified price, as a special case, till decision regarding tapering linkage was taken. Two MOUs for supply of coal were signed in October and November 2015.

The first unit of Barh-II was commissioned on 15 November 2014 and for the period from November 2014 to November 2015, the Company tapped costly sources like e-auction and imported coal for running the station, incurring extra expenditure of ₹527.43 crore. Audit observed that the FSAs signed by the Company for other stations commissioned prior to 31 March 2009 allowed transfer of coal among stations wholly owned by the Company. But this provision was not invoked to meet the coal requirement of Barh-II. Even, the initial carpeting⁸ of the coal yard was done using costly coal by incurring extra expenditure of ₹5.28 crore.

Ministry stated (November 2016) that it was the first time Super Critical Technology based 660 MW thermal power plant was being installed by an Indian Company (BHEL), and during the execution of the project it was felt that actual commissioning of the unit may take more time due to various complex technological issues being faced at the station. Regarding inter-plant transfer, Ministry stated that this was not possible from Barh-I and other stations covered by new FSA⁹. Ministry added that NTPC had requested MoC for tapering coal linkage to Barh-II in April 2013 and as a special case, MoUs at notified prices were agreed (September 2015) by MoC till grant of tapering coal linkage. Ministry further stated that the station got approval for Bridge Linkage (earlier referred to as tapering linkage) in March 2016 and MOUs with coal companies for supply were signed in August 2016.

The reply is to be viewed against the fact that fuel tie-up was one of the pre-requisites for project implementation. Hence the Company should have taken timely action for obtaining tapering/bridge linkage or considered inter-plant transfer which was permissible under the old FSAs. Audit also noticed that for supplies under Bridge Linkage for Barh-II, the Company has agreed to coal prices demanded by the coal company which were 10 percent above notified rates¹⁰, though notified rates were applicable for coal supplied under the 'linkage' route. The higher prices, agreed to (August 2016) by the Company would correspondingly increase energy charges for the station.

3.1.1.2 Kahalgaon-II power station

Existing power stations as on 31 March 2009 were given coal linkages (Annual Contracted Quantity - ACQ) as per the recommendation of CEA. In the case of Farakka (1600 MW) and Kahalgaon-I (840 MW), CEA recommended (April 2009) a combined ACQ of 15 MTPA as against the requirement of 22.94 MTPA. The reason for the reduced linkage was the delay in production from linked mines and constraints in railway logistics cited by CIL. In the case of

⁷ Tapering linkage is the short-term linkage provided to those coal consumers who have been allotted captive coal blocks for meeting their coal requirements of their linked end-use plant where production of coal from these blocks does not synchronize with the requirements of the end-use plant.

⁸ It is a layer of compressed coal, which is spread on the yard to serve as a carpet upon which further heaps of coal are placed.

⁹ As per this FSA, diversion for plants linked to captive coal blocks was not permissible.

¹⁰ Except for higher grade coal (Up to G5 grade and WCL coal).

two units of Kahalgaon-II (2 x 500 MW), CEA stated (June 2009) that ACQ for these units would be recommended separately as and when additional coal was available from the linked mines or movement of additional coal was made possible by Railways. CIL, however, clubbed the coal requirement of Farakka, Kahalgaon-I and Kahalgaon-II and the Company signed (August/September 2011) FSAs for 15 MTPA for all the three stations. Though NTPC took up the issue both with CEA, CIL/Ministry of Coal, it could not succeed in enhancing coal allocation for these three stations. Finally, Ministry of Coal informed (March 2014) NTPC that the issue could not be decided at that point in time.

Audit observed that the coal companies actually supplied more than the ACQ but demanded performance incentive (PI) at applicable rates, *i.e.*, 40 percent over and above the notified rates, which was the highest slab rate payable for supplies beyond ACQ. The station paid PI amounting to ₹476.14 crore for coal supplies beyond ACQ, at 40 percent above notified rates during the period from 2012-13 to 2015-16.

Ministry stated (November 2016) that the request to increase the ACQ was turned down by CIL and it had no option but to sign FSAs with Eastern Coalfields Limited for ACQ of 15 MTPA. It was added that NTPC continuously took up the issue at different levels for an upward revision in ACQ ever since ACQ was finalized but did not succeed. Ministry further added that in the deliberations between NTPC and CIL in July 2016, CIL has agreed to supply additional 3.69 Million MTPA to Kahalgaon under the FSA terms and conditions.

Ministry's reply indicates that additional supply at FSA rates has been agreed to, implementation of which would be watched in future audits. However, running two units of Kahalgaon II having capacity of 1000 MW entirely on costlier sources of fuel for four years (2012-13 to 2015-16) increased the fuel cost of the station which in turn was passed on to the consumers through power tariff.

3.1.1.3 Ramagundam III power station

In order to meet the coal requirement of Ramagundam-III, the Standing Linkage Committee (Long Term) of Ministry of Coal (MoC) offered (September 1998) a linkage of 2.5 MTPA from Western Coalfield Limited (WCL). Later, MoC accorded in principle approval for coal linkage of 2.5 MTPA from South Eastern Coalfields Limited (SECL) in September 1999. However, NTPC did not sign the FSA for coal linkage of 2.5 MTPA with either WCL or SECL before commissioning the unit on 25 March 2005.

In October 2007, the New Coal Distribution Policy (NCDP) was notified stating that coal at notified price would be available only on signing of FSA. NTPC signed FSAs with SECL (26 July 2011) and Mahanadi Coalfields Limited (MCL) (15 July 2011) for supply of ACQ of 1 MTPA (0.5 MTPA each). As against the requirement of 2.5 MTPA, the FSAs ensured 1 MTPA of coal as CIL expressed its inability to supply more. Consequently, NTPC incurred extra expenditure of ₹1474.54 crore due to procurement of coal through costly sources (MOU and e-auction) during the period from 2010-11 to 2015-16.

Ministry stated (November 2016) that coal supply under FSA became mandatory only after introduction of New Coal Distribution Policy (NCDP) in October 2007 and till such time Standing Linkage Committee Short Term (SLC- ST) used to approve coal linkage on

quarterly basis from time to time. Ministry added that SECL and MCL mines were located far away from the station. Ministry further stated that ACQ from MCL and SECL have now been transferred to Singareni Collieries Company Limited (SCCL) on 21 January 2016 as per the recommendations of New Inter-Ministerial Task Force (IMTF) and subsequently, NTPC requested (March 2016) SCCL to revise the ACQ for Ramagundam as per approved linkage.

The reply is not tenable. FSA mechanism was prevalent even before NCDP. In the instant case, NTPC had failed to sign the FSA with either WCL or SECL, when it had the approval of Ministry of Coal (in September 1999), much before commissioning of the unit in March 2005. Subsequently, the Company had to sign the FSA for supply from the same distant mines and agree to a lower ACQ, which resulted in extra expenditure.

3.1.2 Coal pricing done on cost plus basis for Mouda FSA

Mouda station was granted (21 June 2010) coal linkage of 1.78 MTPA from WCL mines for Unit II of Stage-I. FSA was signed by the station in September 2013. At the time of implementation of FSA, WCL stated that it was not in a position to supply coal at notified rates and offered coal on 'cost-plus basis'. Coal supplied under cost-plus agreement was costlier than notified rates. Execution of another FSA on cost-plus basis was initially resisted by the Company but eventually agreed to at a review meeting held on 30 August 2013 and cost plus FSA for 0.6 MTPA was signed in January 2015.

Audit observed that NCDP envisaged supply of coal at rates declared/notified by CIL for power utilities and there was no provision for coal supply on cost-plus basis. As such, the Company's acceptance of cost-plus prices was not in line with NCDP and has resulted in extra fuel cost of ₹31.11 crore¹¹ during the period from February 2015 till March 2016.

Ministry stated (November 2016) that the Letter of Assurance (LOA) dated 21.06.2010 issued by WCL provided that in case the quantity of normative requirement necessitates opening of a dedicated mine, then coal shall be priced at the higher of the cost plus reasonable return or such notified price. Ministry added that as WCL did not have coal quantity available for supply at notified prices, it had identified New Majri mines from which cost plus coal can be supplied to Mouda Unit 2 in terms of the LOA. Ministry further stated that the issue was taken up with WCL/CIL, MoP/MoC for signing of FSA at notified price after finalization of the model FSA-2012. However, MoC, vide letter dated 02 September 2013 communicated to MoP that WCL could supply coal from only cost-plus mines and requested MoP to advise NTPC to sign cost-plus FSA with WCL. There was no option available to NTPC but to sign cost plus FSA with WCL, as directed.

The reply is to be viewed against the fact that Standing Linkage Committee – Long Term, in its meeting dated 30 April 2002, had decided that cost plus pricing should be resorted to only in those cases where the consumer seeks supply from a specific mine. As in the present case, NTPC did not seek supply from a specific mine, NTPC ought not to have agreed to cost plus pricing. Moreover, NCDP provided for supply of coal at notified rates only and did not envisage cost plus pricing for coal.

¹¹ Cost plus price agreed by the Company was ₹1926.62 per tonne, while notified price was ₹1070 per tonne (G9 grade). Quantity delivered was 3,63,213.55 tonne. Hence, excess cost is equal to ₹31.11 crore (₹1926.62 – ₹1070 x 3,63,213.55).

3.1.3 Additional fuel cost due to long time taken in signing Fuel Supply Agreement

Audit observed that there were significant time gaps between Commercial Operation Date of units and signing of FSA by five stations in the audit sample. Two of these stations, viz., Farakka and Korba entered into MOU with coal companies but the MOU quantity was not adequate to meet the requirement of the station. These stations were forced to procure coal under 'Performance Incentive' provision in the existing FSA of older units, incurring additional fuel cost as explained below:

Table-3.1: Performance Incentive paid due to long time taken in signing FSA

Name of the station	Details of Unit			Coal procured for new units against old FSA (In Tonnes)	PI paid for new units during the period between COD to FSA signing(₹crore)
	Commercial Operation Date (first unit)	FSA date	Time gap in signing FSA (months)		
Farakka-III	01.04.2012	11.7.2013	15	1280471	90.74
Korba-III	20.03.2011	17.07.2013	27	2366031	7.51
Vindychal-IV	01.03.2013	02.09.2013	6	931649	19.24
Rihand-III	19.11.2012	02.09.2013	10	1685772	37.35
Sipat-I	25.05.2012	01.09.2013	16	6425236	168.53
Total					323.37

Ministry stated (November 2016) that delay in signing of MOU was on the part of CIL subsidiary. Ministry added that the model FSA was provided by CIL only in April 2012, with many one sided provisions in CIL's favour which led to protracted negotiations and consequent delay. Ministry further stated that the time invested in negotiation with CIL before signing of FSAs may not be deemed as delays since NTPC tried to protect the interests of consumers only.

It needs to be highlighted here that the time gap in signing FSA led to extra expenditure of stations for sourcing coal by paying incentive, which, in turn, was passed on to the consumers. Moreover, protracted negotiations did not yield significant dividends in commercial terms.

3.1.4 Performance incentive paid under FSA

Commercial terms in the FSA were incorporated after negotiations between the Company and CIL. Audit noticed that conditions for payment of performance incentives by power stations were agreed to in disregard of NCDP to the detriment of the Company as discussed in succeeding sub-paragraphs:

3.1.4.1 Payment of Performance Incentive for quantities within ACQ

As per NCDP, 100 percent of the quantity as per the normative requirement of the consumers would be considered for supply of coal through FSA at fixed prices to be notified by CIL. However, the Company agreed to pay performance incentive for supplies above 90 percent of ACQ (10 percent performance incentive for supply between 90 and 95 percent of ACQ and 20 percent performance incentive for supply between 95 and 100 percent of ACQ). This

resulted in increased fuel cost for the stations examined in audit. The incentive paid within ACQ in case of 10 stations¹² was ₹ 558.00 crore (2010-11 to 2015-16).

Ministry stated (November 2016) that NCDP authorizes CIL to declare/notify prices for coal supplies, and during discussions held on 08 April 2009 between CEA, CIL, NTPC and other power utilities, it was informed that in the coal shortage scenario, coal companies would be motivated to produce more coal with the incentive provision. Ministry added that Performance Incentive (PI) being applicable only for supplies above 100 percent of ACQ might have resulted in higher notified prices and under such a scenario, even the coal supplied below 80 percent ACQ would have attracted increased fuel charges. Ministry further stated that it was a collective decision of CEA, CIL and power utilities including NTPC and not a clause agreed to by only NTPC. Ministry further added that NTPC has taken up with CIL for PI to be restricted to supplies beyond 95 percent of ACQ (@ 10 percent only) and CIL/ECL have now withdrawn PI for the coal of G5 Grade and above.

The reply confirms that the commercial terms of FSA agreed to by NTPC were beyond the rates specified by NCDP. As NCDP is the overarching framework for coal linkage, NTPC ought to have stressed its implementation, particularly as the incentives agreed to in the negotiated FSAs were not in the interest of the Company.

3.1.4.2 Payment of PI on Deemed Delivered Quantity

The amount of PI to be paid by the Company is worked out on the basis of the quantity of coal delivered during the year. The FSA for stations commissioned after 31 March 2009 provided that PI was to be paid on Deemed Delivered Quantity¹³ (DDQ) which included imported coal not actually delivered to the station, having been surrendered by the Company. The payment of PI for notional deliveries of imported coal increased the outgo of the power stations without any commensurate benefit.

Audit observed that two stations in the Audit sample paid ₹ 18.43 crore (Vindhyachal ₹5.86 crore and Rihand ₹12.57 crore) towards PI on such DDQ for the year 2013-14.

Ministry informed (November 2016) that during negotiations on FSA terms, NTPC insisted that PI should be payable on actual deliveries but CIL did not agree. Ministry added that CIL later amended the provision and from 2014-15 onwards, PI is payable on actual quantity only.

While the response regarding corrective action taken is noted by Audit, the fact remains that the correction has been done for 2014-15 onwards and the amount of PI of ₹ 18.43 crore (pertaining to 2013-14) paid by Vindhyachal and Rihand stations would not be recovered even with the change in FSA terms.

¹² Dadri (₹ 1.85 crore), Vindhyachal (₹ 130.18 crore), Talcher (₹ 15.14 crore), Sipat (₹ 27.76 crore), Rihand (₹ 60.85 crore), Farakka (₹ 42.70 crore), Korba (₹ 63.72 crore), Ramagundum (₹ 150.88 crore), Badarpur (₹ 4.28 crore) and Kahalgaon (₹ 60.64 crore). The incentive paid in case of Vallur and Jhajjar was Nil.

¹³ As per FSA for stations commissioned after 31 March 2009, the coal companies can offer imported coal up to a certain percentage to meet their minimum supply requirements (80 percent of ACQ). Such imported component agreed was 15 percent of ACQ for the years 2012-13 to 2014-15, 13 percent of ACQ in the year 2015-16 and 5 percent of ACQ for the year 2016-17 onwards. NTPC has the option to surrender the imported coal so offered, in which case it would be considered as Deemed Delivered Quantity or DDQ.

3.1.4.3 Additional payment of PI

As per the FSA (both old and new), the trigger level for PI was 90 *percent* of ACQ. The new FSA (applicable for units commissioned after 31 March 2009) introduced a compensation payable by coal companies in case supply falls below 80 *percent* of ACQ. Thus, as per the new FSA, there was a dead band for supply between 80 and 90 *percent* of ACQ which entailed neither payment of incentive nor receipt of compensation.

Audit observed that in six stations¹⁴, both the old and new FSAs with the same coal companies were in operation. NTPC and CIL arrived (12 March 2013) at an understanding regarding apportionment of supply against old and new FSAs. CIL would consider supply of coal up to 90 *percent* of the ACQ in respect of old FSA and after fulfilling minimum commitments (80 *percent* of ACQ) under new FSA, the balance supply, if any, would be considered for incentive against old FSAs. This effectively implied that NTPC would need to pay additional PI for supplies beyond 80 *percent* of ACQ in new FSAs. Audit noticed that the extra incentive payment made by five stations¹⁵ on this account was ₹32.65 crore for the period 2013-14 and 2014-15.

Ministry stated (November 2016) that this was a commercial agreement reached in apex level meeting between CMDs of the two organisations.

The reply is not acceptable as the understanding arrived at between NTPC and CIL was disadvantageous to NTPC. Moreover, the additional expenditure incurred by NTPC has been passed on to the consumers.

3.1.5 Implementation of Fuel Supply Agreement

While FSA terms were negotiated at the corporate level, its implementation was carried out at the station level. Audit observed following shortcomings regarding implementation of FSA:

3.1.5.1 Deviation in monthly and quarterly scheduled quantities

The ACQ was divided into quarterly scheduled quantities, *viz.*, 25 *percent* each of ACQ in first and third quarter, 22 *percent* in second quarter and 28 *percent* of in the fourth quarter. Quarterly quantity was further divided into monthly scheduled quantity, which is one third of the quarterly quantity. FSAs provided that the deviation in monthly scheduled quantity up to 5 *percent* can be made with the written consent of both the station and the coal company but total variation in any month shall in no case exceed 10 *percent* of the scheduled quantity. For quarterly scheduled quantities, old FSA did not permit any excess supplies, while the new FSA permitted deviation with the written consent of both the station and the coal company.

Audit examined data regarding actual supplies vis-à-vis scheduled supplies in respect of stations selected in audit sample and observed that there were significant deviations in deliveries to stations, as given in **Annexure 3.1**. It was noticed that the supplies were rarely as per schedule and the deviation in supplies were beyond the permitted level in majority of months at all stations.

¹⁴ Farakka, Kahalgaon, Simhadri, Korba, Vindhyachal, and Rihand.

¹⁵ Rihand - ₹ 12.00 crore; Vindhyachal - ₹ 8.08 crore; Kahalgaon - ₹ 1.47 crore; Farakka - ₹ 9.29 crore; and Korba - ₹ 1.81 crore.

FSAs provided for monetary compensation for both short delivery by coal companies and short lifting by power stations when the annual supplies were below the specified trigger level. Audit observed that the earning of incentive by coal companies were not affected as long as there was no annual shortfall of supply. This led to a paradoxical situation where the stations suffered generation loss due to coal shortage while paying incentives for additional supplies made over the year. Review of records in audit did not indicate that the Company escalated this issue with coal companies to seek a remedy, though intra-year/temporary shortages forced the Company to tap costly sources of coal through e-auction, MOU and imports.

Ministry stated (November 2016) that NTPC regularly monitors the level of coal supplies and makes a very regular follow-up with coal companies for supplying coal. Ministry added that in a scenario of coal shortages, NTPC had no option but to agree to this clause and that NTPC shall again take up the issue with coal companies.

Considering that there was no disincentive in the FSA for short supply of monthly/quarterly quantities and the significant impact such short supply had on power stations, there may be a need to introduce safeguards in the FSA to enforce timely delivery of scheduled quantities, including monthly and quarterly supplies.

3.1.5.2 Non recovery of compensation for short supplies under FSAs

Review of payment of incentive by power stations on account of annual supplies beyond 90 percent and receipt of compensation from coal companies for short supplies below 80 percent of ACQ revealed the following:

(i) **Badarpur power station:** In the case of FSA with CCL, there was short delivery vis-a-vis ACQ in all the years of the period covered in audit. The stations claimed short delivery compensation of ₹21.23 crore for 2010-11, 2011-12 and 2013-14 but CCL did not accept the claim attributing the short delivery to force majeure conditions. The claim of ₹ 0.15 crore (2011-12) was waived off by the station and claim of ₹ 21.08 crore (2010-11 and 2013-14) was under consideration for waiver/verification. However, for a single year (2012-13), the delivery had been above 90 percent and for this, performance incentive of ₹1.21 crore was released to CCL. Thus on the one hand, Badarpur station failed to get the compensation amount for short delivery of coal from CCL amounting to ₹21.23 crore (2010-11 to 2015-16) as per the provisions of FSA, and at the same time, released performance incentive of ₹1.21 crore to CCL.

(ii) **Ramagundam power station:** South Eastern Coalfields Limited (SECL) and MCL could not adhere to the ACQ and short supplied coal (except in 2013-14 by SECL and in 2010-11 by MCL). Audit noticed that the station had claimed compensation for the short supply of coal amounting to ₹35.18 crore (2010-11 to 2015-16), which was not received (October 2016). However, the station paid performance incentives amounting to ₹126.87 crore to the coal companies for additional supplies in 2010-11 and 2015-16. Payment of performance incentive without recovery of compensation for short delivery was, therefore, not in order.

(iii) **Jhajjar power station:** During 2013-14 and 2014-15, there was supply deficit of 69.89 percent and 68.17 percent respectively *vis-à-vis* the ACQ. The compensation amount of ₹58.27 crore was not recovered by the station from MCL with whom it had FSA.

(iv) **Vallur power station:** From 2013-14 to 2015-16, the level of delivery of coal by MCL was short of ACQ by 36.31 percent (2013-14), 48.07 percent (2014-15) and 46.18 percent (2015-16). However, the Company did not claim any compensation from MCL.

Ministry stated (November 2016) that short supply of coal by the coal companies was on account of less rakes supplied by Railways and hence, the power stations were not eligible for the compensation. Regarding payment of PI, Ministry stated that the same was done in terms of relevant clauses of FSA.

The reply points out reasons for short supply of coal by the coal companies. Audit, however, has highlighted the payment of incentives to the coal companies by power stations despite short supplies particularly as short supply of fuel as pointed out above has a significant impact on functioning of the power stations.

3.1.5.3 Rationalisation of quantities under FSAs

Badarpur station had FSAs with ECL for an ACQ of 2 lakh tonne and with CCL for ACQ of 40 lakh tonne. Audit observed that CCL had consistently short supplied coal in all years covered in audit (except in 2012-13), which had attracted compensation of ₹21.23 crore from CCL. This was claimed, but were being considered for waiver by the station. On the other hand, ECL had been supplying more than the ACQ in all the five years and NTPC paid performance incentive of ₹47.06 crore during this period (2010-11 to 2014-15) to ECL. However, audit examination did not indicate that NTPC tried to address this situation by taking up the matter either with SCL-LT, Ministry of Coal or with Ministry of Power for re-appropriation of the quantity among ECL and CCL.

Ministry stated (November 2016) that NTPC took up the matter regarding rationalization of ACQ with CIL and the ACQ with CCL has been reduced from 4.00 to 1.72 Million MTPA in September 2016 and the balance quantity has been allocated to other station(s). Ministry added that FSA with ECL has been cancelled.

The action taken by the Ministry/ NTPC and resultant correction in allocation is noted.

3.2 Procurement of coal through MOUs

In addition to FSAs, power stations entered into Memoranda of Understanding (MOUs) with coal companies to supplement coal supplies. Procurement of coal through MOUs was not mandated under NCDP which provided for FSAs and e-auctions. Audit noticed that high premium was being paid for MOU procurements, even compared to maximum incentive of 40 percent over notified rates under FSA:

- Premium agreed by NTPC under MOU with SCCL was higher by ₹1600.64 crore (during April 2010 to March 2016).
- MOU of NTPC with ECL (January 2014 to March 2016) provided for premium of ₹1433.19 crore while MoU with NCL allowed for premium of ₹394.45 crore.

While entering into MOUs, NTPC compared the imported rates for coal. It was, however, noticed that the procurement cost under MOU was in some cases higher than the cost of imported coal. This was noticed in three stations, viz., Simhadri, Ramagundam and Talcher Kaniha. Besides, in July 2014, the import parity criterion was waived off for other stations, viz., Barh, Mouda, Dadri, Korba and Sipat, citing declining trend of imported coal prices, which also resulted in high cost coal being procured under MOUs.

Ministry stated (November 2016) that the premium for MOU coal was mutually agreed based on the premium realized by the coal companies in e-auctions in the past period and hence it may be reasonably deemed as the price discovered through competitive procurement only. Ministry added that alternatively, NTPC could have participated in the e-auctions conducted by the coal companies, but in such cases there was no assurance of winning the bids and as such coal security essential for running the power plant would not be available. Ministry further stated that power stations were designed for domestic coal and there were technical restrictions of blending imported coal with domestic coal and to avoid loss of generation, stations had to tie-up domestic coal, in spite of prices being more than imported coal on some occasions. Ministry also stated that coal companies with whom MoUs have been entered are public sector entities.

The reply is to be viewed against the fact that there has been no price discovery in case of MOUs and the premium payable under MOU procurement was decided only through negotiation. Agreeing to significantly higher rates, even considering the maximum incentive amount under FSAs would increase the power generation costs which would eventually be passed on to the consumers. Moreover, MOU route of coal procurement was not envisaged in the NCDP.

3.3 Procurement of coal through e-auction

The Company procured coal through e-auction to supplement the supplies under FSA. Audit reviewed the e-auction process and noticed that the benchmark price used by NTPC for bidding in e-auction was based on price of imported coal with GCV of 5700 kCal/kg. The Company derived the price of the coal being auctioned (as per GCV of the offered coal) based on this import price¹⁶. Audit noticed that there were significant differences between the derived price and the actual import price for the grade of coal on offer in e-auction. In such a situation, two scenarios could occur:

- where the import price for the grade of offered coal is lower than the derived price, the bid amount would be on the higher side and the Company would win the bid by quoting a higher amount for an inferior quality of coal.

¹⁶ For example, if the landed cost of imported coal of 5700 GCV was ₹5589 per MT, the landed cost of imported coal of GCV 1000 kCal/kg was taken as ₹0.981 (5589 divided by 5700). ₹0.981 was multiplied by the GCV of domestic coal being offered through e-auction and the prices were worked out backwards to achieve parity between domestic and imported coal prices.

- where the import price is higher than the derived price, the Company may be losing the bid.

NTPC stated (April 2016) that since the quantity procured is very low, this assumption may not significantly affect the fuel procurement for NTPC. Ministry noted the audit observation (November 2016).



Chapter 4

Import of Coal

The Company has been importing coal since 2005-06 to supplement domestic coal supplies. Prior to 2011-12, The Company was importing coal through Public Sector Undertakings (PSUs), viz., MMTC Limited and State Trading Corporation of India Limited. These PSUs imported coal through suppliers and charged a service margin over and above their cost. The New Coal Distribution Policy (NCDP) notified in October 2007 by Government of India, Ministry of Coal (MoC) stipulated that CIL shall supply coal to meet the normative requirement of consumers. NCDP provided that CIL could import coal and adjust its overall price accordingly.

In April 2009, ACQ of stations was reviewed by CEA in consultation with CIL, NTPC and power utilities. While the stations whose Commercial Operation Date (COD) was declared prior to 31 March 2009 were given ACQ as per the extant level of supply; the new stations, i.e., stations commissioned after 31 March 2009, got ACQ corresponding to normative requirement, i.e., 85 percent Plant Load Factor (PLF). Hence for declaration of capacity¹⁷ of stations above normative levels as well as for meeting disruptions in domestic coal supplies, the Company resorted to import of coal. The Company did not exercise the option of import of coal through CIL and imported coal on its own through tendering from November 2011 onwards.

The quantity of coal to be imported was fixed on a country-wide basis by Ministry of Power (MoP) on the basis of domestic coal availability and generation level for the year as assessed by CEA. A 'target' for import of coal was given to each generating utility. Details of import of coal by NTPC during the last six years ending 2015-16 and price comparison with domestic coal are tabulated in Table 4.1.

¹⁷ As per Indian Electricity Grid Code 2010, the generating stations shall make an advance declaration of their capacity foreseen for the next day, based on which the beneficiaries schedule drawal of power from the stations.

Table-4.1: Year-wise quantity and price of imported vis-à-vis domestic coal

Year	Target given for import	Quantity awarded	Actual coal import	Average landed cost of imported coal per tonne at stations (in ₹)*	Average landed cost of domestic coal per tonne at stations (in ₹)*	Difference in price between imported and domestic coal (in ₹)
	(in million tonnes)					
(1)	(2)	(3)	(4)	(5)	(6)	(7)=(5-6)
2010-11	13.90	12.00	10.50	7788	2325	5463
2011-12	15.45	4.00	12.00	8992	2790	6202
2012-13	16.00	12.00	9.10	6745	3017	3728
2013-14	16.60	7.83	10.80	6880	3374	3506
2014-15	16.60	18.88	16.40	5999	4653	1346
2015-16	12.00	7.00	9.70	5951	4415	1536

* Column 5 denotes average landed cost of imported coal of 10 stations and column 6 is the average weighted average cost of domestic coal procured through FSA, MOU and e-auction by 10 stations (out of 13 in the audit sample), data of which was provided to Audit. Badarpur was excluded since it used imported coal during 2010-11 only. Dadri and Vallur stations did not provide necessary data. These rates were further multiplied by 1.5 in order to arrive at normalized price of domestic coal vis-à-vis imported coal considering that 1.5 kg of domestic coal is equivalent to one kg of imported coal for consumption purpose.

Actual import of coal registered an increasing trend during the period from 2010-11 to 2011-12 and again during 2013-14 to 2014-15 but reduced in 2012-13 and 2015-16, however, prices showed a mixed trend. The quantity awarded exceeded the 'target' in 2014-15. Audit reviewed various aspects relating to import of coal and the observations are indicated below.

4.1 Policy framework for import of coal

Audit noticed that no specific policy was laid down by the Company for importing coal. While examining (November 2012) the draft Coal Import Policy 2012 recommended by the Committee of Directors, the Board constituted another sub-committee (Committee for Review of Coal Import Policy) to examine the evolution of Coal Import Policy since 2009 onwards, identify reasons for changes made in the policy from time to time, chart out future course of action and finalize a coal import policy. However, no comprehensive policy for coal import has yet been finalized over the past four years.

Ministry stated (November 2016) that policy for import of coal shall be put up to Board of Directors by the end of the year.

In absence of a comprehensive policy, there were instances of different approaches to key decisions such as splitting of quantity among bidders, qualification requirements, type/GCV of coal to be procured *etc.*, as pointed out below:

A. Splitting of packages

During the period from April 2011 to March 2016, the Company awarded 64 contracts (40 packages) for import of coal. 36 of the 40 packages¹⁸ {worth ₹ 22796.91 crore (approx.)}, for

¹⁸ Including two packages awarded as L2, due to spitting.

36.79 million tonnes of coal accounting for over 75 percent of the procurement by value} were awarded to a single entity, Adani Enterprises Limited. In the initial 17 packages awarded from February 2012 to February 2013, the entire package quantity was awarded to the L1 bidder and no splitting of quantity among qualified bidders was done. Subsequently, to enhance participation level, the Company decided to split the quantity among the qualified bidders. In the first tranche of 2013-14, NTPC envisaged splitting up the package quantity in the ratio 50:30:20 for award amongst L1, L2 and L3 bidder respectively, at L1 prices for the package quantity 1 MMT and above. It was decided that for package quantity between 0.5 MMT and 1 MMT, the quantity would be split in the ratio of 60:40 amongst L1 and L2 bidders respectively. However, these ratios were followed only for one tranche of three packages awarded on 31 October 2013, and in subsequent eight packages, the ratio was changed to 70 (L1):30(L2), but reasons for the change were not recorded. Subsequently, splitting of contracts was dispensed with after 'Reverse Auction' was introduced in August 2014. Hence there was an inconsistency regarding the splitting mechanism adopted by the Company across packages.

Ministry stated (November 2016) that in case of split ratio of 60:40/ 50:30:20, five to eight bidders purchased bidding documents and only two bidders submitted their bids in each of the packages. It was later decided to change the splitting ratio to 70:30 to keep parties motivated to quote aggressively to become L1 bidder. With change of splitting ratio to 70:30, 15 to 24 bidders purchased the bidding documents and three to six bidders submitted their bids in each of the packages. Ministry added that after changing the split-up ratio to 70:30, better award prices were achieved and the same were also closer to the cost estimates. All packages were awarded at L-1 prices only. Ministry also stated that Reverse Auction was introduced to bring about highest level of transparency and further ensures that no bidder gets any advantage vis-à-vis others on any ground other than the lower prices. Ministry further stated that in order to have wider participation, NTPC has been floating tenders for each package of procurement of imported coal on International Competitive Bidding (ICB) basis.

The reply has to be viewed against the fact that the change in the splitting ratio increased the quantity to be awarded to L1 bidder from earlier 50 / 60 percent to 70 percent. The increased level of participation cannot be attributed to modification of splitting ratio alone as there would be other factors including market conditions which would affect participation. Besides, Audit noticed that key qualification requirements¹⁹ were also changed in tandem with the change in splitting ratio, which may have affected the degree of participation. As such, it may not be possible to come to a conclusion based only on one tender that the poor response was due to the splitting ratio alone. It was also seen that prices were higher than cost estimates in 22 out of 36 packages examined by Audit.

¹⁹ (i) When splitting ratio was 50:30:20/60:40, minimum qualification requirement for a bidder to participate in the tender was that he must had an experience of supplying 50 or 60 per cent of package quantity. However, when splitting ratio was changed to 70:30, this was modified to 44 per cent of package quantity. (ii) Modified QR provided that a bidder meeting the requirement of supply and handling attributes could also participate in bids after tying up with mine owner(s) through a 'Letter of Authority' from them.

B. Re-tendering/annulment of packages

A review of the import orders revealed that in 22 out of 36 packages examined by Audit, the L1 rates obtained through the tender process were higher than the estimates²⁰. Audit noticed that the Company did not have a consistent approach in dealing with such cases.

- In 11 of these packages, the Company carried out re-tendering citing higher quotes received from bidders.
- In six cases (including 3 re-tendered packages), the Company carried out post-bid negotiations based on which the contracts were awarded.
- In the balance eight cases, the Company awarded the contracts without any negotiations or resorting to re-tendering.

Ministry stated (November 2016) that re-tendering/ annulment was carried out keeping in view NTPC's commercial interest and applying due prudence by taking note of coal stock position, demand for coal and coal prices arrived during tendering etc. Ministry added that all these decisions have been approved by Board/Sub-committee, as the case may be. Ministry further stated that higher expenditure would not reflect on the bottom line of NTPC since as per the business model, fuel cost was pass through.

The reply indicates that there was a certain degree of subjectivity involved in these decisions.

4.2 Source verification of quantity and quality of coal

The Company changed the Qualification Requirement (QR) for bidders in July 2013 in an attempt to bring about participation by mine owners abroad and obtain assurance about the quantity and quality of imported coal. The new QR stipulated that the bidder should be a mine owner or consortium with a mine owner as one of the parties. During pre-bid conference held on 23 July 2013, prospective bidders expressed that overseas mine owners were reluctant to sign such consortium agreements where they would be liable for supplying and handling part also. In order to address this, QR was modified and it was provided that a bidder having supply and handling experience could also participate in bids after tying up with mine owner(s) through a 'Letter of Authority' from them. Since the bid prices obtained with this condition was higher than cost estimates, the requirement regarding 'Letter of Authority' was relaxed in subsequent tenders. It was decided that the bidder would only submit a list of mines from which supply would take place.

Audit observed that, the bidders, in line with the relaxed conditions, submitted a list of mines (from 33 to 740 mines)²¹ from where they could source the coal. Hence the objective of obtaining assurance about the source, quantity and quality of coal from the coal producer never actually materialized as none of the bidders submitted the exact names of the mines along with quantity and quality (Gross Calorific Value-GCV) of coal to be imported from these mines.

²⁰ Award values were more than cost estimates by 0 to 5 percent in 10 cases; 5 to 10 percent in 8 cases; 10 to 20 percent in 1 case; 20 to 30 percent in 1 case and 30 percent & above in 2 cases.

²¹ The list of mines submitted by bidders mentioned 340 mines-AEL consortium; 535 mines- Knowledge Infrastructure System Private Limited (KISPL); 33 mines – MBG Commodities Private Limited (MBG) and 740 mines – Trimex International FZE (TIF) Consortium (in respect of 1.3 MMT package for Simhadri and Ramagundam)

Ministry stated (November 2016) that there are a number of small coal mines in Indonesia and hence bidders used to declare a substantial number of mines in the above mentioned format. Ministry added that once the source of coal mine(s) is declared by the successful bidder, he is bound to supply the coal from only the declared mine(s), meeting the technical specification of coal. It was also stated that the objective of obtaining assurance about the quantity and quality of coal was fulfilled with source declaration.

The reason for non-participation of mine owners abroad was supply and handling of coal up to station end. Instead of addressing this concern, the Company relaxed the requirement of declaration for specific mine (s). Though declaration of specific mine(s) would have caused some inconvenience to the bidders, the same would have provided assurance to the Company about quantity and quality of coal being procured by the bidder.

4.3 Indices adopted for price settlement of imported coal

NTPC imported coal from Indonesia under 15 packages involving 14.6 MMT during February 2012 to February 2013. As per bid conditions, FOB coal price quoted was subject to variations for payment purposes, considering lower of the specified indices²² on base date and weekly basis, based on indexation.

Coal pricing was based on Gross Calorific Value (GCV) and GCV measured on 'Air Dried Basis' (ADB) was used for payment of imported coal. The Indonesian coal index, which was one of indices considered for payment settlement, reported GCV on 'Gross as Received' (GAR) basis. Audit noticed that the GCVs worked out on ADB and GAR basis were considerably different, the GCV being higher on ADB basis compared to GAR. The GCV of coal required for the imported coal packages was 6300 kCal/kg worked out on ADB basis. This would translate to GCV in the range of 5800 on GAR basis. NTPC indicated in the contract document that one of the parameters for price basis was GCV of 6300 kCal/kg (on ADB basis) and that FOB prices would be subject to variation considering specified indices, including Indonesian Coal Index of 6500 GAR. Audit observed that since the appropriate Indonesian Coal Index was not specified, (6500 GAR was specified instead of 5800 GAR), extra expenditure was entailed at the time of payment for coal deliveries.²³ Difference in price per tonne of Indonesian coal, as per 6500 GAR and 5800 GAR ranged from 11.97 USD to 18.75 USD (rates which prevailed on award dates). Since the imported coal supplies were from Indonesia, adoption of appropriate index was important.

Ministry stated (November 2016) that the bidders would include the impact of all the probable risks and other commercial conditions in their bid prices, irrespective of the

²² (i) CERC methodology (which comprised of indices for the Richard Bay API4 for 6000 kCal/ Kg NCV, Newcastle Export Index (NEX) for 6700 kCal/ Kg GAD and Global Coal New Castle (GCNEW C) for 6000 kCal/ Kg NCV with weightage 50:25:25); (ii) Methodology using the Indices for the Country of Origin of Coal (in this case one of the indices considered was Indonesian Coal Index (ICI) 6500 GAR).

²³ For example, in the bid opened on 3.2.2012, the bidder quoted 97.35 \$ per tonne for coal of GCV 6300 (GCV to be assessed on ADB basis). The market price of coal as per Indonesian Coal Index 6500 (GAR basis) at that time was 113 \$. The quoted price, which was accepted, was lower than the market price as per this index. However, the market price as per Indonesian Coal Index 5800 (GAR basis), which was the appropriate index at that time was 94.25 \$ but the quoted price was higher than this value. The same analogy was applicable during price settlement at the time of actual delivery also.

particular index number used. Ministry added that indices were used only for the payment of price escalation.

The reply is to be viewed against the fact that adoption of appropriate index was crucial for payment purpose, including escalation with reference to base date, since coal pricing varied according to moisture and basis of reporting (ADB or GAR).

Chapter 5

Assessment of Quality and Quantity of Coal

In coal fired power stations, coal of appropriate quality is essential for proper combustion and operational efficiency of the boiler. Pricing of coal also depends on its quality or 'Grade'. Accurate assessment of quality and quantity of coal is crucial to appreciating the adequacy and efficiency of inputs of the power station. Audit examined assessment of coal quality as well as weighing of coal and the findings are detailed below.

5.1 Sample collection and methods of measurement for coal quality

The most important quality parameter for coal is its heat value referred to as 'Gross Calorific Value' or GCV. Pricing of coal by coal companies and pricing of energy by generating companies depends significantly on the GCV of coal. GCV depends on the location from which samples are collected and the method used for its measurement.

A. Quality of coal

Different methods of measuring GCV were used for different purposes. Three methods²⁴ were seen to be used:

- For imported coal, GCV was reported on 'Air Dried basis' (ADB) while paying for coal imports.
- For payment to domestic coal companies for supplies, GCV was reported on 'Equilibrated basis' (EB)
- For energy billing, the stations reported GCV on 'Total Moisture basis' (TMB)

The different methods used for assessing GCV lead to the following:

- (i) For a given sample, ADB method gives the highest GCV value followed by EB method. The TMB method gives the lowest GCV value among the three methods.
- (ii) GCV on ADB basis gave undue advantage to the supplier since moisture present in coal, i.e., the sample, gets dried in the process for determination of GCV for payment to the coal suppliers. As a result, payment was made without taking into account loss of heat value due to moisture, but the coal actually fired in the boilers had the moisture content.
- (iii) Energy tariff (as per formula mandated by CERC) is inversely proportional to GCV. A lower GCV would thus lead to higher tariff. TMB method, which gives the lowest GCV, is used by stations for billing which would lead to higher burden on consumers. At the same time, coal companies are reimbursed on ADB (for imports) and EB (for domestic supplies) which gives a higher GCV and hence higher payment.

²⁴ (i) Total Moisture Basis – GCV is reported taking into consideration the total moisture, i.e., moisture inherently present in coal and surface moisture present in the sample. (ii) Equilibrated Basis – The sample is brought to standardized moisture and humidity levels and GCV of the resultant sample is reported. (iii) Air Dried Basis - The given coal sample is air dried, as per procedure given by the Bureau of Indian Standards and the GCV is measured thereafter.

B. Quantity of coal

The method of estimation of quantity of coal did not provide adequate assurance regarding its accuracy:

(i) The collection of samples was done by private agencies at the stations and control mechanisms such as witnessing of the sample collection by Company's employees and maintenance of log book for collection was not found on record. The significance of representative sampling can be gauged from the fact that a 1000 MW station requires around 25000 tonnes of coal per day and GCV of this quantity of coal is assessed once daily, by placing one gm of the processed coal sample in the Bomb Calorimeter (device used to measure GCV).

(ii) GCV test results given by the Bomb Calorimeter were manually entered into a register maintained for the purpose, and thereafter entered into the computerized system. There was an option to print the GCV test results carried out by the Bomb Calorimeter but such printed results were not maintained by the stations.

Ministry stated (November 2016) that total moisture based GCV is the standard industry practice. Ministry further stated that payment for domestic coal was as per the provisions of FSA and for imported coal it was on the basis of competitive bidding and hence did not result in any undue advantage inter-se to any-one supplier over the others. Ministry added that in case of imported coal, GCV is measured on ADB basis, however, adjustment is made for excess moisture. Regarding collection of samples, Ministry stated that this was highly labour intensive and hence outsourced but appropriate supervision was undertaken by NTPC personnel.

The reply is to be viewed against the following:

- (i) Total moisture method, though adopted by power utilities, was not expressly provided for in CERC regulations. GCV reported under total moisture method was lower by around 280 to 350 kCal/kg²⁵ when compared to EB. CEA has stated that reduction in GCV by 100 kCal/kg would increase consumption by three *percent*. Hence there may be a need for standardising the method of reporting GCV.
- (ii) Regarding adjustment for excess moisture in imported coal, it was seen that the specified moisture level, as per contract was 25 *percent* and tolerance limit for rejection was 32 *percent*. Supplies in the range of 25 to 32 *percent* moisture were accepted with reduction in quantity for excess moisture. Hence adjustment carried out for 'excess' moisture vis-a-vis tender specification, did not address the loss of heat value due to determination of GCV on ADB, for payment of imports.
- (iii) Though Ministry has stated that appropriate supervision of collection of samples by outsourced agency was undertaken by NTPC personnel, Audit noticed that payment to the agency was made based on quantity of coal brought to the lab. Maintenance of records to ensure integrity of sample collected such as logbook for

²⁵ As per Fuel Audit Report of Central Power Research Institute uploaded on the web site of Punjab State Electricity Regulatory Commission.

recording collection particulars, witnessing of collection by NTPC personnel etc. were not in practice.

5.2 Reduction in heat value (GCV) of coal

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, GCV of coal ‘as received’ at the unloading point of the power station and GCV of coal ‘as fired’ in the boilers for a year (from October/November 2012 to September 2013)²⁶ in the stations covered in audit. It was observed that GCV of coal progressively decreased from the ‘as billed’ stage to the ‘as fired’ stage, though as per CEA, the three GCV values, *i.e.*, GCV ‘as billed’, ‘as received’ and ‘as fired’ should be approximately same barring minor losses due to storage. The differences in GCV are summarized below:

Table-5.1: Station-wise GCV differences during October 2012 to September 2013

Sl. No.	Name of station	Range of GCV differences between different stages					
		(kCal/kg)					
		‘As billed’ and ‘As received’		‘As received’ and ‘As fired’		‘As billed’ and ‘As fired’	
		Low	High	Low	High	Low	High
1	Dadri Stage– I	286	788	(-)74	618	543	1097
	Dadri Stage– II	286	788	(-)72	703	453	1155
2	Badarpur	1134	1943	573	976	2012	2682
3	Korba Stage-I&II	108	826	144	672	595	1143
	Korba Stage– III	108	826	141	673	592	1136
4	Vindhyachal	13	28	10	17	27	38
5	Talcher Thermal	5	51	326	383	354	395
6	Rihand	674	1178	197	616	971	1715
7	Vallur	(-)180	1405	0	980	(-)95	1405
8	Sipat	N.A.	N.A.	78	632	N.A.	N.A.
9	Farakka	N.A.	N.A.	199	358	N.A.	N.A.

Note: GCV difference between ‘As billed’ and ‘As received’ as well as ‘As billed’ and ‘As fired’ was not calculated for Sipat and Farakka as the stations did not provide GCV ‘As billed’ data. Three stations, viz. Jhajjar, Ramagundam and Mouda, did not provide the necessary data for making the comparison. Barh-II was commissioned in November 2014, i.e., subsequent to the period of above comparison.

As can be seen from the above table, except in Vindhyachal, the difference in GCV between ‘as billed’, ‘as received’ and ‘as fired’ was significant irrespective of whether the station was pithead or non-pit head (it is expected that the difference in case of pithead stations would be much lesser than non-pit head stations owing to the shorter transportation of coal). The above

²⁶ During these months GCV figures were available for the three locations, *i.e.*, at the loading point (‘as billed’), at the unloading point at the station (‘as received’) and at the boiler (‘as fired’). GCV ‘as received’ was not measured by the stations in other months. Beyond July 2014, the location for collection of sample for measurement of GCV was changed to ‘secondary crusher’ from the ‘bunker/firing’ stage, hitherto adopted, for billing of energy charges.

GCV reduction increased energy charges billed to the beneficiaries, as explained in subsequent para 5.2.1.

Ministry stated (November 2016) that sampling (for GCV 'As received') was done as a quick check/on trial basis for limited purpose of optimization of combustion in Boiler and the values were used to take up the issue with coal suppliers for taking necessary actions. Ministry further stated that though coal bill payments were regulated based on the GCV analyzed at power station end, the final settlement took place by extrapolating the GCV analyzed by the third party at mine end only, in terms of the communication from Ministry of Finance, Govt. of India. Ministry added that the coal collected from wagons were not representative in nature and did not reflect true GCV.

The reply is to be viewed against the fact that payment to coal companies was regulated by stations based on GCV 'as received' at stations during the above mentioned period. The contention that samples of coal collected from wagons at the receiving end were not representative is not tenable as samples were collected from wagons itself at the mine end to arrive at the 'as billed' GCV of coal. Besides, while the GCV differences between 'as billed' and 'as received' stage involved other parties, viz., coal companies and Railways, difference in GCV between 'as received' and 'as fired' values was attributable entirely to the power stations. However, the same was passed on to consumers while billing for energy.

5.2.1. Impact of GCV differences on efficiency and energy charges

Operational efficiency of power stations is regulated through a parameter called 'Station Heat Rate' (SHR)²⁷, which denotes the input heat value incurred by the station to produce one unit of energy. SHR depends on the quantity as well as quality/grade of coal used by the station. CEA, in its 'Recommendations on operation norms for thermal power stations, tariff period 2014-19' pointed out that the difference between 'as received' GCV vis-à-vis 'as fired' GCV would be very marginal and would be solely on account of marginal loss of heat during the coal storage. CEA added that 'international publications indicated a loss of heat value of about one *percent* for one year storage for high rank coals and three *percent* coal storage for low rank coals' and went on to comment that even after considering a three *percent* heat loss for Indian coals, 'the average loss of heat value for ten days storage would be about 0.08 *percent*' and added that storage losses of coal were almost negligible especially for low storage periods as in Indian stations.

The power stations reported SHR using GCV 'as fired'. The SHR values, so determined, were well within the laid down CERC norms and hence the stations were considered to be efficient. Audit compared the reported SHR (using GCV 'as fired') with the SHR worked out using GCV 'as received'²⁸ for the period October 2012 to September 2013²⁹ and found that SHR worked out on the basis of GCV 'as received' was significantly higher at stations indicating lower efficiency (**Annexure 5.1**).

²⁷ Station Heat Rate = $\frac{\text{Quantity of coal} \times \text{Gross Calorific Value}}{\text{No. of units of energy generated}}$

²⁸ GCV 'as received' was reduced by storage loss as envisaged by CEA, i.e. 0.08 *percent* for 10 days. For pit head stations storage loss was calculated for 15 days and for non pit-head stations storage loss was calculated for 30 days, as per CERC norms for coal stock.

²⁹ The only period when the stations measured GCV 'as received'.

Audit also worked out the difference in energy charges considering the ‘as received’ and ‘as fired’ stage for the same period (October 2012 to September 2013). It was seen that during this period, Energy Charge Rate (ECR) worked out on ‘as fired’ basis was higher than ‘as received’ basis by ₹0.03 to ₹0.96 *per unit* of electricity for the different stations, as per details given below:

Table-5.2: Summary of higher energy charges due to GCV difference

Sl. No.	Station Name*	Range of difference in ECR	Total impact (₹in crore)
1	Dadri Stage– I	(-)0.06 -0.43	135.64
	Dadri Stage – II	(-)0.07 -0.46	165.06
2	Badarpur	0.58 -0.96	324.73
3	Korba Stage -I&II	0.05 -0.18	161.01
	Korba Stage – III	0.03 -0.16	32.65
4	Vallur	0.06-0.45	58.25
5	Sipat	0.04 -0.23	144.36
6	Rihand Stage I	0.09 - 0.17	87.26
	Rihand Stage II	0.11 -0.21	121.90
	Rihand Stage III	0.05 -0.25	30.89
7	Talcher	0.09-0.11	31.97
8	Farakka I & II	0.17-0.38	110.23
	Farakka III	0.17 -0.38	36.38
9	Vindhyachal	Not calculated as GCV differences were minor	
Total			1440.33

Overall, for the eight stations studied in Audit, energy charges billed on ‘as fired’ basis was higher by ₹1440.33 crore for a one year period (October/November 2012 to September 2013).

Ministry stated (November 2016) that during the period (October/November 2012 to September 2013) CERC Tariff Regulation did not envisage GCV ‘as received’ for ECR computation. Ministry added that the formula for calculation of energy charges as per CERC Regulations provided for using GCV on ‘as fired basis’ and billing was made accordingly. Ministry further stated that Dadri and Badarpur stations also used washed coal in significant quantities but GCV ‘as received’ was not measured for the same and added that GCV was not determined for ‘diverted in’ and e-auction coal also. Ministry also stated that ‘as received’ GCV measured to take up with the coal companies was on Equilibrated basis (EB) while GCV ‘as fired’ was on Total Moisture (TM) basis and the two values would be different depending on the total moisture.

The reply is to be viewed against the following:

(i) Though CERC Tariff Regulations provide for energy billing on GCV ‘as fired’ values, measurement of GCV on TM basis was not expressly mentioned in the Regulations. It is pertinent to note that TM method gives lower GCV values and correspondingly increases energy charges.

(ii) CEA, in its 'Recommendations on operation norms for thermal power stations, tariff period 2014-19' stated that "any arbitrary practice of using as fired GCV for SHR computations without proper guidelines for determining the same would only lead to inflated claims of coal consumption". This is reflected in the SHR worked out considering GCV 'as received' by Audit.

(iii) The Company has not clarified whether GCV was less for the types of coal mentioned- washed coal, coal procured through e-auction and 'diverted in' coal. Besides, their effect on the overall GCV would be minimal considering that their quantities were marginal.

5.3 Weighment of domestic coal

As per FSA between power stations and coal companies, payment for the coal supplies was made as per the weighment carried out at the delivery/loading point at mine end. The FSAs also provided for weighment at unloading point (power station) in order to ensure recalibration of weigh bridges at loading point. It was, however, noticed that stations covered in audit (pithead as well as non-pithead stations) did not regularly weigh domestic coal (*i.e.*, coal procured through FSA, MOU and e-auction) when the wagons arrived at the station, though in-motion weigh bridges were installed in these stations. Due to non-weighment of coal on arrival, the stations lost the opportunity to cross verify the quantity of coal and ensure that there were no errors in weighment at the loading point.

As a test case, at Vindhyachal station, the in-motion weighbridge remained out of order during 840 days (46 *percent* of time) during five years ended 31 March 2015. After the first calibration in October 2009, the next calibration was carried out five years later, only in February 2014. At Barh station, weighment started only from December 2015, while at Farakka station, weighment started in November 2015. Non-weighment of coal resulted in deficiencies in ascertaining transit loss.

Ministry stated (November 2016) that in terms of the FSA, payment for coal billing is required to be released based on weight measured at loading end and there was no requirement of weighing at station end. Ministry added that coal weighment was done occasionally at station end for the purpose of cross checking. Ministry further stated that weighing system at Vindhyachal is working satisfactorily now.

The reply is to be viewed against the fact that though the payment for coal was to be made as per the weighment at loading point, the Company had the resources to weigh the rakes at the station and cross check the weighment at loading point. But the in-motion weighbridges at stations either were frequently under outage or stations were not following the practice of weighing coal on receipt.

5.4 Weighment of imported coal

The agreements for import of coal provided for payment based on quantity received at the station. Audit observed certain inadequacies at stations in this regard:

- (i) Vindhyachal station was not weighing imported coal received at the power station till February 2014 and was making payment on the basis of quantities mentioned in

Railway Receipt (RR). Further, out of total 353 rakes of imported coal received during 2014-15, only 208 rakes were weighed.

- (ii) One Wagon Tippler associated with Vindhyachal-III commissioned on 31 December 2014 was without 'in-operation' weighing arrangement. As such, quantity of coal unloaded using this wagon tippler was being accepted based on quantity indicated in RR. Second set of in-motion weigh bridge was commissioned only in July 2015.

Management stated (April 2016) that a lot of efforts were taken up at Vindhyachal station to stabilize the weigh bridge operation at the station end which included various modifications in the weigh bridge in consultation with the supplier and commissioning of the second weigh-bridge in July 2015.

The corrective steps taken by the Company are noted. The fact remains, however, that even imported coal, which was required to be weighed at station for payment purpose, was not weighed in Vindhyachal nearly half the time (imported coal was not weighed for 840 days during five years ended 31 March 2015).

5.5 Assessment of transit loss through indirect method

Transit loss is the difference between quantity of coal dispatched from the mines and quantity of coal received by stations. CERC Tariff Regulations provided normative transit and handling loss of 0.8 and 0.2 *percent* for non-pithead stations and pithead stations respectively. Transit losses up to this extent could be recovered through tariff and any loss beyond this limit was to be borne by the station. The stations adopted an indirect method called 'volumetric method' for ascertaining transit loss instead of weighing the railway rakes when they arrive at the station to find the loss. As per this method, assessment of actual transit loss was carried out by way of physical verification of closing stock of coal stored in the yard and bunker at the end of every quarter. The quantity of coal physically verified on quarterly basis was compared with the quantity that should have been present in the yard as per billing records. The difference between physically verified stock and closing stock as per billing records was worked out and considered as the transit and handling loss. For determining quantity of coal present in the yard, mathematical formula for converting volume into weight is used, based on dimensions of coal stacked in heaps in the coal yard (hence referred to as volumetric method). Audit reviewed the transit and handling loss for domestic and imported coal at the stations in the audit sample and found that the losses were very close to the normative transit loss of 0.8/0.2 *percent* fixed by CERC. The issues noticed regarding transit loss are highlighted below:

- (i) Volumetric method of ascertaining transit loss is an indirect method since coal was not actually weighed at station at the time of receipt. Instead, mathematical formula was used to convert volume to weight using density of coal. Density, however, could be subjective since coal is not a homogeneous mixture like oil and, hence, density is likely to vary depending on the point in the coal heap from where the sample are taken for measurement of density.

- (ii) Inaccuracy of the transit loss ascertained using this method was further evidenced by the fact that coal physically verified at the coal yard at the following stations was even more than the storage capacity of the yard.

Table-5.3: Coal stock in excess of coal yard capacity

Sl. No.	Name of station [@]	Physical quantity of coal more than the storage capacity of the yard *		Excess coal stored above storage capacity (in percentage)
		Quarters (in No.)	Quarters	
1	Badarpur	6	Q II (2013-14)	17
			Q IV (2013-14)	6
			Q IV (2014-15)	30
			Q I (2015-16)	114
			Q II (2015-16)	94
			Q III (2015-16)	48
2	Sipat	1	Q I (2015-16)	37
3	Mouda	5	Q III (2014-15)	18
			Q IV (2014-15)	22
			Q I (2015-16)	41
			Q III (2015-16)	37
			Q IV (2015-16)	23
4	Rihand	5	Q IV (2010-11)	9
			Q I (2015-16)	36
			Q II (2015-16)	31
			Q III (2015-16)	28
			Q IV (2015-16)	17
5	Ramagundum	3	Q IV (2012-13)	1.7
			Q IV (2014-15)	23
			Q I (2015-16)	5
6	Vindychal	2	Q IV (2014-15)	16
			Q I (2015-16)	30
7	Farakka	2	Q IV (2013-14)	13
			Q IV (2015-16)	38
8	Korba	5	Q I (2010-11)	13
			Q I (2011-12)	1
			Q II (2011-12)	2
			Q IV (2014-15)	11

* Calculated based on the data regarding storage capacity provided by Corporate Office.

@ Jhajjar did not provide data and Vallur did not provide quarter-wise data. Instances as mentioned above were not seen in the case of Dadri, Talcher and Barh.

In all the above mentioned stations, coal quantity physically verified at the yard was more than the storage capacity in the yard. Notably, at Badarpur station, during two quarters in 2015-16, physical quantity of coal as per the verification reports was 94 to

114 *percent* more than the storage capacity of the yard. This raised doubts on the correctness of coal stock and transit loss reported by the stations.

- (iii) Despite investing in facilities like ‘in-motion weighbridge’, the stations have not been using the same for weighing coal receipts and ascertaining actual transit loss. Local Management Instructions were silent regarding ascertaining transit loss.
- (iv) Since the actual transit loss was not properly ascertained, the station did not take up the issue/lodge claim with Railways regarding en-route theft/pilferage, if any, of coal from wagons.

Ministry stated (November 2016) that weighment of coal by volumetric method was being done as per the practices prevalent in the power industry in the country.

The reply is to be viewed against the deficiencies of volumetric method as pointed out above. Since the Company had the resources to ascertain the actual transit loss at the time of receipt of coal itself, the same should have been used.



Chapter 6

Coal Supply Management

One of the important functions in operating a power station is to ensure uninterrupted supply of coal so that generation loss due to coal shortage does not arise. Coal was required for 'declaration of capacity' (DC) of stations, even though the beneficiaries may not schedule power from the station. The Company operated nine pithead power stations where coal was moved from mine to the power station through the Company's own rail network and wagons called Merry Go Round (MGR) system. In the nine non-pit head stations, coal was transported in wagons from the linked mines to the power station through the Indian Railway network. Imported coal was transported by shipping vessels and upon reaching the ports, coal was shifted to railway rakes for onward transportation to designated stations. Audit reviewed various aspects relating to coal supply management and observed as under:

6.1 Coal stock at stations

Daily coal stock at stations was monitored at Corporate Office level through an online system where stations provided data relating to their daily consumption and stock. Audit noticed that coal stock position was at critical (less than 7 days' requirement considering 90-92 percent PLF) and super-critical (less than 4 days' requirement) levels at various stations during the period 2012-13 to 2015-16, as per details given in table below:

Table-6.1: Details of coal stock below critical and super critical level

(Number of days)

Station Name	2012-13		2013-14		2014-15		2015-16	
	Critical	Super critical	Critical	Super critical	Critical	Super critical	Critical	Super critical
Singrauli	80	83	37	103	-	156	-	-
Rihand	29	79	75	103	24	229	-	-
Unchahar	119	131	17	161	16	153	-	-
Tanda	-	-	79	-	15	117	-	-
Badarpur	123	119	60	38	19	91	-	-
Dadri	19	309	68	209	43	107	-	-
Korba	61	232	11	3	44	146	47	26
Vindhyachal	62	128	26	148	21	195	-	-
Sipat	5	229	10	100	17	227	-	-
Farakka	-	365	68	122	34	84	94	15
Kahalgaoon	34	331	13	91	17	53	30	76
Talcher Kaniha	24	341	40	322	71	59	-	-
Talcher Thermal	31	8	-	-	-	-	-	-
Barh	-	-	-	-	90	-	51	-
Ramagundam	166	110	39	231	-	57	-	-
Simhadri	26	278	5	330	56	92	20	-
Mouda	-	-	-	-	48	81	-	-

Audit also noticed that domestic coal stock dropped to **zero level** at various stations during 2012-13 to 2014-15 as per details given in **Annexure 6.1**. It can be seen from the above table that during 2012-13, the stock level was at super critical position in seven stations for more than six months. Similar situation prevailed in four stations during 2013-14. There was some improvement in 2014-15 but three stations reported super critical stock levels for more than six months. During 2015-16, the situation improved significantly at all stations except Korba, Farakka and Kahalgaon where coal stock level was super critical for 26 days, 15 days and 76 days respectively.

Ministry stated (November 2016) that coal stock at various stations was closely monitored and the matter was continuously pursued with coal companies, MoP, MoC and Railways at various forums. Ministry added that the actual coal supply was the responsibility of coal companies and the short supply might be due to various reasons including less production from mines or railway constraints etc. Ministry further stated that during negotiations over FSA terms, coal was supplied to NTPC stations under short term MoUs.

The reply needs to be seen against the fact that during 2012-13 and 2013-14, supply of coal to stations was disrupted due to delay in signing of FSA and payment dispute with coal companies. Import of coal also did not significantly mitigate fuel shortage since imported coal could only be blended up to 30 percent. Hence the Company resorted to costly options for procuring domestic coal such as MOU at premium rates, involving higher costs.

6.2 Generation loss due to coal shortage

There were instances of units being taken out of operation or being operated at partial load in view of coal shortage during the period from 2010-11 to 2015-16. Audit noticed that during this period, 11 out of 13 stations covered in audit reported a generation loss of 19546.26 million units of electricity with potential revenue loss of ₹4299.80 crore as indicated in the table below:

Table-6.2:Station-wise generation loss due to coal shortage

Sl. No	Name of station	Total generation loss (million units)	Revenue loss (₹ in crore)
1	Dadri	789.05	275.09
2	Badarpur	321.77	135.46
3	Vallur	2829.04	563.36
4	Mouda	422.27	157.73
5	Rihand	2766.41	432.45
6	Jhajjar	1303.41	530.81
7	Sipat	592.52	95.42
8	Vindyachal	4643.94	762.21
9	Farakka	3308.87	886.30
10	Ramagundum	2105.23	412.05
11	Korba	463.75	48.92
Total		19546.26	4299.80

Audit observed that while the stations suffered generation loss due to coal shortage on the one hand, they paid performance incentive to coal companies for excess supply of coal beyond ACQ on the other. Audit also noticed that the FSA allowed transfer of coal meant for one station to another station, if both stations were wholly owned by the Company. However, this provision of transfer was used sparingly.

Ministry stated (November 2016) that in spite of best efforts, coal shortages were there in the country on some of the occasions due to unavoidable problems in mining, natural calamities, seasonal issues *etc.* Regarding inter-station transfer of coal to address shortages of coal, Ministry stated NTPC has used the provision on many occasions during the period under audit, as per FSA terms.

Though Ministry has stated that provision for inter-station transfer of coal was used to address shortages, the fact remains that the efforts taken by the Company to tide over coal shortages proved inadequate as 11 stations suffered generation loss of 19546.26 million units due to shortage of coal.

6.3 Declaration of capacity of station despite non-availability of coal

Even on days when the coal stock was zero, it was possible for the station to generate power with the help of coal received through railway rakes/MGR system during the day. But any unduly positive presumption regarding coal receipt could lead to a generation default and penalty in the form of Unscheduled Interchange (UI) charges. Four power stations (Dadri Stage I & II, Badarpur, Jhajjar and Mouda) incurred UI charges during the period from 2010-11 to 2015-16 amounting to ₹101.41 crore due to such generation default. Audit observed that 'Local Management Instructions' issued by the stations did not provide specific guidance for capacity declaration of stations so that payment of UI charges could be avoided.

Ministry stated (November 2016) that declaration of capacity is done on daily basis based on different parameters including the availability of coal and added that provisions of the Grid Code were followed and there was no violation of the same.

Since capacity declaration is a key decision taken by stations on a daily basis, NTPC may consider laying down guidelines for the same, especially in view of financial implication of any failure to make available the capacity.

6.4 Storage capacity of coal yards at power stations

As per CERC Tariff Regulations, interest on capital equivalent to fuel charges for 15 days' consumption of coal was allowed as part of fixed charges for pit head stations and 30 days' consumption for non-pithead stations, on normative basis. Details of coal storage capacity of 17 stations was examined by Audit and observed that in six stations, *viz.*, Rihand, Badarpur, Dadri, Korba, Farakka and Kahalgaon, the storage capacity was less than the above norm of 15/30 days' requirement. Shortage in capacity as a percentage of requirement ranged from 2.60 percent (Rihand) to 53.62 percent (Farakka). Further, import of coal by stations warranted earmarking a specific area for storage of imported coal, which in turn, limited the space available for storage of domestic coal.

Ministry stated (November 2016) that imported coal was stored separately in the yard and that any portion of the yard could be earmarked for storing imported coal based on requirement.

The reply is to be viewed against the overall shortage in the storage capacity of coal.

6.5 Storage of domestic coal along with imported coal

As per 'Local Management Instructions' issued by the stations, imported coal was to be stacked separately in identified yard at earmarked stockpiles.

Physical verification of both domestic coal and imported coal kept in coal yards was carried out by the stations at the end of every quarter. Physical verification reports (April 2010 to March 2016) of coal stock were reviewed in Audit and it was observed that domestic and imported coal were stored in the same yard as per details given below:

Table-6.3: Details regarding storage of imported coal in domestic coal yard

Sl. No.	Station	Quarters when imported coal quantity exceeded the storage capacity of imported coal yard		Imported coal in excess of imported coal yard capacity (in %) ³⁰
		No. of quarters	Quarters	
1	Vindychal	4	Q IV (2014-15)	50
			Q I (2015-16)	127
			Q II (2015-16)	73
			Q III (2015-16)	28
2	Mouda	6	Q III (2014-15)	158
			Q IV (2014-15)	121
			Q I (2015-16)	127
			Q II (2015-16)	53
			Q III (2015-16)	61
			Q IV (2015-16)	50
3	Sipat	2	Q 4 (2014-15)	62
			Q I (2015-16)	12
4	Dadri	1	Q II (2013-14)	147
5	Farakka	3	Q I (2011-12)	78
			Q II (2011-12)	6
			Q IV (2013-14)	57

The above instances indicated that domestic and imported coal were stored in the same yard. Audit noticed that at Dadri station, domestic coal constituted 7.50 percent to 61.31 percent of coal kept in the imported coal yard and during the period from April 2014 to September 2014, more than half the coal present in imported coal yard was domestic coal. The deficiencies in proper storage affected the blending ratio, which was an important component

³⁰ $\frac{\text{Imported coal as per physical verification of stock} - \text{Storage capacity of imported coal yard}}{\text{Storage capacity of imported coal yard}} \times 100$

in determining the Energy Charge Rate recovered from consumers.

Ministry stated (November 2016) that imported coal was stored separately in the yard and that any portion of the yard could be earmarked from time to time for storing imported coal based on requirement. Ministry added that it is also possible to stack more than the yard capacity in short run by increasing the height of the stock-piles.

Since domestic coal and imported coal were stored in the same yard, the chances of both types of coal getting mixed in the yard itself even before they were actually blended, was high. In view of the deficiency as pointed out above, the blending ratio declared by the station may not be the actual ones due to mixing of the two types of coal at the yard itself.

6.6 Railway logistics

Nine stations of the Company were rail-fed stations and hence proper railway logistics had an important role in the day to day operation. Pithead stations also utilized railway network for bringing imported, MOU and e-auction coal. Audit observed the following inadequacies in railway logistics:

6.6.1 Payment of demurrage charges

The coal supplied through railway rakes was required to be unloaded within a stipulated period known as 'Free Time', beyond which demurrage was charged by Railways. All the 13 stations selected for audit paid demurrage charges amounting to ₹129.67 crore during the period from 2010-11 to 2015-16.

Table-6.4: Year-wise demurrage paid by power stations

(₹ in crore)

Sl. No.	Name of station	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	Total
1	Barh	0	0	0	0	1.57	3.58	5.15
2	Sipat	1.79	0.26	2.31	0.98	5.91	3.73	14.98
3	Mouda	0	0	0	1.22	6.56	0.26	8.04
4	Rihand	0.26	0.11	0.05	1.11	3.49	0.94	5.96
5	Vindhyachal	0.87	0.50	0.04	5.64	3.96	2.02	13.03
6	Korba	0.05	0.57	0.77	0.47	1.15	1.27	4.28
7	Dadri	1.23	0.98	1.87	3.75	2.41	1.63	11.87
8	Badarpur	1.58	1.39	1.79	3.72	1.15	0.83	10.46
9	Ramagundum	0.92	0.66	0.40	3.66	1.44	0.01	7.09
10	Farakka	3.17	2.63	2.50	8.23	5.35	10.63	32.51
11	Talcher Thermal	0.01	0.01	0.06	0.05	0.02	0.01	0.16
12	Vallur	0	0	0.01	0	0	0	0.01
13	Jhajjar	1.94	2.04	2.96	1.26	3.19	4.74	16.13
Total		11.82	9.15	12.76	30.09	36.20	29.65	129.67

The demurrage had to be paid on account of inefficiencies of the stations in unloading coal from railway rakes.

Ministry stated (November 2016) that all efforts were made to reduce the demurrage but some of the times, it became unavoidable due to reasons beyond the control of the company e.g. bunching of rakes, maximum permissible free time allowed by Indian Railways being

inadequate for long sidings *etc.* Ministry added that demurrage has decreased during 2011-12 and on company-wide basis, demurrage has decreased over the last two years.

The reply is to be viewed against the fact that demurrage was not recoverable from tariff and hence there is a need to avoid payment of demurrage.

6.6.2 Diverted rakes

Indian Railways routinely diverted rakes of coal consigned for one consumer to another, due to congestion on a particular line or route. Even if the rakes were diverted, the bills were required to be cleared by the original consignee as per terms of FSA. The rake which arrived at a station but not originally consigned to it was termed 'diverted in' rake while the rake which was originally consigned to the station but diverted to another consumer was termed 'diverted out' rake. Reconciliation at periodical intervals was carried out in coordination with Railways to make adjustments for 'diverted in' and 'diverted out' rakes. Adjustments in prices were carried out following reconciliation of quantity diverted. Quality of coal diverted was not considered for price adjustments.

Audit noticed that the diversion was not always between power stations of NTPC. In cases where rakes were 'diverted in' or 'diverted out' between stations of NTPC and other companies, there would be an adverse impact on NTPC on account of high GCV coal of NTPC stations being 'diverted out' and low GCV coal of other companies 'diverted in'.

Ministry stated (November 2016) that the matter had been suitably taken up and added that there is 'NIL' diversion of rakes outside the NTPC in last two years.

While noting the response of the Ministry, Audit noticed (from data reported by the power stations) that diversion of rakes to other than NTPC stations persisted at Ramagundam and Jhajjar stations in 2015-16 also.

Chapter 7

Consumption of Coal by Power Stations

Coal is the primary fuel for the coal fired power stations while oil (High Speed Diesel and Light Diesel Oil) is the secondary fuel. Coal is used to boil water which is converted into steam. The steam, in turn, drives turbine generators to produce electricity. For producing one unit of electricity, 500 gm to one kg of coal and around one ml of oil is consumed. Audit analysed various aspects relating to consumption of coal by the 13 stations selected for audit and the following position emerged:

7.1 Specific Coal Consumption by Stations

Coal used to produce one unit of energy is termed as ‘Specific Coal Consumption’ (SCC). SCC is arrived at by dividing the quantity of coal consumed by the number of units of electricity generated by the station, for a given period. The pattern of SCC in 11 out of 13 stations examined by Audit during the period from 2010-11 to 2015-16 is summarized in the following table. Monthly average SCC for the stations (from April 2010 to March 2016) is given in **Annexure 7.1**.

Table-7.1: Specific Consumption of Coal by Stations

Name of station	Coal used to produce one unit of energy (yearly average in kg)						Min SCC	Max SCC
	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	(Monthly avg. in kg)	
Dadri	0.66	0.67	0.69	0.67	0.71	0.65	0.61	0.76
Badarpur	0.81	0.89	0.88	0.86	0.82	0.76	0.70	1.02
Mouda	0.00	0.00	0.00	0.84	0.69	0.65	0.56	3.21
Rihand	0.64	0.67	0.69	0.71	0.69	0.66	0.60	0.75
Sipat	0.00	0.64	0.64	0.63	0.60	0.63	0.56	0.73
Vindychal	0.68	0.69	0.73	0.69	0.70	0.69	0.64	0.77
Vallur	0.00	0.00	0.79	0.67	0.68	0.67	0.60	0.87
Talcher	0.82	0.81	0.82	0.82	0.80	0.82	0.66	0.84
Jhajjar	0.70	0.80	0.72	0.73	0.78	0.70	0.63	0.93
Ramagundum	0.59	0.59	0.62	0.67	0.69	0.67	0.50	0.75
Farakka	0.66	0.69	0.80	0.73	0.73	0.75	0.57	0.89
Korba	0.74	0.72	0.75	0.73	0.72	0.70	0.61	0.82
Barh	0.00	0.00	0.00	0.00	0.60	0.63	0.57	0.66

The above data shows that the average coal used annually to produce one unit of energy ranged between 0.59 kg to 0.89 kg in the sample reviewed during the period from 2010-11 to 2015-16. Although yearly average SCC remained below one kg, there were significant monthly variations as can be seen from the range of minimum and maximum monthly SCC. Notably, the maximum SCC in some cases was very high, at 3.21 kg in the case of Mouda and 1.02 kg in the case of Badarpur. Keeping in view the fact that the stations were required to meet their coal requirements from the ACQ allocated to them, SCC beyond a limit ought to be monitored by the power stations for their smooth operation.

Ministry has noted the Audit observation (November 2016).

7.2 Blending of imported coal with domestic coal

The stations were allocated imported coal by the Corporate Office of the Company to supplement domestic coal supplies. The imported coal was blended with domestic coal and fired in the boilers. GCV of imported coal ranged from 5700 to 6300 kCal/kg while that of domestic coal ranged from around 2900 to 4200 kCal/kg (GCV of coal measured at the time of 'firing'). The blending ratio adopted by the eleven stations reviewed in audit varied between 0 to 55 percent.

Audit noticed that maximum permissible blending ratio as per Central Electricity Authority (CEA) was 30 percent which was exceeded in five stations, viz., Vallur (55.04 percent), Farakka (40.15 percent), Jhajjar (41.25 percent), Barh (36.86 percent) and Mouda (61 percent). Given the very high difference in quality (GCV) between domestic and imported coal, it was expected that blending of higher percentage of imported coal would result in lower consumption of the blended coal for the same amount of energy generated. Audit noticed instances where the coal used to produce one unit of energy, i.e., SCC remained the same, irrespective of whether imported coal was blended to a lesser or greater extent as shown in **Annexure 7.2**. This raises doubts whether imported coal was indeed superior to domestic coal even though the Company incurred higher cost for procuring it.

Ministry stated (November 2016) that SCC at any time depends upon several factors including the coal quality, which may be very poor for domestic coal based on the source/seam/season etc. and added that imported coal was blended with domestic coal to maintain the SCC at desired level. Ministry further stated that GCV of domestic coal varied widely depending on the coal source (whether supply was from ECL, CCL etc.) and added that even there was no blending, SCC varied from 0.66 to 0.73 at Rihand.

Ministry has argued that domestic coal quality was very poor. Audit noticed that while domestic coal supplies were from mines which have a 'Declared Grade', the source of imported coal was not known to the Company (refer Para 4.2 of Chapter 4 - Import of Coal). Quantity-wise imported coal was considered to be equivalent to 1.3 to 1.5 times of domestic coal but no perceptible advantage in SCC was noticed even after blending imported coal up to 30 percent in some months.

7.3 Use of washed coal to reduce environmental pollution

Ministry of Environment and Forests (MoEF) guidelines (September 1997 and June 1998) stipulated that from June 2001 onwards (extended to June 2002), raw coal has to be cleaned to reduce the ash content to less than 34 percent, if coal is transported beyond 1000 kms³¹ or if burnt in environmentally sensitive areas. In that case, the entire coal to be used in those stations should be washed coal in order to meet the requirement of MoEF guidelines.

Out of 13 stations selected for audit, six stations (Vindychal, Korba, Sipat, Rihand, Talcher Thermal and Ramagundum) are pithead and the above guidelines were not applicable to them. Use of washed coal by Dadri and Badarpur stations in the sample is given below:

³¹ Subsequently, vide Notification No.-GSR- 02(E) dated 02 January 2014, these Rules were made applicable for 750-1000 Kms. w.e.f. 01 January 2015 and for 500-750 Kms. w.e.f. 05 June 2016.

Table-7.2: Use of washed coal by stations

Name of station	Year	Total quantity of coal procured (Tonnes)	Total quantity of washed coal procured (Tonnes)	Percentage of washed coal to total coal procured
a	b	c	d	e= d/c x 100
Dadri	2010-11	64,73,355	45,15,269	69.75
	2011-12	71,76,435	49,41,399	68.86
	2012-13	71,82,266	46,65,349	64.96
	2013-14	71,45,332	38,62,744	54.06
	2014-15	66,71,333	30,30,935	45.43
	2015-16	59,48,795	33,51,437	56.34
	Total	405,97,516	243,67,133	60.02
Badarpur	2010-11	32,78,899.73	8,82,067.32	26.90
	2011-12	41,60,266.90	3,42,537.74	8.23
	2012-13	41,13,054.98	4,50,893.91	10.96
	2013-14	38,42,055.75	5,87,812.16	15.30
	2014-15	28,39,043.56	4,71,932.64	16.62
	2015-16	15,00,499.02	4,44,978.92	29.66
	Total	197,33,819.94	31,80,222.69	16.12

Note: Among other five non-pit head stations in the audit sample viz., Vallur and Jhajjar procured 4957858.60 MT and 15543135 MT of coal respectively during the period of audit, out of which washed coal quantity was 'nil'. Data in respect of Mouda, Farakka and Barh were not made available.

From the above data, Audit observed that:

- (i) At Dadri station, percentage of washed coal to total coal showed a declining trend during the period from 2010-11 to 2014-15. In 2014-15, quantity of raw coal exceeded quantity of washed coal, indicating that there was deterioration in the degree of compliance with MoEF orders. The situation improved in 2015-16.
- (ii) In the case of Badarpur, percentage of washed coal to total coal decreased drastically from 2010-11 to 2011-12 but has been increasing gradually over the years. However, procurement of washed coal, on an average during 2010-11 to 2015-16 was only 16 percent of total coal procured.

Ministry stated (November 2016) that coal of requisite quality conforming to statutory obligations was required to be supplied by the coal companies. Ministry added that as per MoEF gazette notification dated 02 January 2014, coal companies were responsible for supplying coal with less than 34 percent ash to the identified power stations.

Use of un-washed coal infringed upon the guidelines issued by MoEF. NTPC ought to have taken appropriate steps to ensure compliance (to wash coal on its own or tie up with washeries) quite apart from the obligations of the coal companies.



Chapter 8

Conclusion and Recommendations

8.1 Conclusion

The installed electricity generation capacity in the country as on 31 October 2016 was 307278 MW out of which coal based generation capacity was 186493 MW (60.69 percent). Coal cost constitutes 60 to 70 percent of the total generation tariff of a coal based power station. Audit of fuel management in the power stations indicated inefficiencies which increased fuel cost of the power stations and cost of energy to the ultimate consumers.

Supply of domestic coal to power stations was governed by National Coal Distribution Policy (NCDP) notified by Ministry of Coal. Domestic coal was supplied to power stations by coal linkages established through Fuel Supply Agreements (FSAs) at prices notified by Coal India Limited (CIL). However, inadequate coal linkages of power stations, delay in signing of FSAs and intra year shortfall in supplies led to procurement of coal at prices higher than the notified rates. Power stations also incurred additional cost by way of performance incentives even for quantities within Annual Contacted Quantity (ACQ) and on deemed delivered quantities, premium on MoU procurement, e-auction *etc.* Besides, the power stations paid performance incentives for additional annual supplies even as they suffered generation loss due to intra year shortfall in coal supply. The Company incurred additional expenditure of ₹6869.95 crore over 2010-16 in procurement of domestic coal even as it lost an opportunity to generate revenue of ₹4299.80 crore due to full or partial outages of stations on account of shortage of coal.

Though the Company has been importing coal since 2005-06, no comprehensive policy for import of coal had been designed resulting in non-uniform decisions regarding splitting of packages among bidders, qualification requirements, re-tendering and annulment of packages. Imported coal having higher Gross Calorific Value (GCV) compared to domestic coal but was stored in the same yard affecting the blending ratio of domestic and imported coal. Besides, Audit noticed that despite the very significant quality difference (GCV difference) between domestic and imported coal, the specific coal consumption of the power station was not significantly affected by a change in the quantity of imported coal blended.

Fuel price depends on the quantity and quality of coal. To accurately determine the 'quantity of fuel procured', proper weighment of coal was necessary. Weighment of domestic coal was not carried out regularly when the rakes arrived, despite the provision of in-motion weigh bridges. Instead of ascertaining transit loss of coal (difference between quantity of coal dispatched from the mines and quantity of coal received by stations) by weighing the railway rakes, an indirect method called 'volumetric method' was used. There were also concerns regarding accuracy of the stock reported at the stations, considering that some stations reported larger stocks than the storage capacity of yard.

The quality of coal (represented by GCV) was measured by three different methods; while paying for coal imports, Air Dried Basis (ADB) method was used, while paying to domestic

coal companies for supplies Equilibrated Moisture (EM) method was used and for energy billing Total Moisture (TM) method was used. ADB method gives the highest value of GCV while TM gives the lowest. As fuel cost is directly proportional to GCV, working out GCV on ADB and EB method increased the fuel cost for the power stations. Energy charges are however inversely proportional to GCV and employing the methodology to generate the lowest GCV value (TM method) increased energy charges recoverable from consumers. Besides, there were significant differences in GCV of coal 'as received' in the power stations and 'as fired' by them. Such significant differences were not technically expected and were within the control of the power stations. The energy charges were worked out on the basis of GCV 'as fired'. Audit worked out the energy charges on the basis of GCV 'as received' for a one year period (October/ November 2012 to September 2013) and noted that energy charges would have been lower by ₹1440.33 crore had it been worked out on GCV 'as received' basis.

Audit of fuel management of coal based power stations in NTPC indicated inefficiencies in coal procurement (domestic procurement and import), storage, supply and consumption which led to higher fuel cost of the stations which were passed on to the final customer through higher energy charges.

8.2 Recommendations

8.2.1. In order to undertake corrective measures for overcoming the deficiencies in fuel management, following recommendations are made for implementation by NTPC:

1. The Company may review the procedures for procurement of coal above notified rates such as incentive procurement, MOU, e-auction and imports.
2. The Company may invoke, wherever feasible, provisions in the existing Fuel Supply Agreements for inter-station transfer of coal to tide over temporary coal shortages.
3. The Company may formulate a policy for import of coal. Action may also be taken to ensure source and quality of imported coal.
4. Methods for measurement of GCV for procurement of coal and billing of energy may be standardized in coordination with competent authorities.
5. Weighment of coal may be carried out at the time of receipt of coal at unloading point to ascertain the actual transit loss and take remedial measures.

8.2.2. The Company is the largest power generating utility in the country and the inadequacies noticed by Audit also require intervention at the Ministry/Regulatory level for appropriate remedial action for the power sector as a whole. The following recommendations are, therefore, suggested to Ministry of Power:


6. Pricing of energy is based on Station Heat Rate, which, in turn, is based on quantity and quality of coal (GCV) consumed by the stations. While quantity of coal received is not weighed by the stations, quality assessment of coal has inherent as well as manmade infirmities due to heterogeneous nature of coal and sampling errors. There is a need to appropriately review the method for energy pricing. Ministry may coordinate with

Central Electricity Regulatory Commission to examine this aspect in the light of the audit findings.

7. The commercial terms in FSAs were not in accordance with New Coal Distribution Policy and FSAs did not have safeguards for intra-year shortfall in deliveries. Ministry may, therefore, review the terms of FSAs in consultation with Ministry of Coal/Coal India Limited to rectify these inadequacies.

The above recommendations were discussed in the Exit Conference held in October 2016 and Ministry/NTPC Limited were generally in agreement with the recommendations.

New Delhi
Dated : 01 December 2016


(NAND KISHORE)
Deputy Comptroller and Auditor
General and Chairman, Audit Board

Countersigned

New Delhi
Dated : 01 December 2016


(SHASHI KANT SHARMA)
Comptroller and Auditor General of India



Annexure 3.1
Range of monthly and quarterly deviation in actual vis-à-vis scheduled supplies
(Referred to in para 3.1.5.1)

Name of station	Name of coal company	No. of months having a variation of > 10 per cent from monthly scheduled quantity		No. of quarters having a variation of > 10 per cent from quarterly scheduled quantity	
		Instances	Range (in %)	Instances	Range (in %)
Badarpur	ECL	57 out of 67	-100 to 337	20 out of 23	-33 to 112
	CCL	49 out of 72	-100 to 41.43	18 out of 22	-98 to 14
Dadri	ECL (FSA signed in September 2013)	28 out of 31	-100 to -1.62	6 out of 10	-33 to -1
	CCL	60 out of 72	-63 to 107	13 out of 24	0 to 32
Vindhyachal	NCL	36 out of 72	-36 to 136	7 out of 24	-20 to 24
Sipat	SECL	60 out of 72	-99 to 59	20 out of 24	-37 to 71
Rihand	NCL	39 out of 72	-36 to 32	12 out of 24	-16 to 16
Korba	NCL	28 out of 72	-25 to 35	9 out of 24	-21 to 17
Vallur	MCL (FSA signed in July 2013)	32 out of 32	-27 to -67	10 out of 10	-57 to -42
Talcher	MCL (data for 2015-16 not provided)	49 out of 60	-20 to 68	18 out of 20	2 to 48
Ramagundum	SCCL	52 out of 72	-39 to 61	16 out of 24	-13 to 41
	MCL	67 out of 72	-100 to 158	21 out of 24	-100 to 58
	SECL	67 out of 72	-100 to 648	23 out of 24	-100 to 357
Farakka	ECL	47 out of 60	-67 to 56	15 out of 20	-15 to 37
	BCCL	51 out of 60	-100 to 146	8 out of 20	-100 to 75
	MCL	23 out of 24	-100 to 79	8 out of 8	-82 to -24
	CCL	24 out of 24	-100 to 3	8 out of 8	-74 to 25
	NECL	54 out of 60	-100 to 192	15 out of 20	-100 to 148
Mouda	WCL (clause not included in FSA)	15 out of 15	-100 to 11	5 out of 5	-86 to -32
	SECL (FSA started in Apr 2015)	10 out of 12	-97 to 134	3 out of 4	-47 to -8
	MCL (FSA signed in July 2013 & terminated in March 2015)	21 out of 21	-100 to -34	7 out of 7	-98 to -41
Jhajjar data not provided					

Annexure-5.1
Comparison of SHR reported by stations using GCV 'As Fired' and SHR worked out using GCV 'As Received'
(Referred to in para 5.2.1)

(Figures in kCal/kWhr)

Name of station	Range of SHR reported by stations (using GCV 'as fired')	Range of SHR worked out using GCV 'as received'	Range of difference
	1	2	3
Dadri Stage I	2376 - 2411	2416 - 3198	6-803
Dadri Stage II	2356 - 2408	2350- 2951	(-)47 - 568
Talcher	2804 -2828	3429 -3510	625 - 682
Badarpur	2614 - 2765	3187 - 3572	477 - 828
Korba Stage I & II	2371 - 2398	2488 -2870	102 - 499
Korba Stage III	2347 - 2481	2472 - 2852	29 -501
Vallur	2417 - 2659	2765 - 3656	110 -1103
Rihand stage I	2318 - 2368	2728 - 2900	360 - 572
Rihand stage II	2338 - 2384	2724 - 2996	375 - 652
Rihand stage III	2321 - 2530	2536 - 3848	215 - 1124
Sipat	2279 - 2375	2079-2972	(-)44 - 611
Farakka	2395 - 2406	3244 - 3667	848 - 1261

Annexure-6.1
Details of stations which had zero stock of coal
(Referred to in Para 6.1)

2012-13			2013-14			2014-15		
Month	Stations having zero domestic coal stock		Month	Stations having zero domestic coal stock		Month	Stations having zero domestic coal stock	
	Stations	No. of days		Stations	No. of days		Stations	No. of days
April	-	-	April	Dadri	20	April	-	-
May	-	-		Badarpur	3	May	-	-
June	Unchahar	2	May	Dadri	14	June	-	-
	Dadri	1		Farakka	1	July	Vindhyachal	2
July	Farakka	2	June	-	-	August	-	-
	Unchahar	16	July	Ramagundum	6	September	Ramagundum	7
	Kahalgaon	1	August	-	-	October	Rihand	2
	Dadri	4	September	-	-		Unchahar	26
August	Unchahar	8	October	Ramagundum	1		Tanda	9
	Vindhyachal	5	November	Rihand	1		Badarpur	21
September	Tanda	1		Unchahar	7	Dadri	1	
October	Dadri	5			Talcher Kaniha	1	November	Vindhyachal
	Sipat	10	December	Unchahar	14	Badarpur		10
November	Dadri	13		Ramagundum	1	Tanda		23
	Sipat	29	January	Unchahar	18	Unchahar		30
December	-	-		Ramagundum	1	Singrauli		16
January	Dadri	15	February	Unchahar	16	December	Unchahar	31
	Sipat	1	March	-	-	January	Unchahar	3
February	Dadri	2				February	-	-
March	Dadri	28				March	-	-

Annexure – 7.1
Specific Coal Consumption of Stations from April 2010 to March 2016
(Referred to in Para 7.1)

(in Kg.)

Month	Dadri	Farakka	APCPL Jhajjar	Mouda	Ramag- undum	Rihand III	Sipat	Talcher Thermal	NTECL Vallur	Vindhya- achal IV	Badarpur	Korba	Barh
Apr-10	0.64	0.77	0	0	0.57	0.67	0	0.81	0	0.71	0.80	0.75	0
May-10	0.67	0.77	0	0	0.56	0.67	0	0.81	0	0.70	0.77	0.72	0
Jun-10	0.64	0.70	0	0	0.57	0.67	0	0.81	0	0.71	0.78	0.75	0
Jul-10	0.64	0.81	0	0	0.60	0.68	0	0.81	0	0.69	0.81	0.80	0
Aug-10	0.67	0.66	0	0	0.63	0.64	0	0.82	0	0.64	0.80	0.79	0
Sep-10	0.69	0.64	0	0	0.62	0.63	0	0.84	0	0.65	0.80	0.74	0
Oct-10	0.67	0.63	0	0	0.61	0.60	0	0.82	0	0.67	0.81	0.68	0
Nov-10	0.68	0.63	0	0	0.59	0.63	0	0.82	0	0.65	0.81	0.76	0
Dec-10	0.71	0.60	0	0	0.58	0.62	0	0.82	0	0.66	0.80	0.75	0
Jan-11	0.63	0.59	0	0	0.57	0.62	0	0.81	0	0.67	0.85	0.70	0
Feb-11	0.64	0.00	0	0	0.58	0.63	0	0.82	0	0.68	0.87	0.72	0
Mar-11	0.65	0.58	0.70	0	0.58	0.60	0	0.82	0	0.68	0.84	0.72	0
Apr-11	0.63	0.61	0.78	0	0.58	0.63	0	0.81	0	0.69	0.84	0.74	0
May-11	0.63	0.66	0.71	0	0.61	0.64	0	0.81	0	0.68	0.83	0.72	0
Jun-11	0.65	0.65	0.77	0	0.62	0.68	0	0.82	0	0.70	0.84	0.71	0
Jul-11	0.65	0.66	0.93	0	0.57	0.69	0	0.82	0	0.70	0.83	0.73	0
Aug-11	0.69	0.69	0.91	0	0.57	0.68	0	0.82	0	0.72	0.87	0.72	0
Sep-11	0.67	0.69	0.84	0	0.50	0.69	0	0.83	0	0.65	1.02	0.67	0
Oct-11	0.71	0.67	0.75	0	0.55	0.64	0.64	0.82	0	0.67	0.99	0.68	0
Nov-11	0.69	0.72	0.80	0	0.59	0.67	0.64	0.82	0	0.70	0.89	0.71	0
Dec-11	0.67	0.72	0.77	0	0.65	0.70	0.63	0.81	0	0.69	0.94	0.74	0
Jan-12	0.67	0.71	0.78	0	0.61	0.69	0.60	0.80	0	0.69	0.89	0.74	0
Feb-12	0.68	0.77	0.71	0	0.63	0.67	0.69	0.81	0	0.71	0.86	0.73	0

Month	Dadri	Farakka	APCPL Jhajjar	Mouda	Ramagundum	Rihand III	Sipat	Talcher Thermal	NTECL Vallur	Vindhya-achal IV	Badarpur	Korba	Barh
Mar-12	0.66	0.73		0	0.59	0.68	0.67	0.82	0	0.70	0.87	0.71	0
Apr-12	0.69	0.70	0.70	0	0.63	0.70	0.63	0.82	0	0.70	0.87	0.73	0
May-12	0.66	0.72	0.72	0	0.62	0.70	0.62	0.82	0	0.71	0.92	0.72	0
Jun-12	0.67	0.67	0.73	0	0.59	0.70	0.67	0.82	0	0.73	0.93	0.75	0
Jul-12	0.73	0.73	0.79	0	0.59	0.73	0.73	0.82	0	0.76	0.90	0.69	0
Aug-12	0.76	0.89	0.76	0	0.58	0.68	0.63	0.82	0	0.77	0.90	0.73	0
Sep-12	0.74	0.84	0.76	0	0.58	0.66	0.65	0.82	0	0.74	0.92	0.76	0
Oct-12	0.70	0.85	0.80	0	0.69	0.66	0.60	0.82	0	0.72	0.89	0.82	0
Nov-12	0.65	0.78	0.71	0	0.63	0.68	0.58	0.82	0.86	0.69	0.88	0.69	0
Dec-12	0.67	0.79	0.68	0	0.64	0.67	0.62	0.81	0.87	0.73	0.87	0.77	0
Jan-13	0.67	0.88	0.66	0	0.64	0.67	0.67	0.81	0.78	0.72	0.85	0.75	0
Feb-13	0.67	0.87	0.63	0	0.65	0.71	0.62	0.81	0.74	0.71	0.82	0.77	0
Mar-13	0.69	0.85	0.67	0	0.62	0.67	0.63	0.81	0.70	0.74	0.81	0.79	0
Apr-13	0.66	0.79	0.66	0.00	0.65	0.67	0.61	0.81	0.68	0.72	0.85	0.77	0
May-13	0.63	0.77	0.80	0.00	0.67	0.67	0.67	0.82	0.66	0.68	0.86	0.74	0
Jun-13	0.62	0.77	0.80	3.21	0.66	0.69	0.68	0.82	0.60	0.67	0.86	0.78	0
Jul-13	0.62	0.74	0.78	1.30	0.64	0.70	0.66	0.82	0.62	0.70	0.85	0.71	0
Aug-13	0.68	0.75	0.72	1.17	0.66	0.73	0.64	0.82	0.68	0.71	0.87	0.67	0
Sep-13	0.68	0.77	0.70	1.20	0.72	0.69	0.66	0.82	0.67	0.68	0.88	0.67	0
Oct-13	0.70	0.77	0.76	1.52	0.70	0.73	0.64	0.82	0.71	0.67	0.87	0.69	0
Nov-13	0.70	0.69	0.71	1.08	0.69	0.72	0.63	0.82	0.69	0.65	0.88	0.70	0
Dec-13	0.69	0.66	0.71	1.02	0.68	0.75	0.58	0.81	0.73	0.72	0.84	0.74	0
Jan-14	0.68	0.70	0.68	0.86	0.66	0.72	0.62	0.81	0.69	0.71	0.83	0.74	0
Feb-14	0.68	0.67	0.72	0.61	0.66	0.71	0.60	0.81	0.69	0.71	0.83	0.74	0
Mar-14	0.71	0.72	0.76	0.56	0.67	0.72	0.62	0.81	0.68	0.70	0.85	0.81	0
Apr-14	0.70	0.77	0.75	0.56	0.68	0.72	0.59	0.81	0.65	0.71	0.81	0.70	0

Month	Dadri	Farakka	APCPL Jhajjar	Mouda	Ramag- undum	Rihand III	Sipat	Talcher Thermal	NTECL Vallur	Vindhy- achal IV	Badarpur	Korba	Barh
May-14	0.68	0.75	0.74	0.58	0.68	0.69	0.65	0.81	0.66	0.71	0.81	0.73	0
Jun-14	0.67	0.77	0.78	0.67	0.70	0.70	0.61	0.81	0.68	0.71	0.82	0.74	0
Jul-14	0.71	0.74	0.82	0.78	0.74	0.71	0.57	0.82	0.67	0.72	0.85	0.78	0
Aug-14	0.71	0.77	0.86	0.79	0.75	0.72	0.62	0.82	0.73	0.71	0.87	0.75	0
Sep-14	0.72	0.74	0.83	0.75	0.70	0.70	0.59	0.82	0.66	0.72	0.87	0.69	0
Oct-14	0.73	0.74	0.87	0.73	0.66	0.68	0.62	0.82	0.69	0.68	0.87	0.67	0
Nov-14	0.72	0.72	0.80	0.68	0.66	0.71	0.59	0.82	0.71	0.68	0.81	0.78	0.57
Dec-14	0.74	0.70	0.72	0.74	0.67	0.69	0.59	0.82	0.70	0.69	0.81	0.76	0.59
Jan-15	0.72	0.69	0.71	0.72	0.71	0.66	0.62	0.66	0.69	0.70	0.77	0.71	0.59
Feb-15	0.71	0.72	0.72	0.73	0.68	0.67	0.56	0.81	0.67	0.70	0.76	0.69	0.60
Mar-15	0.71	0.67	0.72	0.71	0.67	0.65	0.57	0.81	0.63	0.70	0.76	0.67	0.65
Apr-15	0.63	0.82	0.71	0.68	0.69	0.66	0.67	0.81	0.64	0.71	0.80	0.69	0.66
May-15	0.61	0.79	0.65	0.70	0.70	0.67	0.66	0.82	0.65	0.69	0.77	0.78	0.64
Jun-15	0.62	0.78	0.69	0.69	0.71	0.71	0.64	0.82	0.66	0.72	0.77	0.73	0.62
Jul-15	0.66	0.78	0.68	0.71	0.69	0.68	0.62	0.82	0.64	0.71	0.78	0.77	0.65
Aug-15	0.68	0.75	0.71	0.73	0.70	0.67	0.64	0.83	0.67	0.69	0.76	0.79	0.64
Sep-15	0.69	0.72	0.70	0.71	0.69	0.66	0.67	0.83	0.73	0.71	0.79	0.74	0.65
Oct-15	0.65	0.72	0.69	0.70	0.68	0.65	0.59	0.83	0.69	0.69	0.73	0.65	0.66
Nov-15	0.64	0.71	0.64	0.74	0.67	0.65	0.61	0.83	0.70	0.70	0.70	0.64	0.66
Dec-15	0.65	0.74	0.72	0.72	0.66	0.63	0.60	0.83	0.68	0.71	0.74	0.68	0.61
Jan-16	0.66	0.72	0.74	0.00	0.65	0.67	0.63	0.82	0.64	0.67	0.74	0.63	0.60
Feb-16	0.65	0.71	0.75	0.73	0.61	0.63	0.62	0.82	0.66	0.67	0.74	0.66	0.57
Mar-16	0.61	0.74	0.71	0.72	0.62	0.63	0.61	0.82	0.69	0.66	0.74	0.61	0.60

Annexure-7.2
Impact of blending of imported coal on Specific Coal Consumption (SCC)
(Referred to in Para 7.2)

Sl. No.	Station	SCC (in kg)	Month (blending ratio)	
			(Difference of 6% and above taken into account)	
1	Badarpur	0.80	December 2010 (8%)	August 2010 (21%)
		0.81	October 2010 (4%)	July 2010 (14%)
		0.87	August 2011 (0.01%)	February 2011 (7%)
2	Rihand	0.63	November 2010 (2%)	September 2010 (10%)
		0.66	September 2012 (0%)	January 2015 (7%)
		0.67	February 2012 (0%)	June 2010 (9%)
		0.68	August 2012 (0%)	August 2011 (15%)
		0.69	January 2012 (1%)	September 2011 (12%)
		0.70	May 2012, June 2012 and April 2012 (0%)	September 2014 (13%)
		0.71	February 2014 (0%)	November 2014 (8%)
		0.72	November 2013, January 2014 and April 2014 (0%)	August 2014 (6%)
		0.73	July 2012 and December 2013 (0%)	August 2013 (11%)
3	Dadri	0.63	April 2011 (9%)	May 2013 (25%)
		0.64	February 2011 (7%)	July 2010(22%)
		0.65	March 2011 (3%)	July 2011 (25%)
		0.66	April 2013 (6%)	March 2012(21%)
		0.67	February 2013 (8%)	June 2012 (30%)
		0.68	February 2014 (1%)	August 2013(22%)
		0.69	March 2013 (1%)	August 2011 (23%)
		0.71	December 2010 (2%)	March 2015 (28%)
		0.72	September 2014 (11%)	January 2015 (24%)
		0.74	September 2012 (1%)	December 2014 (23%)
4	Sipat	0.58	December 2013 (5%)	November 2012 (16%)
		0.59	April 2014 (4%)	September 2014 (15%)
		0.61	April 2013 (3%)	June 2014 (9%)
		0.62	May 2012 (1%)	August 2014 (13%)
		0.63	March 2013 (4%)	August 2012 (15%)
		0.64	October 2011 (4%)	August 2013 (12%)
		0.65	May 2014 (8%)	September 2012 (22%)
		0.67	June 2012 (5%)	May 2013 (14%)
5	Vindhachal	0.65	November 2013 (1%)	September 2011 (13%)
		0.67	October 2010 and October 2013 (2%)	October 2011 (8%)
		0.68	March 2011 (2%)	October 2014 (9%)
		0.69	December 2014 and January 2012 (0%)	July 2010 (7%)
		0.70	January 2015, March 2012 and April 2012 (0%)	March 2015 (7%)
		0.71	February 2014, May 2012, February 2012, February 2013 and January 2014 (0%)	June 2010 (7%)

Sl. No.	Station	SCC (in kg)	Month (blending ratio) (Difference of 6% and above taken into account)	
		0.72	January 2013 and December 2013 (0%)	August 2011 (8%)
6	Vallur	0.66	May 2013 (30%)	September 2014 (49%)
		0.67	September 2013 (20%)	July 2014 (52%)
		0.68	April 2013 (20%)	March 2014 (38%)
		0.69	January 2015 (32%)	October 2014 (43%)
		0.70	March 2013 (35%)	December 2014 (55%)
		0.71	October 2013 (13%), November 2014 (53%)	November 2014 (53%)
7.	Jhajjar	0.70	March 2011 (9.40%)	September 2013 (28.65%)
		0.71	May 2011 (5.42%)	January 2015 (38.21%)
		0.72	May 2012 (17.76%)	March 2015 (41.25%)
		0.75	April 2014 (16.92%)	October 2011 (24.05%)
		0.76	March 2014 (14.68%)	August 2012(38.01%)
		0.77	June 2011 (5.01%)	December 2011 (17.18%)
		0.78	April 2011 (9.88%)	June 2014 (32.76%)
		0.80	November 2011 (16.38%)	October 2012 (31.22%)
8	Ramagundam	0.58	September 2012 (0%)	December 2010 (8.55%)
		0.62	May 2012 (1.55%)	September 2010 (7.59%)
		0.63	November & April 2012 (0%)	August 2010 (10.30%)
		0.64	December 2012 (0.85%)	July 2013 (22.90%)
		0.65	December 2011 (0%)	February 2013 (9.68%)
		0.66	February 2014 (0.86%)	October 2014 (22.20%)
		0.67	May 2013 (0.60%)	March 2015 (25.42%)
		0.68	December 2013 (6.34%)	May 2014 (21.82%)
		0.70	October 2013 (0%)	September 2014 (8.28%)
9.	Talcher	0.81	February 2014 (0%)	April 2010, May 2010, July 2010, June 2010 (4%)
		0.82	November 2012 (0%)	August 2010 (1%)
10.	Korba	0.67	October 2014 (1%)	September 2011, March 2015 (4%)
		0.69	November 2012 (1%)	September 2014 (8%)
		0.71	March 2012 (1%)	January 2015 (6%)
		0.72	May 2010 (1%)	May 2011 (6%)
		0.73	May 2014 (3%)	July 2011 and August 2012 (5%)
		0.74	April 2011, December 2013 (1%)	May 2013 (8%)
		0.75	December 2010 (1%)	June 2012 and August 2014 (5%)
		0.76	November 2010 (3%),	September 2012 (9%)
		0.78	July 2014 (5%)	June 2013 (8%)

List of Abbreviations

Sl. No.	Abbreviation	Full Form
	A	
1.	ACQ	Annual Contracted Quantity
2.	ADB	Air Dried Basis
3.	ARB	As Received Basis
	B	
4.	BCCL	Bharat Coking Coal Limited
	C	
5.	CCL	Central Collieries Limited
6.	CEA	Central Electricity Authority
7.	CERC	Central Electricity Regulatory Commission
8.	CIL	Coal India Limited
9.	COD	Commercial Operation Date
10.	CPRI	Central Power Research Institute
11.	CSGS	Central Sector Generating Stations
12.	CVC	Central Vigilance Commission
13.	CVO	Chief Vigilance Officer
	D	
14.	DC	Declaration of Capacity
15.	DDQ	Deemed Delivered Quantity
	E	
16.	ECR	Energy Charge Rate
17.	ECL	Eastern Coalfields Limited
18.	EM	Equilibrated Method
	F	
19.	FOB	Free on Board
20.	FOR	Free on Road
21.	FSA	Fuel Supply Agreement
	G	
22.	GAR	Gross as Received
23.	GCV	Gross calorific Value
	I	
24.	ICB	International Competitive Bidding
25.	IGSTPP	Indira Gandhi Super Thermal Power Project
26.	IIA	Independent Inspection Agency
27.	IM	Inherent Moisture
28.	IMTF	Inter Ministerial Task Force
	J	
29.	JVs	Joint Ventures
	M	
30.	MCL	Mahanadi Coalfields Limited

31.	MoC	Ministry of Coal
32.	MGR	Merry Go Round
33.	MoEF	Ministry of Environment and Forest
34.	MoP	Ministry of Power
35.	MoU	Memorandum of Understanding
36.	MMT	Million Metric Tonne
37.	MT	Million Tonne
38.	MTPA	Million Tonne Per Annum
39.	MU	Million Units
40.	MW	Mega Watt
	N	
41.	NCCL	North East Coalfields Limited
42.	NCDP	New Coal Distribution Policy
43.	NCL	Northern Coalfields Limited
	O	
44.	O&M	Operation and Maintenance
	P	
45.	PLF	Plant Load Factor
46.	PI	Performance Incentive
47.	PSUs	Public Sector Undertakings
	Q	
48.	QR	Qualifying Requirement
	R	
49.	RR	Railway Receipt
	S	
50.	SCC	Specific Coal Consumption
51.	SCCL	Singareni Collieries Company Limited
52.	SECL	South Eastern Coalfields Limited
53.	SHR	Station Heat Rate
54.	SLC-LT	Standing Linkage Committee - Long Term
55.	STC	State Trading Corporation of India Limited
	T	
56.	TM	Total Moisture
57.	TMB	Total Moisture Basis
	U	
58.	UHV	Useful Heat Value
59.	UI	Unscheduled Interchange
	W	
60.	WCL	Western Coalfields Limited

Glossary of Technical Terms

Sl. No.	Term	Description
1.	Air Dried Basis (ADB)	A method of determining Gross Calorific Value of coal by taking into account the moisture inherently present in coal (excluding Surface Moisture).
2.	Annual Contracted Quantity (ACQ)	Annual Contracted Quantity is the quantity of coal agreed to be supplied every year under the Fuel Supply Agreement signed between NTPC and the coal companies.
3.	Auxiliary consumption	Power consumed within the premises of the generating station is referred to as Auxiliary consumption.
4.	Bomb Calorimeter	Bomb calorimeter is a device used to determine the energy contained in a substance by measuring the heat generated during its combustion.
5.	Carpeting of coal yard	It is the initial process of preparation of coal yard for storage. A layer of compressed coal is spread on the yard to serve as a carpet upon which further heaps of coal are placed.
6.	Central Sector Generating Station (CSGS)	The generating stations of companies owned or controlled by the Central Government.
7.	Commercial Operation Date (COD)	The date declared by the generator on achieving maximum continuous rating through a successful trial run.
8.	Declared Capacity (DC)	‘Declared Capacity’ or ‘DC’ in relation to a generating station means the capability to deliver electricity in MW declared by such generating station in relation to any time-block of the day as defined in the Grid Code or whole of the day, duly taking into account the availability of fuel and water.
9.	Deemed Delivered Quantity (DDQ)	As per the Fuel Supply Agreement signed between NTPC and the coal companies, certain quantities of coal, though not actually supplied, are deemed to have been supplied. These include the quantity of coal not supplied owing to omission or failure on the part of purchaser to submit in advance the designated rail programmes; the quantity of coal not supplied owing to cancellation, withdrawal or modification of the rail programmes; the quantity of coal not supplied owing to seller exercising the right of suspension of supplies; the quantity of coal offered from alternative source including imported coal which is not accepted by the purchaser, <i>etc.</i>
10.	Equilibrated Basis	A method of determination/computation of Gross Calorific Value of coal expressed at Equilibrated Moisture level determined at 60 <i>percent</i> relative humidity, at 40 degree Celsius.
11.	Equilibrated Moisture	The moisture content as determined after equilibrating the coal sample at 60 <i>percent</i> relative humidity, at 40 degree Celsius as per the relevant provisions of Bureau of Indian Standards.
12.	Free on Board	FOB is a term used in imports/exports, requiring the seller to

	(FOB)	deliver goods on board a vessel designated by the buyer. The seller fulfils its obligations and title to the goods is transferred to the purchaser when the goods have passed over the ship's rail.
13.	FOR destination	A term used in contracts for Sale of Goods wherein the seller pays the cost of carriage, including insurance, necessary to bring the goods to the named destination.
14.	Fuel Supply Agreement (FSA)	FSA is a legally enforceable agreement between the seller (coal company) and the consumer (generating company) wherein the terms and conditions regarding coal supplies such as Annual Contracted Quantity, Grade(s), procedure for checking quality, source of supply, commercial terms, etc. are specified. FSAs are valid for 20 years, with a provision for review every five years.
15.	Gross Calorific Value (GCV)	GCV denotes the heat produced by complete combustion of unit quantity of coal in a Bomb Calorimeter. GCV determines how much coal is required in the power plant.
16.	GCV 'As Billed'	The GCV determined by coal companies by collecting samples at the loading point near the coal mine, which is used for billing of coal supplies, is referred to as 'GCV as billed'.
17.	GCV 'As received'	GCV determined by power stations by collecting samples when the rakes are received at station, is referred to as GCV 'As received'.
18.	GCV 'As fired'	GCV determined by power stations by collecting samples from the bunkers, just before coal is fed to the boilers, is referred to as GCV 'As fired'.
19.	Inherent Moisture	Inherent moisture means moisture that exists as an integral part of the coal seam in its natural state, including water in pores, but excluding that present in macroscopically visible fractures.
20.	In-motion Weigh Bridge	In-motion weigh bridge is a machine installed at power stations for weighing railway rakes that bring coal to the stations. Weighment is done when the rakes are in motion.
21.	Kilo Watt Hour (kWh)	It is a unit of energy. When 1000 watts of electrical power is utilised for one hour, the quantum of energy recorded is one Kilo Watt Hour, commonly referred to as 'Unit'.
22.	Megawatt (MW)	Megawatt means one million watts. It is a measure of electrical power produced by a generating unit in any given instant.
23.	Memorandum of Understanding (MoU)	Memorandum of Understanding is a bilateral agreement between NTPC and coal company, wherein terms and conditions for short term supply of coal are specified.
24.	Merry -go-Round (MGR)	Merry-Go-Round system is a closed-circuit dedicated rail network operated by pit-head power plants to transport coal from the mines to the plant.
25.	Million Units (MU)	Million units (MU) is equivalent to 10,00,000 Kilo Watt Hours.
26.	Performance Incentive (PI)	As per Fuel Supply Agreement signed between NTPC and coal company, if coal is supplied in excess of 90 percent of Annual Contracted Quantity in a particular year, NTPC shall pay Performance Incentive at slab-wise agreed rates.

27.	Pit Head Station	Generating station located near coal mine is referred to as Pit Head station.
28.	Plant Load Factor (PLF)	PLF is the ratio of the total number of units of electricity supplied by a generating station to the total number of units which would have been supplied if the generating station had been operated continuously at its maximum continuous rating.
29.	Secondary Crusher	Secondary crusher is a large machine deployed at power stations to crush coal supplied by coal companies. It is referred to as 'secondary' since 'primary crusher' is used by coal companies to crush coal to some extent before loading.
30.	Specific Coal Consumption (SCC)	Coal used to produce one unit of energy is termed as 'Specific Coal Consumption'.
31.	Station Heat Rate (SHR)	Operational efficiency of power stations is regulated through a parameter called 'Station Heat Rate', which denotes the input heat value incurred by the station to produce one unit of energy.
32.	Surface Moisture	Surface moisture in coal results from water held on the surface of coal particles. This is normally due to exposure to rain, humidity <i>etc.</i>
33.	Tapering Linkage	Tapering linkage is the short-term linkage provided to those coal consumers who have been allocated captive coal blocks for meeting the coal requirements of their linked end use plants, in cases where the production of coal from these blocks does not synchronize with the requirement of the end use plants.
34.	Total Moisture (TM)	Total moisture means the sum of surface and inherent moisture content in coal, expressed as a percentage.
35.	Unscheduled Interchange (UI) charges	UI charges are a commercial mechanism to maintain grid discipline. The UI charges are payable by generators and distributors who deviate from the schedule given by Load Despatch Centers for injection/drawl of electricity on a day to day basis.
36.	Volumetric Method	A method through which quantity of coal is determined based on the dimensions of coal heaps kept in the yard using mathematical formula, <i>i.e.</i> , $\text{Weight} = \text{Volume} \times \text{Density of coal}$.
37.	Wagon Tippler	Wagon Tippler is a machine used for emptying coal from the loaded railway wagons that arrive at power station. The machine holds each wagon from the top as well as sides by using clamping devices and topples the wagon sideways to empty the cargo of coal to underground chambers.

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