

CHAPTER-III

REVIEW IN RESPECT OF STATUTORY CORPORATION

Procurement, performance and maintenance of transformers in Madhya Pradesh State Electricity Board

Highlights

Madhya Pradesh State Electricity Board failed to maintain a balance between the growth of sub-transmission & distribution transmission capacity in relation to the connected load. The Distribution transformation capacity was 155 to 230 per cent higher than the connected load upto the year ended 31 March 2004. The mismatch resulted in overloading with consequential failure of transformers and transmission and distribution (T&D) losses of over 250 per cent of the accepted level of such losses fixed by the Central Electricity Authority.

(Paragraphs 3.6.1 and 3.6.2)

The Board lost Rs.10619.31 crore of potential revenue due to these excessive T&D losses. The Board failed to achieve even the modest target of reduction of T&D losses progressively to 28 percent by 2004-05 as prescribed by the regulatory commission.

(Paragraph 3.6.2)

Deficient planning and bid evaluation coupled with delays in bid evaluation, commissioning of transformers, construction of sub-stations, resulted in avoidable excess expenditure of Rs.70.40 crore on the procurement of transformers. Besides, the delays in completion of various schemes resulted in unquantifiable losses in revenue.

(Paragraphs 3.6.4, 3.6.5, 3.6.7, 3.6.8 and 3.6.9)

The failure rate of transformers at 14.56 per cent in the year 2000-01 increased to 24.14 per cent during the year 2003-04 indicating slack and deteriorating quality assurance system.

(Paragraph 3.6.12)

The guidelines issued by Power Finance Corporation (PFC) lay down that no transformer should be loaded beyond 75 to 80 percent of its capacity. During the years from 2000-05, 211 transformers were, however, found overloaded from 100.02 to 124.37 per cent.

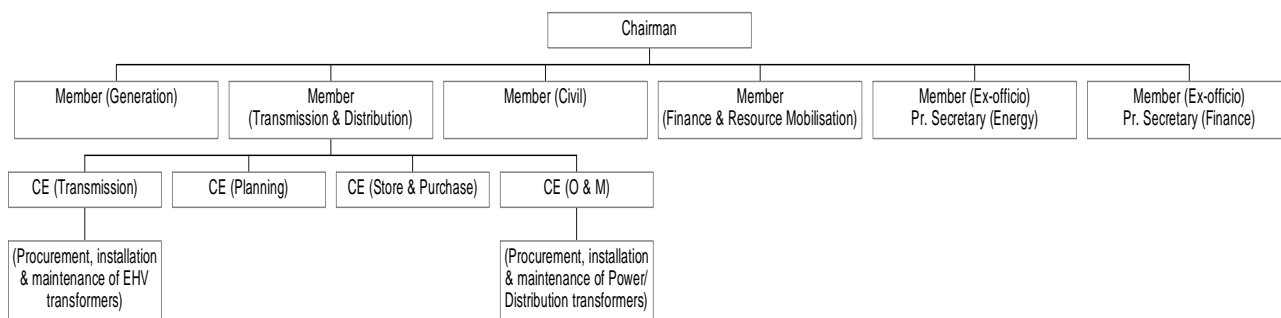
(Paragraph 3.6.13)

The Board did not take action for the repair of high cost EHV transformers as also repair and conversion of other transformer for up to four years. Timely action for repair of nine 40 MVA and 15 transformers up to 20 MVA could have saved the Board financial outgo of Rs.10.62 crore and Rs.12.00 crore respectively. Ineffective contract management by the Board with regard to repair of transformers including non-availment of guarantee cover, non-invocation of risk and cost clause etc. cost the Board Rs.6.82 crore in addition to non-maintenance of quality supply to the consumers.

(Paragraphs 3.6.6, 3.6.15, 3.6.21 and 3.6.23)

Introduction

3.1 Transformer is a static equipment used for stepping up or stepping down voltage in generation, transmission and distribution of electricity. Power is usually generated at a low voltage of 11 KV to 15.4 KV and is then stepped up to 132 KV/ 220 KV/400 KV through power transformers for bulk transmission to the load centres. At the receiving sub-station, voltage is brought down (220 KV/ 132 KV/ 66 KV/ 33KV) by using stepdown transformers and further stepped down (11 KV to 0.4 KV) for supplying to various consumers. The transformers used at the generating stations and in the high voltage sub-stations (known as transmission system) are called power transformers while transformers used in the distribution system are called distribution transformers. Power is distributed to the consumers and licensees through transmission and distribution lines at voltage ranging from 440 volts to 132 KV. The benefit of transmitting power at high and extra high voltages is the reduction in line losses. The organization set-up of the Board is as under:



The procurement, performance and repair of transformers by MPSEB (Board) were last reviewed and incorporated in the Report of the Comptroller and Auditor General of India for the year 1987-88 (Commercial) which was discussed (31 October 1995) by the Committee on Public Undertakings

(COPU). The recommendation of the COPU and the Action Taken Note thereon were, however, awaited (August 2005).

Scope of Audit

3.2 The present review covers the performance of the Board with regard to procurement, performance and repair of transformers for the last five years ended March 2005. Audit was carried out between January and May 2005 through examination of records at the headquarters of the Board at Jabalpur, one out of two Major Transformer Repairing Units (MTRUs), 12 out of 142 Operation and Maintenance (O&M) divisions and 6 out of 15 Area Stores.

Audit objectives

3.3 Performance audit of the procurement, performance and repair of transformers by MPSEB was carried out to assess whether:

- the transformation capacity was commensurate with the connected load;
- there existed an appropriate procedure for the procurement of transformers to minimise delay, ensure quality and to avoid extra/excess expenditure in procurement;
- transformers failed within or beyond guarantee period are got repaired quickly;
- transformers installed at various substations are maintained as per the manufacturers' specification to ensure trouble free service and long life; and
- the Board ensures the extent of compliance of maintenance schedule of transformers installed in the system.

Audit criteria

3.4 The following audit criteria were adopted:

System of planning, award of work/contract management for system augmentation, construction of sub-stations, procurement of material and their storage, number and installed capacity of transformer repair workshops, rules, procedures, specifications and other Board's instructions with regards to repair and inventory management including scrapping of transformers. Terms and conditions of transformer repair agreements, delegation of powers including instructions of the specialized agencies etc.

Audit methodology

3.5 Audit was carried out through analysis of the data/information on transformer related records at Head Office and O&M divisions, verification of procurements made, the maintenance programme, cause-wise reasons of failure, time taken to repair the failed transformers so as to put them to use in system, examination of recommendation files, Tender specification files, order files, execution files, loss/extra expenditure on procurement.

Audit findings

The audit findings were reported to the Government/Management in June 2005 and discussed at a meeting of the Audit Review Committee for Public Sector Enterprises (ARCPSE) held on 18 August 2005, where Government was represented by the Secretary, Energy Department and the management was represented by the senior officials of the Board. The review was finalised after considering the views of the Government/Management.

The audit findings are discussed in the succeeding paragraphs.

Growth of transformation capacity

3.6.1 Adequate grid power transformation capacity is needed for evacuation of power from generating stations. Sub-power transformation capacity is the middle chain for feeding distribution transformers to meet power load of the consumers.

The table below indicates the growth of the power transformation capacity, distribution transformation capacity, connected load, and length of High Tension (HT) / Low Tension (LT) lines during the five years ended March 2005.

Sl. No.	Particulars	2000-01	2001-02	2002-03	2003-04	2004-05 **
1.	Grid power Transformation capacity (400/220/132/66/33 KV)					
	MVA	16615	16653	16975	19509	21812
	MW	14123	14155	14429	16583	18540
	No. of transformers	362	362	372	399	430
2	Sub-power Transformation capacity (220/132/66/33/11/KV)					
	MVA	8437	8601	9347	9935	11193
	MW	7171	7311	7945	8445	9514
	No. of transformers	2437	2470	2642	2758	2970

Sl. No.	Particulars	2000-01	2001-02	2002-03	2003-04	2004-05 **
3.	Distribution Transformation capacity (11/0.4 KV)					
	MVA	13816	13391	14087	15120	15162
	MW	11744	11382	11974	12852	12888
	No. of transformers	155280	158267	164687	168393	170860
4.	Percentage of distribution transformation capacity in excess of sub-power transformation capacity	63.75	55.69	50.71	52.19	35.46
5.	Total connected load					
	MVA	9620	10061	10146	10209	10468
	MW	8177	8552	8624	8678	8898
6	(a) Distribution transformation capacity in excess of connected load (MW) (3-5)	3567	2830	3350	4174	3990
	(b) Percentage of excess distribution transformation capacity (6/5)	43.62	33.09	38.85	48.1	44.84
7.	Sub-power Transformation capacity per MVA of connected load (2/5)	0.88	0.85	0.92	0.97	1.07
8.	Distribution transformation capacity per MW of connected load (3/5)	1.44	1.33	1.39	1.48	1.45
9	Length of lines (Kms)					
	LT	319422	320406	331067	335062	337021
	HT	198720	199690	206836	209929	NA
10	Ratio of LT Lines to HT Lines	1.61:1	1.60:1	1.60:1	1.75:1	NA
	Million Watt (MW)= Million Voltage Ampere (MVA x 0.85)					

**** Figures for 2004-05 are provisional**

It would be seen from the above table that

There was mismatch between sub-transformation and distribution transformation capacity and the connected load

- As on 31 March 2004, the sub-power transformation capacity was 9935 MVA and distribution transformation capacity was 15120 MVA against the connected load of 10209 MVA. The sub-transformation capacity per MVA of connected load ranged between 0.85 MVA and 1.07 MVA during 2000-01 to 2004-05 against the ideal capacity of one. Similarly, the distribution transformation capacity per MW of connected load ranged between 1.33 to 1.48 MW during the last five years ended March 2005 indicating that the distribution transformation capacity was on the higher side. Audit analysis revealed that in three out of seven regions (Ujjain, Indore, Gwalior) the distribution transformation capacity ranged between 1825 and 3131.73 MVA as compared to connected load between 795 and 2024.59 MW during the last four years ended 31 March 2004. Thus, the distribution transformation capacity was 155 to 230 per cent higher than the connected load up to the year ended 31 March 2004.
- This mismatch in sub-transformation capacity and connected load resulted in overloading of Extra High Voltage (EHV) power transformers leading to failure of the transformers. There was thus an urgent requirement to augment the sub-transformation capacity to avoid further damage to the transformers. On the other hand, distribution transformation capacity was much higher than the connected load. The Board failed to maintain a balance in the growth of sub-transformation and distribution transformation capacity vis-à-vis the connected load.

Excessive transmission losses:

3.6.2 Transmission losses occur due to resistance in the conductors through which the energy is carried from one place to another. Transformation losses include copper losses (load losses) which are dependent upon the quantum of power being transformed whereas iron losses (no load losses) are due to design characteristics of the transformers and are constant irrespective of the magnitude of load on the system.

Excessive transmission and distribution losses resulted in loss of potential revenue of Rs.10619.31 crore.

Central Electricity Authority (CEA) fixed the accepted level of transmission and distribution (T&D) losses at 15.5 per cent (8.5 per cent transmission and sub-transmission losses and 7 per cent distribution losses). Against this the actual losses in the Board's system ranged between 43.99 and 50.97 per cent during the last four years ended March 2004, which is 250 per cent of the accepted level of such losses. Due to excessive T&D losses, the Board lost potential revenue of Rs.10,619.31 crore.

The Madhya Pradesh Electricity Regulatory Commission (MPERC) Bhopal, in its tariff order dated 30 November 2002 prescribed targets of reduction of T&D losses to 32 per cent during 2003-04 and 28 per cent during 2004-05 in phased manner, which were not achieved.

Procurement of Transformers

3.6.3 During the last five years ended 31 March 2005, the Board procured 104 EHV power transformers (Rs.153.69 crore) and 42522 distribution transformers (Rs.231.49 crore). Some of the system deficiencies noticed during test check of procurement of transformers are discussed in the succeeding paragraphs.

Deficient planning

Construction of 132 KV sub-stations

3.6.4 The transmission system of the State was overloaded to the extent of 67 per cent resulting in low voltage in several areas of the State. To overcome this problem, a loan assistance of Rs.588.98 crore was sanctioned (July 2001) by Asian Development Bank (ADB) to the Board for taking up various transmission upgradation and strengthening schemes in the State. The project cost benefit analysis revealed that with the installation of 132/33 KV sub-station, the reduction in loss would range between 5 and 16 MW for each 132 KV sub-station constructed. Based on this projection, the potential saving of energy through 25 numbers 132 KV sub-stations for a year worked out to 962 MUs and likely annual benefits of Rs.192.40 crore to the Board.

It was noticed in audit that the work orders for erection of four numbers of 132 KV sub-station (Alirajpur, Madhotal, Ron and Umariya) were issued in December 2002 for completion by June 2003. The supply of transformers started from March 2003 and was completed by April 2004 but the sub-stations could not be commissioned for want of handing over of the site to the contractor. Thus due to failure of the Board to synchronize allied works with the supply schedule of transformers, the commissioning of sub-station had been delayed by over one year which had resulted in a loss of Rs.30.78 crore (proportionately) on account of saving of 153.92 million units of energy foregone in a year through four sub-stations.

Board's failure to synchronize allied works with supply schedule of transformers resulted in loss of Rs.30.78 crore

The Board accepted the delay stating that the works of Ron and Madhotal sub-stations could not be commenced due to delay in acquisition of land and work of Alirajpur sub-station was delayed due to obstacles created by the local tribals. Reasons for delay in completion of Umariya sub-station were not intimated to Audit.

Ineffective contract management

Delay in finalisation of tenders

3.6.5 During the review period the Board invited only three domestic tenders for procurement of transformers. The Board did not fix any time limit within which an offer for tender should be finalised. It was observed in audit that time taken in finalisation of offers ranged from 15 (Tender Specification 16/1999) to 8 months (TS 9/2001 and 10/2001), and in none of the cases was the offer finalised within the initial validity period.

The Board accepted (April 2005) the audit observation and stated that the benefit of delay was achieved by obtaining better design of transformers with lower losses, at reasonable cost. The reply is not tenable as the technical bids are opened and the technical aspects about design and load loss etc. are looked into well before the opening of price bids. The price bids are opened much in advance of the expiry of validity of offers even then there were delays in finalisation of offers and the Board had to bear the avoidable payment of price variation at enhanced rates due to such delays. The additional financial burden on account of extra price variation claim arising from the delays in finalisation of offers for tenders as also the loss due to delayed completion of supply could not be worked out in audit for want of details.

Action not taken against defaulting Contractors

3.6.6 The Board placed (September 2002) an order on Emco Ltd., Thane for supply of two numbers 220 KV/ 160 MVA transformers (TR-09/2001) at a price of Rs.2.24 crore each.

The supplier delayed the delivery of one transformer by eight months and did not deliver the second transformer (May 2005). It was observed in audit that the Board neither initiated any legal action against the supplier nor invoked the risk and cost clause. Due to non-supply of the transformer, the installation/commissioning of sub-station at Pandhurna/ Rajgarh could not be completed as per schedule. The Board procured (September 2002) 220 KV/ 160 MVA transformer incurring extra cost of Rs.71.40 lakh which was recoverable from the defaulting contractor in terms of the contract. Had the Board initiated legal action and invoked the risk and cost clause against the supplier, it could have saved the extra expenditure of Rs.71.40 lakh.

In another case, the delivery schedule (Clause 5) required the supply of two transformers to be completed by May 2003. The firm, however, supplied only one transformer and the other transformer had not been delivered so far (May 2005).

Extra expenditure of Rs.90.40 lakh due to non invoking of risk and cost clause

The Board did not initiate any penal action against the defaulting firm. The Board placed further orders under ADB loan funds for supply of similar transformer at higher rates (Rs.1.41 crore per unit) in September 2002. Non invoking of the risk and cost clause had resulted not only in delay in completion of priority transmission work but also in a loss of Rs.19.00 lakh (Rs.1.41 crore of ADB (-) Rs.1.22 crore of TR-10/01) to the Board.

The Board stated (May 2005) that the risk and cost clause would be initiated only in the event of failure by the firm to supply the transformer by the revised committed date (April 2005 or 1st week of May 2005). The reply is not tenable as there was no provision in the agreement to revise the delivery date and that the Board, had already delayed penal action by two years. Moreover, the supply by the firm was still awaited (May 2005).

Deficient bid evaluation and procurement of 132 KV 40 MVA transformers against ADB loan

3.6.7 The Board procured 315, 160 and 63 MVA power transformers in a single package, while 40 MVA transformers were procured in three packages at three different rates.

Procurement of 40 MVA transformers without giving weightage for low load loss and load plus auxiliary loss resulted in extra expenditure of Rs.14.17 crore.

As per prevailing practice of the Board, adjustments are made towards cost of no load loss at the rate of Rs.2.40 lakh per KW and load plus auxiliary loss at the rate of Rs.0.98 lakh per KW for the difference in loss to bring the quoted rates of suppliers at par. In case of procurement under ADB loan, this practice was not followed and power transformers of the same rating were procured against three different packages at three different rates. Had the prevailing practice been followed, the Board could have saved Rs.14.17 crore.

The Board stated (April 2005) that 40 MVA transformers were procured in three different packages in view of the limited capacity of the manufacturers and to get the transformers within the desired delivery period.

The reply is not tenable as the transformers of the same ratings and technical specifications could be procured in three different packages so as to get timely deliveries but not at three different rates. The rate difference between the three packages ranged from Rs.31 lakh to Rs.38 lakh per transformer.

Defective tender evaluation

Procurement of 40 MVA transformers with similar specification at two different rates resulted extra expenditure of Rs.14.60 crore.

3.6.8 It was noticed in audit that the purchases made against ADB funded procurement for 160 and 40 MVA transformers were at higher rates as compared to Board funded purchases. This rate difference got further accentuated, in view of the fact that the ADB purchases were exempt from payment of Excise Duty. Though the purchase orders against domestic as well as ADB tenders were placed in the same month (September 2002), there was a rate difference amounting to Rs.14.60 crore between the procurement cost of ADB funded and Board funded purchases, as per details given below:-

Particulars of Power Transformers	Quantity procured against ADB funded	Unit FOR rate received against Board funded (Rs. in lakh)	Unit FOR rate of ADB funded (Rs. in lakh)	Unit rate difference (Rs. in lakh)	Total difference (Rs. in crore)
160 MVA	10	284.97	330.84	45.87	4.59
40 MVA (Pkg-IV)	20	122.00	141.24	19.24	3.85
40 MVA (Pkg-VI)	21	122.00	151.34	29.34	6.16
					14.60

Thus, defective system of tender evaluation resulted in extra expenditure of Rs.14.60 crore. The Board stated (April 2005) that the rates received against ADB tenders and domestic tenders could not be compared, as the technical

specifications and scope of supply were different. The reply is not tenable as there was no difference in technical specifications such as capacity of transformers, voltage ratios and there were no load losses and full load losses in both the cases, as per the bid documents.

(ii) In another case of International Competitive Bids (December 2002) for the procurement of distribution transformers under Madhya Pradesh Power Sector Development Projects financed by ADB, there were six packages containing some common items. The bids for the six packages were opened on 25 June 2003 and as per evaluation the lowest evaluated prices for all the six packages for common items were as detailed below:-

Package No.	Name of the lowest bidders	Capacity of distribution transformer (in KVA)	Number of items	Lowest evaluated price (Rs. in lakh)	Price per Unit (Rs.)	Price difference between packages (Rs.)
1.	M/s Star	10	2237	371.34	16,600	(2 – 1)
2.	M/s FTS	10	3727	657.30	17636	1036
3.	M/s RTS	100	1836	657.04	35787	(4 – 3)
4.	M/s Accurate	100	3059	1107.59	36208	421
5.	M/s RKE	200	892	601.92	67480	(6-5)
6.	M/s M & B	200	1483	1000.73	67480	nil

Board incurred extra expenditure of Rs.51.49 lakh on procurement of transformers at different rates in the same tender.

The Board incurred an extra expenditure of Rs.51.49 lakh* for similar items due to ignoring price differences.

The Board stated (April 2005) that pursuant to sub-clause 36.6 of the Instruction to Bidders, the Board was to evaluate and compare the Bids on the basis of packages or combination of packages or total of packages in order to arrive at the least cost combination. The reply is not tenable as the Board should have negotiated with the bidders for the lowest evaluated prices of common items of all the six packages so as to avoid the price difference for the same items in different packages.

(iii) In yet another case the Board invited (November 2002) tenders for procurement of 33 KV and 11 KV Current Transformers (CTs) and 11 KV Potential Transformers (PTs) financed under ADB loan. As per the procedure laid down by ADB, the recommendation for procurement was to be sent to them duly signed by all approving authorities.

As per supply capacity criteria of the tender notice, bidders should have supplied 680 Nos 33 KV CTs, 2200 Nos 11 KV CTs and 300 Nos 11 KV PTs, in any two years put together during the past five years. The Board further

* *(Rs.1036 multiplied by 3727) plus (Rs.421 multiplied by 3059) = Rs.51.49 lakh.*

clarified (November 2002) that the supply of higher ratings of CT and PT and the supply of combined CT/PT units of prescribed/higher ratings shall be considered for deciding supply capacity criteria.

The Board, after vetting the bids, recommended to the ADB to accept the second lowest offer of Electrical Transformer Company, Bhopal (ETC) ignoring the lowest offer of Macroplast Limited, stating that the firm did not fulfill the supply capacity criteria. The ADB approved the proposals and the Board placed orders (May 2003) on ETC for supply of 4842 CTs and 510 PTs, which were supplied by them between August 2003 and February 2004.

On this being pointed out in audit, the Chief Engineer (Purchase) stated (December 2003) that they had not considered the combined CT/PT supply criterion of the lowest bidder as the bidder had counted each combined CT/PT as 3 CTs and 1 PT, which was not acceptable. The reply is not tenable, as the Board while issuing clarification on 22 November 2002 had nowhere stated that while considering the combined CT/PT units of prescribed/higher ratings, one combined CT/PT will be treated as 1 CT and 1 PT only. The ADB had also (March 2003) accepted that combined CT/PT with three CTs has three sets of core and winding and hence it should be counted as three CT and one PT.

Thus non consideration of the lowest offer of Macroplast Limited, who fulfilled the supply capacity criteria, resulted in extra expenditure of Rs.18.65 lakh.

Non-Recovery of liquidated damages

3.6.9 During the years 2000-01 to 2004-05, the Board placed orders for supply of 104 transformers of various ratings under four tenders, of which 91 transformers were received after delays ranging from 14 to 365 days and three transformers remained undelivered till date (May 2005).

Board failed to recover penalty of Rs.10.14 crore for delay in supply of transformers.

As per the Liquidated Damages clause of the agreement, the Board was eligible for recovery of penalty at the rate of 0.5 per cent of price of transformers for each week of delay subject to a maximum of 10 per cent. Accordingly, penalty amounting to Rs.10.14 crore was recoverable. The Board has not given the details of penalty recovered, if any, from the suppliers, so far.

The Board stated (April 2005) that as per the terms of the domestic as well as ADB contracts, the dates of readiness of the units for final inspection were to be considered as the dates of delivery and the delays from the dates of MRC* as adopted by Audit were not correct. The reply is not acceptable as in none of the cases pointed out by Audit, were the dates of readiness of the units for final inspection, the dates of actual inspection by the Board officials and the dates of issue of despatch instructions made available during the course of

* *Material Receipt Certificate.*

audit or subsequently, despite assurance given during the Audit Review Committee meeting.

Deficient execution

Delay in commissioning of Power Transformers

3.6.10 During the period from 2000-01 to 2004-05, the Board placed orders for the procurement of 104 power transformers of various ratings out of which 101 were supplied and one transformer each of 315, 160 and 40 MVA

remained unsupplied (May 2005). It was noticed that there were delays ranging from 2 to 400 days (after allowing 30 days for commissioning from the date of receipt of transformers by the Board) in commissioning of 89 out of 101 transformers and four transformers were still in commissioning stage. These delays resulted in an interest loss of Rs.4.77 crore to the Board (at the rate of 12 per cent per annum) on idle investment in these transformers.

Delay of 2 to 400 days (after allowing 30 days) in commissioning transformers resulted in interest loss of Rs.4.77 crore on idle investment in these transformers.

The Board stated (April 2005) that there had not been any interest loss as 89 units had already been installed before the ADB completion schedule of the project (June 2006). The reply is not tenable because during the period of delay in commissioning of the transformers the intended benefit could not be derived. The overall completion schedule of June 2006 did not mean that all the equipments would be commissioned in June 2006.

In case of four EHV transformers the delay in commissioning were attributed to the following avoidable reasons.

(i) in case of one transformer (Shivpuri), the delay was attributed to financial crunch and delayed tie-up with ADB. (ii) in case of the second (Bairagarh), delay in supply of gantry, columns and single tension hardware (iii) in case of the third (Alirajpur), the delay in acquisition of land and (iv) in case of the fourth (Bina), the reasons for delay were not intimated. The above reasons could have been avoided by proper planning and taking timely action.

Performance of Transformers

3.6.11 The Government of India, Ministry of Power prescribed (March 1994) the life of power transformers as 35 years and of distribution transformers as 25 years. The Board did not, however, formulate any policy for replacement of transformers that had outlived their useful life.

Growing failure rate of distribution transformers

3.6.12 The table below indicates the persistent increase in failure rate of distribution transformers during the last five years up to 2004-05.

Financial year	Number of transformers installed at the beginning of the year	Number of transformers failed during the year	Failure percentage with reference to No. of transformers installed
2000-01	155280	22608	14.56
2001-02	156577	28383	18.13
2002-03	162011	32994	20.37
2003-04	166533	40199	24.14
2004-05	169106	38683	22.88

The failure rate of transformers increased to 24.14 per cent by 2003-04. The percentage in eight O&M circles was found to be 30 per cent or above during these four years.

It would be seen from the table above that the failure rate of distribution transformers was constantly growing during 2000-04 indicating slack and deteriorating quality assurance system. The failure rate at 14.56 per cent in the year 2000-01 increased to 24.14 per cent during the year 2003-04. Failure rate in some of the O&M circles was even higher. In eight O&M circles (Satna, Bhopal, Vidisha, Sehore, Rajgarh, Guna, Shivpuri, Indore) the average failure rate was 30 per cent or above with a constant rising trend during these four years. Neither were remedial measures taken to arrest the rising trend of failure, nor had any norms or permissible limit for failure been fixed by the Board.

The cause-effect analysis of distribution transformers as per the annual review conducted by the Board during 2000-05 is given below:

Sl. No.	Reasons of failure	Percentage of failure			
		2000-01	2001-02	2002-03	2003-04
1.	Manufacturing defects in new units	19.41	17.87	14.75	16.75
2.	Manufacturing defects in new repaired units	16.16	17.71	18.57	12.70
3.	Lightening	10.39	11.46	7.09	6.11
4.	Deterioration of insulators	4.76	3.45	6.73	5.73
5.	Short circuiting	8.04	13.08	9.09	7.81
6.	Other causes	14.51	15.75	20.29	18.03
7.	Reasons yet to be established	8.57	8.83	6.74	11.26
8.	Internal defects	7.96	4.42	9.66	11.97

Note : Details for 2004-05 were awaited.

It may be seen from the above table that the reasons for failure of transformers except Sl.No. 1 and 2, could have been controlled by taking proper maintenance and remedial measures.

Overloading of Extra High Voltage (EHV) transformers

3.6.13 The guidelines issued by Power Finance Corporation (PFC) lay down that no transformers should be loaded beyond 75 to 80 per cent of its capacity.

The overloading of transformer not only results in excessive transmission losses but also leads to pre-mature failure of transformers.

The table below indicates the year-wise number of overloaded transformers and the extent of their overloading for the five years ended 31 March 2005.

211 high cost EHV transformers were overloaded between 100.02 and 124.37 per cent during the last five years.

Year	Number of overloaded EHV transformers	Percentage of overloading with reference to capacity
2000-01	30	100.54 to 117.20
2001-02	35	100.02 to 124.37
2002-03	51	100.02 to 119.51
2003-04	41	100.08 to 113.26
2004-05	54	100.75 to 115.03
Total	211	

Thus, 211 transformers were overloaded during 2000-05 and in one case overloading was up to 124 per cent of the designed capacity. EHV transformers are very costly equipment, the value ranging between Rs.1.25 crore (40 MVA) and Rs.4.73 crore (315 MVA) and heavy overloading thereof leads to premature failure of these transformers.

The Board accepted the fact of overloading and assured (May 2005) that remedial measures would be taken.

Repair of Transformers

3.6.14 The Board undertakes repair of damaged transformers both in-house at Major Transformers Repairing Units (MTRUs) and through contractors against rate contract.

Repair of transformers at Major Transformers Repairing Units

3.6.15 The Board had three MTRUs one each at Jabalpur, Indore and Gwalior (Closed) to repair damaged power (other than EHV power transformers) and distribution transformers. The performance of MTRU at Jabalpur for the period from 2000-01 to 2004-05 was test checked in audit.

The installed capacity, targets vis-à-vis achievements for the repair of transformers during the last five years ended 2004-05 are indicated in the table below:

Year	Installed capacity of transformers (Numbers)	Target (Numbers)	Achievements (Numbers)	Shortfall as against installed capacity (Numbers and percentage)	Shortfall in achievement as against the target (Numbers and percentage)
2000-01	2000	900	800	1200 (60)	100 (11.11)
2001-02	2000	900	710	1290 (64.50)	190 (21.11)
2002-03	2000	900	721	1279 (63.95)	179 (19.88)
2003-04	2000	900	652	1348 (67.42)	248 (27.55)
2004-05	2000	900	653	1347 (67.35)	247 (27.44)

Under utilization of Board's in-house transformers repairing capacity resulted in extra expenditure of Rs.5.31 crore on repair of transformers from outside agencies.

It would be seen from the above that the targets fixed during 2000-01 to 2004-05 were very low as compared to the installed capacity. The shortfall in utilisation of the installed capacity ranged between 60 per cent in 2000-01 and 67.40 per cent in 2003-04. The unit did not achieve even the modest targets fixed and the shortfall in achievement of targets was 11 per cent in 2000-01 and increased over the years to 27 per cent in 2004-05. Due to non-utilisation of the installed capacity of this MTRU, the Board had to incur Rs.5.31 crore on repair of transformers from outside agencies under rate contract, during 2000-05.

The Additional Superintending Engineer- MTRU Jabalpur admitted (April 2005) that about 2000 to 2500 defective transformers could be repaired if sufficient quantity of material/ equipments were provided to them.

Repair of transformers through private agencies

Repair of EHV transformers

3.6.16 The year-wise breakup of failed EHV transformers is as under:

Year	Number of failed transformers	MVA ratings
2000-01	10	160 MVA-2, 40 MVA-2, 20MVA & below-6
2001-02	10	315 MVA -1, 40 MVA-4, 20 MVA-5
2002-03	8	40 MVA -4, 20 MVA-4
2003-04	5	40 MVA-3, 20 MVA-2
2004-05	6	40 MVA-2, 20 MVA-4
Total	39	

Audit noticed that (a) the Board did not initiate any action for repair of 24 out of 39 failed transformers even after lapse of periods ranging from three months to over four years.

Non repair of nine 40 MVA failed transformers resulted in avoidable expenditure of Rs.10.62 crore on purchase of new transformers.

The Board procured 78 numbers 40 MVA transformers at an average cost of Rs.1.18 crore per unit during this period. Timely action for repair of nine 40 MVA transformers by the Board could have saved an expenditure of Rs.10.62 crore on purchase of such transformers. Further, the Board did not take any action for repair of 15 transformers of upto 20 MVA capacity, even after lapse of six months to five years. This resulted in blockage of Rs.12.00 crore (Rs.80 lakh x 15 transformers) and consequential loss of interest of Rs.3.30 crore (up to December 2004).

The Chief Engineer (Planning) stated (April 2005) that the transformers were got repaired depending upon availability of funds allocated for repair and maintenance. The reply is not tenable as the allocation of funds for repair and maintenance should be apportioned according to the annual requirement and priority should be given to repairs over new purchases.

Delay in placement of repair order and non lifting of transformers for repair after placement of order resulted in blockage of Board's inventory worth Rs.19.73 crore.

(b) It was further noticed in audit that in case of 15 out of 39 failed EHV transformers there was a delay ranging from 17 days to more than two years (beyond 30 days) in lifting of 12 transformers by the repairing agencies to whom repair orders were issued and three transformers which failed between August 2000 and November 2002 had not even been lifted despite issue of repair orders. The delay in placement of repair orders/lifting of EHV transformers by the repairing firm resulted in blockage of Board's inventory worth Rs.19.73 crore with consequential loss of interest of Rs.1.13 crore up to March 2005.

The Board accepted (April 2005) the delay and attributed the reasons of delay to various considerations which were to be taken care of before declaring any unit as failed and its handing over to the repairing agencies.

The Board, however, did not specify any time limit for such consideration to be completed before handing over the transformer to the repairing agencies.

Delays in commissioning of transformers after its repair resulted in blockade of inventory worth Rs.13.63 crore.

(c) Four repaired EHV transformers were commissioned after delays ranging from 4 to 154 days (after allowing 30 days for commissioning). The delays in commissioning resulted in blockage of Board's inventory worth Rs.13.63 crore with consequential loss of interest of Rs.3.52 crore at the rate of 12 percent per annum up to March 2005.

The Chief Engineer (Planning) stated (April 2005) that 30 days' period might not be considered adequate for commissioning of a repaired unit. The reply is not tenable as the Board had neither revised the time limit for commissioning of transformers nor were the case-wise reasons for delays furnished to Audit.

Delay in placement of repair orders

3.6.17 The Board did not prescribe any time limit/norms for finalisation of repair order from the date of failure of transformers though it prescribed that the failed transformers should be despatched within three months after finalising the repair orders. It was observed in audit that due attention was not given to timely placement of repair orders in respect of the power/EHV transformers failed at Thermal Power Stations as shown in the table below:

Sl. No.	Make/Serial No.	Capacity and place of failure	Date of failure	Date of despatch for repair	Period of delay in sending the transformer to the firm (Excluding 3 months for formalities) (in months)	Name of repairing firm
1.	NGEF 2800034637	63 MVA ATPS Chachai	4.6.2000	14.2.2003	29	Aditya Vidyut Appliances Ltd., Thane
2.	Vottamp 270512	16 MVA SGTPS Birsinghpur	3.9.2000	18.2.2004	38	-do-
3.	Vottamp 270513	16 MVA SGTPS Birsinghpur	9.5.2001	18.2.2004	30	-do-
4.	APEX Sl.No. NA	500 KVA ATPS Chachai	23.10.2002	Not issued upto 31.1.2005	24 (tentative figure)	Not issued
5.	TELK 1202942	20 MVA SGTPS Birsinghpur	17.6.2003	15.5.2004	8	Aditya Vidyut Appliances Ltd., Thane

The aforesaid transformers being capital intensive required immediate action for repair. The thermal power authorities, however, took 8 to 38 months (beyond three months) in finalising the repair orders and despatching them for repair.

Avoidable expenditure of Rs.24 lakh on repair of transformer

3.6.18 Due to augmentation of substation at Indore to 132 KV one surplus 40 MVA BHEL make working transformer (Sl.No. 6004695) was shifted to 132 KV substation at Barwani. The transportation of the transformer was got done through a local transporter without entering into any agreement/ contract by the Board. The transformer stopped functioning after a day of commissioning on 30 March 2003. Thereafter the Board placed (June 2004) repair order on Rajasthan Transformer and Switchgears, Jaipur at Rs.24 lakh. The transformer is yet to be returned after repairs by the firm (March 2005).

Thus, the Board had to bear an expenditure of Rs.24 lakh on repair of the transformer which failed immediately after its commissioning due to probable mishandling by the transporter during shifting. The Superintending Engineer (T&C), Indore had also attributed the failure to the damage caused to some

spacers of the transformer during the transportation, which rendered the windings loose. The Board could not take any action against the transporter in the absence of any contract/agreement with him. The transformer was not insured for transit. The Board stated (April 2005) that no action was taken against the transporter as the transformer was in service for some time after commissioning at Barwani. The reply is not acceptable as running of a transformer for a few hours could not be considered as successful commissioning after shifting.

Delay in placement/ execution of order for conversion of EHV transformer

3.6.19 A 30 MVA 132/66/11 KV EHV transformer in good working condition rendered surplus in September 1992 at Chhindwara was considered for conversion of its winding from 66 KV to 33 KV ratings. The Board however, placed (June 2001) an order for upgradation/uprating of transformer on Tarapur Transformers (Pvt.) Ltd. (TTPL) Mumbai in June 2001 after a lapse of about nine years. Moreover, TTPL had not carried out even initial joint inspection of transformer at site so far and as such the unit could not be handed over to them till date (April 2005).

Reasons for delay in placement of conversion order as well as non-cancellation of order placed on TTPL even after nine years were not explained to Audit. The Board stated that the transformer had already rendered more than 30 years of service and had completed its useful life. Reply is not tenable in view of the fact that when the transformer was replaced and rendered surplus in 1992 it was considered good and in working condition and good enough for conversion. The delay in placement of order and non-execution of the order by the firm had resulted in idling of such a costly equipment which seems to have lost its utility due to passage of such a long period. Further, the loss could not be quantified for want of details.

Delay in repair of 20 MVA EMCO transformers

3.6.20 One 20 MVA transformer installed at 220 KV sub-station Itarsi which failed in 1991, and remained idle till October 1999, was commissioned after repairs, at 132 KV sub-station Balaghat on 12 November 2001.

Due to augmentation of Balaghat substation, the 20 MVA transformer was taken out (July 2003) and shifted to Mandla where it was re-commissioned on 6 December 2003. The transformer remained unused for 149 days (July to December 2003) out of the performance guarantee of 36 months given by the repairing firm (Star delta, Bhopal).

As such the transformer was under performance guarantee up to 12 November 2004. Due to some technical problem, the transformer stopped functioning on 20 November 2004, eight days after the expiry of the performance guarantee on 12 November 2004 since then the transformer was lying idle (May 2005). Had the transformer been shifted and re-commissioned at Mandla in time (30 days), the Board could have got it repaired free of cost within the performance

guarantee period. The Board accepted (April 2005) the delay in re-commissioning of the transformer at Mandla.

3.6.21 The Board placed an order for repair of one 16 MVA transformer on Rajasthan Transformers and Switchgears, Jaipur (RTS) for a cost of Rs.8.00 lakh. As per the repair order, the repaired transformer was guaranteed for satisfactory performance for a period of 36 months from the date of commissioning.

The repaired transformer commissioned on 26 September 2001 at 132 KV substation, Katni failed on 14 September 2004 when it was still covered under the performance guarantee up to 25 September 2004. The Board intimated (27 October 2004) its failure to the repairing firm RTS for re-repair on 27 October 2004 i.e. after a delay of about one and half months from the date of expiry of the performance guarantee. The firm did not accept Board's claim that the transformer had failed within the performance guarantee as intimation of its failure was given after expiry of the performance guarantee period.

Thus, delayed intimation of failure to the firm resulted in loss of opportunity to save repairing cost of about Rs.8 lakh which the Board was bound to bear on its repair in future.

The Board (April 2005) accepted the delay in intimation of failure of the unit to the firm and stated that the matter was being pursued with the firm.

3.6.22 The Board finalised the rate contract for repair of EHV transformers in 1999 on firm price basis with no price variation clause and placed various orders for repair of such transformers thereafter.

As per the order issued on 18 May 2001, one 40 MVA power transformer was got repaired under the above rate contract from RTS Jaipur at a firm price of Rs.16.80 lakh.

Subsequently, when two 40 MVA failed transformers of Bharat Bijlee Ltd., Mumbai (BBL) were sent for repair, RTS put following conditions (August 2002) for consideration before taking up further repairs:

- The transportation, loading and unloading charges may be reviewed or transformer delivered at their works;
- Charges for insulation material used in winding assembly may be reconsidered.

Instead of reviewing the rates as requested by the firm, the Board placed (August 2002) a repair order on BBL for repair of those two transformers for a cost of Rs.42.52 lakh (exclusive of to and fro transportation, ED/ST) on a single enquiry and without assessing the reasonability of rates. The rates charged by BBL were higher by Rs.4.46 lakh per transformer, excluding transportation, resulting in an extra expenditure of Rs.8.92 lakh.

The Board stated (April 2005) that the timely repair of the two transformers by BBL had helped the Board in sorting out the load management problem and uninterrupted power supply in the area. The reply is not tenable as RTS who were under approved rate contract were also repairing the transformers well in time and the delay occurred due to abnormally delayed payment by the Board.

Non-invocation of guarantee clause and placement of repair order on other firm

3.6.23 A 20 MVA 220/33 KVA TELK make transformer originally installed (October 1991) at Sanjay Gandhi Thermal Power Station, Birsinghpur failed in June 1996 was got repaired by Tarapur Transformers, Mumbai twice and the repaired transformer was shifted to Tons Hydro Electric Station, Sirmour where it was commissioned on 5 October 2003. The guarantee clause as per repair order categorically laid down that the repairing firm was contractually bound to repair the transformers if it failed within 12 months from the date of commissioning or 18 months from the date of dispatch from works, whichever was earlier, failing which the repair could be got done through some other agency at the risk and cost of the defaulting contractor and security deposit of Rs.2.26 lakh forfeited. The transformer failed on 10 January 2004 just after three months of commissioning. The matter was not taken up with Tarapur Transformers for re-repairing under the guarantee clause and finally an order was placed on Transformers and Electricals, Kerala (TELK) (March 2005) at a repair cost of Rs.44.15 lakh excluding taxes and duties. Had the guarantee clause been invoked the aforesaid amount could have been saved. The costly EHV transformer is lying un-repaired for the past one and a half year.

Board's failure to get the transformers repaired within the guarantee period resulted in extra expenditure of Rs.44.15 lakh.

Delay in repairing of power transformers resulting in blockage of funds

3.6.24 Audit scrutiny revealed that 196 power transformers (1.6, 3.15 and 5 MVA) valuing Rs.7.98 crore (179 FBGP : Rs.7.13 crore and 17 FWGP : Rs.85.00 lakh) were lying idle as on 28 February 2005. It was noticed in audit that:

- 179 transformers failed beyond guarantee period had been lying in three Area Stores (Chhindwara, Itarsi and Satna) for periods ranging from 2 to 106 months. The transformers FBGP were lying unattended at Satna for periods ranging from two to 106 months (including 6 burnt transformers), at Itarsi 5 to 17 months and Chhindwara 11 to 29 months. The Board neither initiated any action for getting the transformers repaired nor did it prepare any action plan for their repair in future.
- As per Board's circular (July 1999) the transformers FWGP were to be repaired free of cost by the firm within six months from the date of intimation of failure to the firm. One failed power transformer (3.15 MVA) worth Rs.12 lakh was lying in Area Store Itarsi after November 2003, and had not been lifted by the firm even after a lapse of more than two years after its failure. One power transformer (1.6 MVA)

worth Rs.3.28 lakh lifted by the firm in January 2003 for repair was lying with them and had not been returned back so far. The reasons for delay in getting the transformer repaired were neither found on record nor stated to Audit. The details of balance 15 transformers (FWGP) lying in other stores were not made available to Audit.

Board's failure to get repaired 196 power transformers (both FBGP and FWGP) resulted in blocking of Rs.7.98 crore.

It was further observed in audit that one 2.5 MVA 33/11 KV "NEI" make power transformer (RV 2280/01) valued Rs.4.43 lakh was lifted by United Electricals, Bhopal from Area Store Itarsi in December 1999. The transformer had not been repaired by the firm but the Board did not initiate any legal action against the firm (May 2005).

Thus delay/non-initiation of appropriate action for repairing 196 transformers had resulted in blockage of Board's funds to the tune of Rs.7.98 crore with consequential interest loss of Rs.95.73 lakh per annum at the rate of 12 percent. Besides, the Board had to incur additional expenditure on procurement of new transformers for replacement of failed ones.

Non repair of Distribution Transformers

Distribution Transformers failed within guarantee period

3.6.25 It was noticed in audit that 14170* transformers FWGP valuing Rs.48.41 crore were lying unrepaired either at Area Stores or with the firms as on February 2005. It was further seen that :

Out of 2845 new transformers valuing Rs.11.45 crore which failed within the guarantee period, 1426 and 1419 transformers were lying with the Area Stores and the repairing firms respectively at the end of February 2005.

Similarly, out of 11325 transformers valuing Rs.36.65 crore which failed within the guarantee period of their repair under rate contract, 4912 and 6413 transformers were lying with the area stores and repairing firms respectively at the end of February 2005.

Thus, the failed transformers had been lying unattended for periods ranging from 1 month to over 19 years in Area Stores and from 1 month to 16 years with the firms. The Board did not initiate any action against the defaulting firms.

Failure of the Board in initiating action for repair of 14170 FWGP transformers resulted in idle inventory of Rs.48.41 crore.

The Board's failure in initiating timely action for getting the transformers repaired within the guarantee period had resulted in idle inventory of Rs.48.41 crore. Besides, losing the benefit of free repair of such failed transformers there was an interest loss of Rs.5.81 crore per annum to the Board as the delay in repair of transformers resulted in purchase of new transformers from borrowed funds.

* 25 KVA -434, 63 KVA-7159, 100 KVA-5711, 200 KVA-791 and 315 KVA-75.

Distribution Transformers failed beyond guarantee period (FBGP)

Board's failure in taking timely action for repair of 13104 FBGP transformers resulted in idle inventory of Rs.31.74 crore.

3.6.26 As on 28 February 2005, 13104[♦] transformers up to 315 KVA valuing Rs.31.74 crore FBGP were either lying at various Area Stores[▲] or with the firms[®]. The age-wise details of these transformers were neither made available to Audit nor found on record. It was, however, noticed in four Area Stores (Satna, Chhindwara, Itarsi and Sagar) that the Board did not initiate timely action to get such transformers repaired. In the absence of age-wise details, the period of delay could not be worked out in audit. The Board's failure in initiating timely action for repair of transformers resulted in piling up of idle inventory worth Rs.31.74 crore with consequential interest loss of Rs.3.81 crore per annum.

Transformers worth Rs.4.99 crore lost in fire

3.6.27 A major fire accident broke out on 11 April 2004 at area store Satna. It engulfed 570 transformers valuing Rs.2.22 crore which failed within the guarantee period (FWGP) and were lying in the store for being lifted by the suppliers for repair/replacement at their cost. Besides, 1971 un-repairable 25 KVA transformers and 270 other assorted size distribution transformers valuing Rs.2.77 crore were also burnt in the fire.

An investigation (January 2005) into the cause of the fire revealed that unsafe level of clearance between HT and LT line passing over the area combined with improper sag/tension, and overloading of the top conductor of LT line resulted in a short circuit causing huge fire at the store.

Thus, violation of the Indian Electricity Supply Rules 1956 and absence of necessary precautionary measures resulted in a major fire due to which the Board had to suffer loss of transformers worth Rs.4.99 crore including new transformers valued Rs.2.22 crore besides other losses. Final action on the report of the investigation team had not been taken so far (May 2005).

Conclusion

The performance of the Board with regard to procurement, performance and maintenance of transformers was found to be sub-optimal during the period 2000-05. The Board took up the work in a fragmented way which

[♦] 25 KVA- 5338, 63 KVA – 4640, 100 KVA – 2531, 200 KVA- 545, 315 KVA – 50.

[▲] 25 KVA- 5208, 63. KVA – 2174, 100 KVA – 930, 200 KVA- 152, 315 KVA – 47.

[®] 25 KVA- 130, 63 KVA – 2466, 100 KVA- 1601, 200 KVA- 393, 315 KVA – 3.

suffered from defective planning, ineffective contract management with regard to procurement, repair and maintenance of transformers as also inventory management. The Board's unprofessional handling of these functions not only resulted in its failure to arrest high T&D losses and avoidable extra cost but the consumer also could not be supplied uninterrupted quality power.

Recommendations

The Board should take immediate steps to:

- remove the imbalance in growth of sub-transformation and distribution transformation capacity vis-à-vis connected load;
- arrest excessive T&D losses;
- revamp procedures for procurement of transformers to avoid delays in finalisation of tenders, deficiency in system of evaluation and reasonability of rates;
- fix time limit for finalisation of offers for placement of orders;
- formulate a dependable policy for timely repair of failed transformers; and
- identify and dispose of scrapped transformers.