CHAPTER III

3. PERFORMANCE AUDIT RELATING TO STATUTORY CORPORATION

3. PERFORMANCE AUDIT ON POWER TRANSMISSION ACTIVITY OF BIHAR STATE ELECTRICITY BOARD

Chapter-III

3. Performance Audit on Power Transmission Activity of Bihar State Electricity Board

Executive Summary

Introduction

Transmission of electricity and Grid operations in Bihar are managed and controlled by Bihar State Electricity Board (Board). As on 31 March 2007, the Board had a transmission network of 5559.05 Circuit Kilometer (Ckm) and 67 Extra High Tension (EHT) Sub-stations (SSs) which rose to 6400 Ckm and 86 SSs with installed capacity of 7078 Mega volt ampere (Mva), by 31 March 2012. The quantity of energy transmitted increased from 7371.44 Million Units (MUs) in 2007-08 to 10799.30 MUs in 2011-12. The performance audit of the Board was conducted to assess the economy, efficiency and effectiveness of its transmission activities.

Planning and Development

The Board did not prepare any State Electricity Plan (SEP) during the period covered under Performance Audit. Further, year-wise Short Term plan for addition/augmentation in the transmission system of Bihar was also not prepared by the Board. However, Detailed Project Reports for strengthening of transmission system in Bihar was prepared by the Power Grid Corporation of India Limited (PGCIL) on behalf of the Board. Further, the Board also took decision for construction of five SSs and five transmission lines during the above period.

Capacity Additions

The capacity creation of SSs and lines did not meet the targets, as only 19 SSs and 841.16 Ckm of EHT lines were constructed during the five year period against the target of 30 SSs and 2202.30 Ckm of EHT lines. The shortfall was due to delay in completion of the projects.

Project Management

The Board could not complete its projects as per schedule. We noticed instances of time overrun ranging from four to 78 months and cost overrun of ₹ 2.71 crore during the period 2007-2012. Shortfall in achievement of targeted additions were attributable to delay in finalisation of tenders, delay in getting approvals from railways, delays in approval of drawings and designs, delay in land acquisition, etc.

Operation and Maintenance

The overall transmission capacity was in excess of the requirement for every year. The Board failed to ensure the maximum and minimum voltages as per the norms. Out of 38 feeders in Patna Zone, eight feeders were loaded above 366 amps. Out of eight 220 KV SSs (three single bus bar SSs and five double bus bar SSs), Bus Bar Protection Panel (BBPP) was provided at four SSs only.

Maintenance

Performance of Power Transformers

Out of 16 transformers failed during the period covered in the Performance Audit, two caught fire and burnt due to failure of the installed protection system, four transformers failed due to failure of buchholz and differential relay, two failed due to failure of winding, and the remaining eight failed due to internal defects which could have been avoided by conducting periodical test and proper maintenance.

Transmission losses

The transmission losses ranged between 5.13 per cent and 9.75 per cent and exceeded the norms of four per cent of CEA and BERC in all the five years up to 2011-12. The quantum of transmission

loss suffered by the Board in excess of the norms for the period 2007-08 to 2011-12 was 1830.29 MU valued at ₹ 710.40 crore. The reasons for excess transmission loss included non-accounting of energy consumed by sub-station transformers and excessive transformation losses by the old power transformers.

Grid Management

Out of 86 SSs and one generator, only eight (9.3 per cent) Remote Terminal Units were found utilised as on June 2012. Further, the Board received 135 (A type), 71 (B type) and 79 (C type) messages from Eastern Region Load Dispatch Centre for violation of Grid norm during 2007-12.

Financial Management

We noticed that the Board failed to increase the contract demand of consumer as per provisions of the tariff order which resulted in short billing and loss of revenue of ₹ 11.67 crore

Further, the Board delayed the process of entering into agreement with the consumer which deprived the Board to earn revenue of ₹ 8.08 crore.

Material Management

The Board had huge quantity of the closing stock which indicated that the procurement policy of the Board was defective. During the period from 2007-08 to 2011-12, the closing stock in terms of months consumption ranged between 19 to 59 months.

Non-conducting of Physical verification of stocks in stores

The Physical Verification (PV) of the stores was not being conducted annually and was conducted only in 2007-08 and 2011-12. Further, the Board had not taken action to conduct survey reports and dispose of the scrap/obsolete material, which could have earned revenue.

Monitoring and control

Management Information System (MIS) implemented for monitoring the operations of SSs was incomplete. The Board failed to finalise the tender in time for dismantling the cable and sustained the loss of ₹ 1.50 crore on account of theft/damage of cable and security of cable.

Conclusion and Recommendations

The Board did not prepare year-wise plan for addition/augmentation in the Transmission System of Bihar. Operation of the transmission system was not efficient and effective, as a result, the transmission losses of the Board was in excess of the norms, the voltage level of SSs were not maintained within the limits, feeders were found loaded beyond their Thermal Loading Limit. Disaster management facilities of the Board were not adequate. Energy accounting system of Board was not effective as existence of high percentage of losses and negative losses were found. Energy audit was not done by the Board. Huge quantity of closing stock indicated that the procurement policy of the Board was defective. Physical Verification of the stocks were not done annually and no action were taken to conduct survey and dispose of the scrap/obsolete material by the Board. The monitoring system of the Board was not effective as a result of which, transmission lines tripped several times.

The audit made seven recommendations which included preparation of short-term as well as perspective plan, compliance of the recommendation of the Task Force to avoid delays in construction, operation of the transmission system carried as per norms, implementing effective measures to reduce transmission losses, ensuring availability of adequate disaster management facility, reforming the purchase wing and monitoring activities.

Introduction

3.1 With a view to supply reliable and quality power to all by 2012, the Government of India (GoI) prepared the National Electricity Policy (NEP) in February 2005 which stated that the Transmission System required adequate and timely investment besides efficient and coordinated action to develop a robust and integrated power system for the country. It also, *inter-alia*, recognised the need for development of National and State Grids with the coordination of Central/ State Transmission Utilities.

Transmission of electricity and Grid operations in Bihar are managed and controlled by Bihar State Electricity Board (Board) which is mandated to provide an efficient, adequate and properly coordinated Grid management and transmission of energy. The Board reports to Energy Department of Government of Bihar. The Board was constituted in 1958 under Section 5 of the Electricity Supply Act, 1948. The Board is engaged in the business of generation, transmission and distribution of electricity in the State of Bihar. In terms of Section 172 of the Electricity Act, 2003, the Board constituted under the repealed laws shall be deemed to be the State Transmission Utility (STU) and a licensee under the provisions of the Act for a period of one year from 10 June 2003 i.e. the appointed date. On the request of Government of Bihar from time to time Ministry of Power, Government of India has agreed (August 2012) to extend the time upto 31 December 2012 to continue the Board to function as a STU and Distribution licensee.

3.2 The Management of the Board is vested in the Board of Members with seven members appointed by the State Government. The day-to-day operations are carried out by the Chairman of the Board with the assistance of Member (Administration), Member (Finance and Revenue), Member (Transmission), Member (Generation) and Secretary. During 2007-08, 7371.44 Million Units (MUs) of energy was transmitted by the Board which increased to 10799.30 MUs in 2011-12, i.e. an increase of 47.18 *per cent* during 2007-12. As on 31 March 2012, the Board had transmission network of 6400 Circuit Kilometer (Ckm) and 86 sub-stations (SSs) with installed capacity of 7078 Mega volt ampere (Mva) (2450 Mva at 220/132 KV and 4628 Mva at 132/33 KV), capable of annually transmitting 15023.40 MUs at 220 KV. The turnover of the Board was ₹ 5268.79 crore in 2011-12, which was equal to two *per cent* of the State Gross Domestic Product. The number of employees in the Board was 10278 as on 31 March 2012.

Power Sector Reforms in Bihar

3.3 As part of the Power Sector Reforms, the Bihar State Electricity Board (Board) was to be unbundled. The Government of Bihar (GoB) decided (March 2012) to form and operate five Companies i.e Bihar State Power (Holding) Company Limited, Bihar State Power Transmission Company Limited, Bihar State Power Generation Company Limited, South Bihar Power Distribution Company Limited and North Bihar Power Distribution Company Limited. These companies have commenced their business with effect from 01 November 2012.

A Performance Audit on Incomplete Transmission Schemes of Bihar State Electricity Board was included in the Report of the Comptroller and Auditor General of India (Commercial), Government of Bihar for the year ended 31 March 2003. The Report was discussed by COPU in July 2010.

Scope and Methodology of Audit

3.4 The Performance Audit conducted during April 2012 to July 2012 covered the five years period from 2007-08 to 2011-12. Audit examination involved scrutiny of records of different wings at the Head Office of the Board, State Load Dispatch Centre (SLDC), five[1] out of seven Circles and eight[2] out of 16 Transmission Divisions located in the State.

The Board constructed 19 Sub-stations (SSs) (capacity: 940 Mva) and 28 lines (capacity: 841.16 Ckm) (including 15 SSs and 24 lines constructed by Power Grid Corporation of India Limited (PGCIL) on behalf of the Board), as well as augmented existing transformation capacity by 1660 Mva during the Performance Audit period. Out of four SSs and four lines (length 52 Ckm) constructed by the Board, two SSs (capacity: 80 Mva), four lines (Length: 52 Ckm) and augmentation of existing transformation capacity by 170 Mva were examined. Selection of the sample was done on the basis of capacity of the working SSs in the Divisions using random selection method.

The methodology adopted for attaining audit objectives with reference to audit criteria consisted of explaining audit objectives to the top management in the entry conference, scrutiny of records at Head Office and selected units, interaction with the audited entity's personnel, analysis of data with reference to audit criteria, raising of audit queries, discussion of audit findings with the Management and issue of draft Performance Audit to the Management/ Government for comments.

Audit Objectives

3.5 The objectives of the Performance Audit were to assess whether:

- Perspective Plan was prepared in accordance with the guidelines of the National Electricity Policy/ Plan and Bihar Electricity Regulatory Commission (BERC) and assessment of impact of failure to plan, if any;
- The transmission system was developed and commissioned in economical, efficient and effective manner;
- Operation and maintenance of transmission system was carried out in economical, efficient and effective manner;
- Disaster Management System was set up to safeguard its operations against unforeseen disruptions;

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[1] Electric Transmission Circle, Patna, Muzaffarpur, Biharsharif, Gaya and Dehri-on-sone.

[2] Electric Transmission Division, Khagaul, Patna, Muzaffarpur, Motihari, Hazipur, Biharsharif, Gaya and Dehri-on-sone.

- Effective Energy Accounting and Audit was in place;
- There was an effective and efficient Financial Management system with emphasis on timely raising and collection of bills;
- Efficient and effective system of inventory control mechanism was in existence; and
- There was a monitoring system in place to review performance of Sub-stations and lines as per Grid Code Standards, preparation of Management Information System (MIS) Reports.

Audit Criteria

3.6 The audit criteria adopted for assessing the achievement of the audit objectives were:

- Provisions of National Electricity Policy / Plan and National Tariff Policy;
- Perspective Plan and Project Reports of the Board;
- Standard procedures for award of contracts with reference to principles of economy, efficiency, effectiveness, equity and ethics;
- Report of the Task force constituted by the Ministry of Power to analyse critical elements in transmission project implementation;
- Manual of Transmission Planning Criteria (MTPC) such as Thermal Loading Limit of 366 ampere for ACAR Panther conductor,
- Code of Technical Interface (CTI)/ Grid Code consisting of planning, operation, connection codes viz. Voltage level of 198-245 KV and 119-145 KV for 220 KV and 132 KV SSs respectively, Control Measures such as installation of Bus Bar Protection Panels, etc.;
- Norms/Guidelines with respect to transmission loss issued by BERC/Central Electricity Authority (CEA);
- Report of the Committee constituted by the Ministry of Power recommending the "Best Practices in Transmission"; and
- Reports of Eastern Region Power Committee (ERPC)/ Eastern Region Load Dispatch Centre (ERLDC).

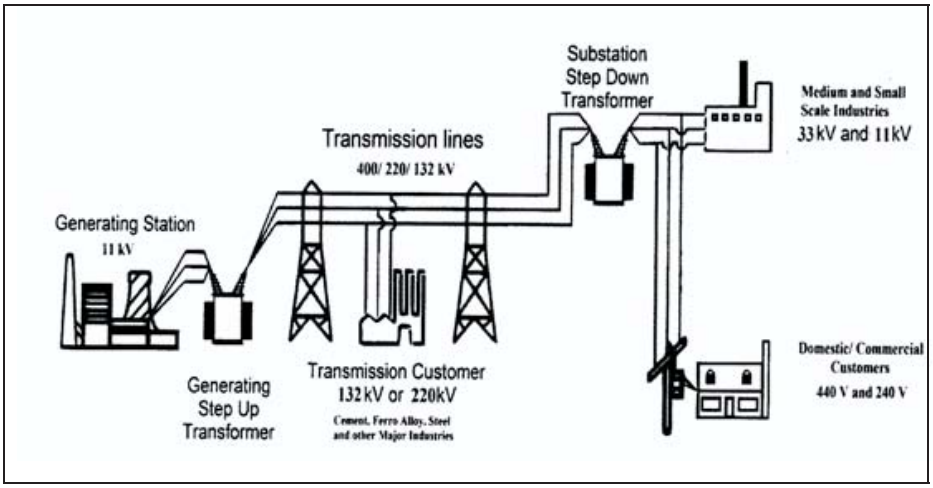
Brief description of transmission process

3.7 Transmission of electricity is defined as bulk transfer of power over long distances at high voltages, generally at 132 KV and above. Electric power generated at relatively low voltages in power plants is stepped up to high voltage power before it is transmitted to reduce the loss in transmission and to increase efficiency in the Grid. Sub-stations (SSs) are facilities within the high voltage electric system used for stepping-up/ stepping down voltages from one level to another, connecting electric systems and switching equipment in and out of the system. The step-up transmission SSs

at the generating stations use transformers to increase the voltages for transmission over long distances.

Transmission lines carry high voltage electric power. The step down transmission SSs, thereafter, decreases voltages to sub transmission voltage levels for distribution to consumers. The distribution system includes lines, poles, transformers and other equipment needed to deliver electricity at specific voltages.

Electrical energy cannot be stored; hence generation must be matched to demand of power. Therefore, every transmission system requires a sophisticated system of control called Grid management to ensure balancing of power generation closely with the demand. A pictorial representation of the transmission process is given below:



Audit Findings

3.8 We explained the audit objectives to the Board during an 'Entry Conference' held on 18 April 2012. Subsequently, audit findings were reported to the Board and the State Government in September 2012 and discussed in an 'Exit Conference' held on 29 November 2012. The Exit Conference was attended by Deputy Secretary, Energy Department, Government of Bihar, Chairman and other officials of the Board. The views expressed by the Board have been considered while finalising this Performance Audit. The audit findings are discussed in the subsequent paragraphs.

Planning and Development

National Electricity Policy/Plan

3.9 The Central Transmission Utility (CTU) and the State Transmission Utilities (STUs) have the key responsibility of network planning and development based on the National Electricity Plan in coordination with all concerned agencies. At the end of Tenth Plan (March 2007), the transmission system in the country at 765/HVDC/400/230/220/KV stood at

1.98 lakh circuit kilometres (Ckm) of transmission lines which was planned to be increased to 2.93 lakh Ckm by the end of Eleventh Plan i.e. March 2012. The National Electricity Plan assessed the total inter-regional transmission capacity at the end of 2006-07 as 14100 mega watt (MW) and further planned to add 23600 MW in Eleventh Plan bringing the total inter-regional capacity to 37,700 MW.

Similarly, the Board's transmission network at the beginning of 2007-08 consisted of 67 Extra High Tension (EHT) SSs with a transmission capacity of 4478 Mva and 5559.05 Ckm of EHT transmission lines. The transmission network as on 31 March 2012 consisted of 86 EHT SSs with transformation capacity of 7078 Mva and 6400 Ckm of EHT transmission lines with an increase of 28.36, 58 and 15.13 *per cent* respectively over the year 2007-08.

The Board neither prepared any State Electricity Plan (SEP) nor year-wise Short Term plan for addition/augmentation in the transmission system of Bihar

The STU was responsible for planning and development of the intra-state transmission system. Assessment of demand is an important pre-requisite for planning capacity addition. We observed that the Board did not prepare any State Electricity Plan (SEP) during the period covered under Performance Audit. Further, year - wise Short Term plan for addition/augmentation in the transmission system of Bihar was also not prepared by the Board. However, for strengthening the sub-transmission system in Bihar, Detailed Project Reports (Phase-II, Part-I and Part-II) containing planning for additions in the capacity of sub-stations and transmission lines during 2007-08 to 2011-12 was prepared by the Power Grid Corporation of India Limited (PGCIL) on behalf of the Board containing plan for construction of 25 SSs (1740 Mva), 50 lines (1967.30 Ckm) and augmentation of capacity of 1630 Mva. Further, the Board also took decision for construction of five SSs and five transmission lines (length: 235 Ckms) during the above period.

The Board, in reply, accepted (October 2012) that year-wise plan/augmentation of transmission system in Bihar was not prepared by the Board, but based on the study done by PGCIL a comprehensive plan for strengthening of Transmission System of Bihar was prepared which was to be completed over a period of 18 to 30 months from execution of the agreement.

Transmission network and its growth

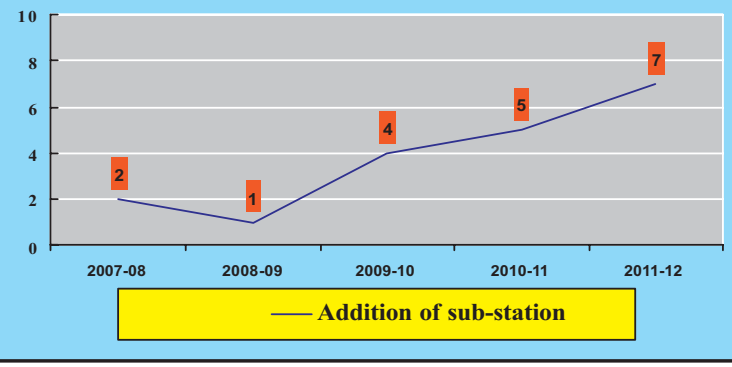
3.10 The transmission capacity of the Board at EHT level during 2007-08 to 2011-12 is given in ***Annexure – 7***.

It can be seen from the annexure that the year-wise planning for addition of sub-stations, capacity augmentation and new transmission lines was not done by the Board.

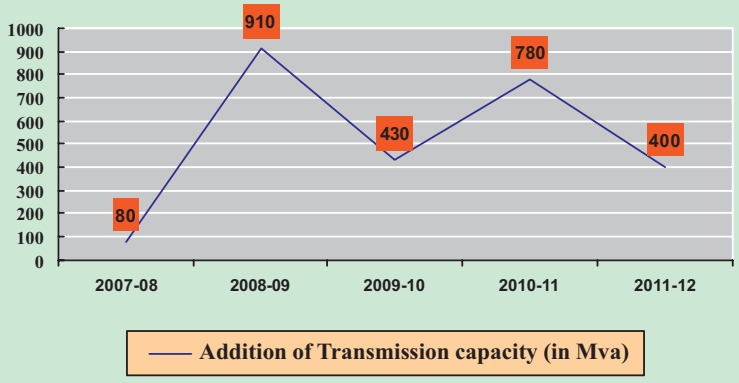
We observed that against the targeted construction of 30 EHT SSs and laying of 2202.30 Ckm of EHT lines (including 25 SSs and 1967.30 Ckm of line to be constructed by the PGCIL), the Board/PGCIL constructed 19 EHT SSs and 841.16 Ckm EHT lines during the five year period with an achievement of 63 per cent and 38 per cent respectively. The transmission

capacity of 2600 Mva was added against 4060 Mva planned (3370 Mva by PGCIL and 690 Mva by the Board) for addition for the five year period ending 2011-12.

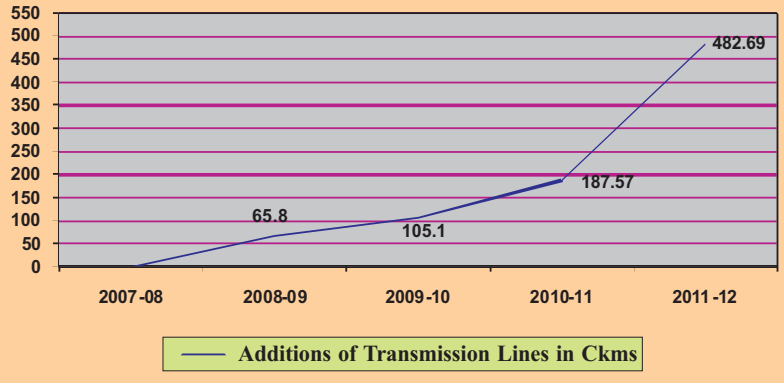
Line Graph: Addition of Sub-stations in numbers



Line Graph: Addition of Transmission Capacity (in Mva)



Line Graph: Addition of lines in Circuit Kilo meters



Our audit scrutiny revealed that shortfall in achievement of targeted additions was attributable to delay in completion of the projects due to various reasons such as delay in acquisition of land, Right of way problem, delay in getting approvals from railways, delay in finalisation of tenders, etc. The reasons are discussed in detail in paragraph no. 3.12, 3.13 and 3.14.

The Board accepted (October 2012) that there were some shortfall and time overrun in targeted addition which was mainly due to issues not controllable by the Board viz. delay in land acquisition, hindrance from local people and ROW problem. The reasons viz. delay in finalisation of tenders, getting approvals from railways, approval of drawings and designs etc., were controllable and could have been avoided by better coordination and timely action.

Project management of transmission system

3.11 A transmission project involves various activities from concept to commissioning. Major activities in a transmission project are (i) Project formulation, Appraisal and Approval Phase and (ii) Project Execution Phase. For reduction in project implementation period, the Ministry of Power, Government of India constituted a Task Force on transmission projects (February 2005) with a view to:

- analyse the critical elements in transmission project implementation,
- implementation from the best practices of CTU and STUs, and
- suggest a model transmission project schedule for 24 months' duration.

The Task Force suggested and recommended (July 2005) the following remedial actions to accelerate the completion of Transmission systems.

- Undertake various preparatory activities such as surveys, design & testing, processing for forest and other statutory clearances, tendering activities, etc. in advance/parallel to project appraisal and approval phase and go ahead with construction activities once Transmission Line Project sanction/approval is received;
- Splitting the transmission projects into clearly defined packages in such a way that the packages can be procured and implemented requiring least coordination and interfacing and at same time it attracts competition facilitating cost effective procurement; and
- Standardise designs of tower fabrication so that six to 12 months can be saved in project execution.

3.12 We observed that all the construction projects were carried out by the Board on turnkey basis wherein the contractors were required to undertake various preparatory activities such as surveys, design & testing, processing for forest and other statutory clearances, etc. contrary to the recommendation of the task force which ultimately resulted in delay in completion of the projects.

Notwithstanding the elaborated guidelines given by the Task Force for timely completion of the projects, the Board failed to execute several SSs and Lines during 2007-12 as detailed below:

Capacity in KV	Total No. constructed		Delay in construction (Numbers)		No. test checked by Audit		Time overrun[3] (Range in months)		Cost overrun (₹ in crore)	
	SSs	Lines	SSs	Lines	SSs	Lines	SSs	Lines	SSs	Lines
220	01	02	01	02	-	-	-	-	-	-
132	18	26	17	26	02	04	72 to 78	4 to 72	4.12	2.71
Total	19	28	18	28	02	04			4.12	2.71

Out of total 19 SSs and 28 transmission lines constructed during the period covered in Performance Audit, 15 SSs and 24 transmission lines were constructed by PGCIL on behalf of the Board, out of which 14 SSs and 24 transmission lines were completed with a delay ranging from two to 38 months. The Board constructed remaining four SSs and transmission lines each during above period with delay ranging between four to 78 months.

Reasons for delay in construction of SSs and Transmission Lines as observed in audit were delay in approval of survey and soil investigation report by the Board, Right of way (ROW) problems, delay in acquisition of land, delay in finalisation of tenders and award of work orders, delay in execution of the projects by the contractors, not seeking timely clearances from Railways, etc. Besides, the standardised designs for tower fabrication was not prepared by the Board, also delayed the projects.

Some of the instances of time and cost overrun in construction of SSs, transmission lines and other construction projects are discussed in details below:

Time and cost overrun in construction of Sub-station at Sherghati

3.13 For construction of 40 Mva SS at Sherghati and its associating 132 KV line from Gaya to Sherghati on turnkey basis, Notice Inviting Tender (NIT) with an estimated cost of ₹ 14 crore was floated in December 2003. As per terms and conditions of the NIT, the validity period of the bid was 180 days from the date of opening of technical and financial part of bid. In response to the NIT, one bid (M/s Alstom India Ltd.) was received (January 2004). The price quoted by the bidder was ₹ 18.46 crore. The Board instead of finalising the tender within the validity period of 180 days (upto July 2004), invited (December 2004) the firm for negotiation and requested the firm to extend the quoted validity period which was not accepted by the bidder citing the reasons of increase in the cost of materials. The Board decided (June 2005) to go for a fresh tendering process with revised estimated cost of ₹ 21.50 crore but no bid was received in response to second tender. The Board again invited tender (July 2006) and the work was finally awarded (May 2008) at a cost of ₹ 22.14 crore. The work was

[3] Test checked in audit.

scheduled to be completed within 18 months from the date of award of work. The work was completed in January 2012 with a delay of more than six years from the date of validity period of first NIT. Further, there was delay of 14 months from the scheduled date of completion as per work order. This resulted in cost overrun of ₹ 3.68 crore.

Non-finalisation of tender within validity period of bid resulted in delay in completion of SS by six years and cost overrun by ₹ 3.68 crore

We observed that the Board failed to take decision within the validity period at the time of first tender regarding award of work to single tenderer, whose quoted rate was higher than the estimated price

Thus, due to failure in finalisation of tender within validity period, the project was delayed by more than three and half years even before commencement of execution and also the Board had to incur an extra expenditure on the project.

The Board stated (October 2012) that there was single bid received and rate was very high with discrepancy in price part. The firm was ultimately called for rate negotiation but the firm declined to reduce the rate and the tender was cancelled. The reply does not explain as to why the first tender was not finalised within the validity period of bid. Further, the estimated price given in NIT was for idea purpose only and comparison of the bid with the same was not proper. The discrepancy with respect to price part in bid was also clarified by the bidder before expiry of validity period and finally the work was awarded to single tenderer in May 2008.

Unplanned construction of Sub-station at Masaurhi

3.14 For construction of a SS of 40 Mva capacity at Masaurhi, the Board issued a work order (August 2000) to M/s Bhojpur Construction Pvt. Ltd. (Contractor) at a cost of ₹ 5.12 crore. Material for the work was to be supplied by the Board. As per the work order the scheduled completion period of work was 15 months i.e. October 2001.

After completing one third of the work, the Contractor stopped (November 2001) the work due to non-availability of structure, design of foundation and drawings of transformer/breaker, delay in payment of bills, etc. In March 2005, the Board, after receiving a sum of ₹ five crore from Government of Bihar, again requested the contractor to execute the left over work. The Contractor demanded a price escalation which was refused by the Board. The Board decided to construct the SS departmentally and the same was completed (May 2008) at a cost of ₹ 6.86 crore.

By awarding the work without proper planning, the construction work of SS was delayed by more than six years which resulted in cost overrun of ₹ 1.74 crore

We observed that there was lapse on the part of Government of Bihar in providing the fund which resulted in delays in execution. Besides, the Board also started the work without ensuring the required designs/drawings and equipments which indicated improper planning on the part of the Board.

Thus, awarding of the work without proper planning, the work of SS was delayed by more than six years which resulted in cost overrun of ₹ 1.74 crore.

The Board stated (October 2012) that due to various reasons such as non-availability of power transformer, paucity of fund, difficulty in transportation of construction materials, etc., the construction programme of Masaurhi SS was extended several times and could not be commissioned in time and suffered cost overrun due to price hike of materials. The fact remains that the commencement of execution of the projects without ensuring availability of adequate funds and equipments indicated improper planning on the part of the Board.

Avoidable expenditure

3.15 As per agreement signed (May 2006) between Government of Bihar (GoB), PGCIL, Ministry of Power, Government of India (GoI) and the Board, the work of Renovation and Modernisation (R&M) of 220/132 KV Grid sub-station at Biharsharif was to be carried out by the Board. Total fund available for the above work was ₹ 26.89 crore. The Board awarded (September 2008) the work of R&M of sub-station at Biharsharif to M/s Techno Electric and Engineering Company Ltd. at a total cost of ₹29.26 crore. The scope of work included installation of one new 20 Mva 132/33 KV Transformer valuing ₹ 2.01 crore which was to be installed for exclusive utilisation in providing 33 KV supply to substation transformer (630 Kva×2) for lighting and other auxiliary purpose.

Further, as per above agreement, the work of augmentation of capacity of existing SSs in Bihar was being carried out by the PGCIL which included replacement of existing lower capacity transformers with higher capacity transformers. Accordingly, a 7.5 Mva 132/33 KV transformer was replaced (July 2008) with a new 20 Mva transformer at Sultanganj SS by PGCIL and as a result of the said replacement, the existing transformer of 7.5 Mva became idle and was kept in stores without any use till date (November 2012).

Due to failure in taking prudent decision to utilise 7.5 Mva 132/33 KV spare transformer, the Board had to incur an avoidable expenditure of ₹ 2.01 crore

We observed that the expenditure incurred on installation of a new transformer at Biharsharif could have been avoided by utilising the 7.5 Mva transformer (replaced at Sultanganj) for providing 33 KV supply to substation transformer at Biharsharif.

Thus, due to failure in taking prudent decision regarding utilisation of 7.5 Mva 132/33 KV spare transformer, the Board had to incur an avoidable expenditure of ₹ 2.01 crore.

The Board stated (October 2012) that the replaced transformer was very old and was in no way reliable for auxiliary supply to SS and kept as standby to meet the emergency. The reply is not based on the facts as the transformer was in normal condition and the same was sent (December 2009) to Hathidah SS for utilisation but could not be transported due to route constraints. Thus, it became idle due to imprudent decision taken by the Board and the Board incurred avoidable expenditure.

Performance of transmission system

3.16 The performance of the Board mainly depends on efficient maintenance of its EHT transmission network for supply of quality power with minimum interruptions. In the course of operation of Sub-stations and lines, the supply-demand profile within the constituent sub-systems is identified and system improvement schemes are undertaken to reduce line losses and ensure reliability of power by improving voltage profile. These schemes are for augmentation of existing transformer capacity, installation of additional transformers, laying of additional lines and installation of capacitor banks. The performance of the Board with regard to O&M of the system is discussed in the succeeding paragraphs.

Transmission capacity

3.17 The Board, in order to evacuate the power from the Generating Stations and to meet the load growth in different areas of the State, constructs lines and SSs at different EHT voltages. A Transformer converts AC voltage and current to a different voltage and current at a very high efficiency. The voltage levels can be stepped up or down to obtain an increase or decrease of AC voltage with minimum loss in the process. The evacuation is normally done at 220 KV. However, the Board also evacuates the power at 132 KV. The transmission capacity (220 KV and 132 KV) created *vis-à-vis* the transmitted capacity (peak demand met) at the end of each year by the Board during the five years ending March 2012 was as follows :

Transmission capacity (in Mva)				
Year	**Installed**	**After leaving 30 per cent towards margin**	**Peak demand including non-coincident demand**	**Excess/ shortage (3-4)**
1	**2**	**3**	**4**	**5**
2007-08	4558	3191	1244	1947
2008-09	5468	3828	1348	2480
2009-10	5898	4129	1508	2621
2010-11	6678	4675	1664	3011
2011-12	7078	4955	1712	3243

(Source: Information provided by the Board)

From the above table it would be observed that the overall transmission capacity was in excess of the requirement for the last five years ending March 2012. The existing transmission capacity excluding 30 *per* cent towards redundancy worked out to an excess of 3243 Mva at the end of March 2012**.** Further, in case of 15 test checked SSs constructed during 2007-12, the maximum load met during 2007-12 by seven[4] numbers of 132/33 KV sub-stations ranged between 5.8 MW and 10 MW (15 to 30 *per cent* of installed capacity) for a period ranging from three months to 60

[4] SSs at Belaganj, Dhaka, Masaurhi, Attaula karpi, Tekari, Hulasganj, Sheetalpur.

months. Thus, existence of extra/idle capacity in the transmission network and at the same time prevalence of overloads in eight feeders of Patna Zone as well as high voltages in 38 SSs of Patna and Muzaffarpur Zones, reflected unscientific planning in creation of transmission network.

The Board stated (October 2012) that installed capacity had been shown by adding capacity of 220/132 KV and 132/33 KV and the peak load is met mainly by capacity at 132/33 KV. The reply is not convincing as the peak load met by the Board also included power supplied to EHT consumers at 132 KV level which was fed from 220/132 KV SSs.

Sub-stations

Adequacy of Sub-stations

3.18 The Manual on Transmission Planning Criteria (MTPC) stipulates the permissible maximum capacity for different SSs i.e., 320 Mva for 220 KV and 150 Mva for 132 KV SSs. Scrutiny of the maximum capacity levels of SSs revealed that three[5] 220 KV and one[6] 132 KV SSs exceeded the permitted levels.

MTPC also prescribes that every SS of capacity 132 KV and above should have at least two transformers. Further, the Transmission Planning and Security Standards prescribed by MTPC indicated that the size and number of transformers in the SS shall be planned in such a way that in the event of outage of any single transformer the remaining transformer(s) could still supply 80 per cent of the load. However, we observed that only one transformer was found installed in Begusarai 220/132 KV SS, Vaishali and Biharsharif 132/33 KV SS.

The Board stated (October 2012) that MTPC provided general guidelines for optimum sizing of Grid capacity and exceeding the capacity was not a major issue. The reply, however, does not take cognizance of the fact that the capacity and number of transformers in the substations as prescribed by MTPC was for better and secure operation of Grid and should be followed for effective operation of transmission system.

Voltage management

3.19 The Licensees using intra-state transmission system should make all possible efforts such as installation of Capacitors, Reactors, Flexible Alternating Current Transmission system etc. to ensure that grid voltage always remains within limits. As per Indian Electricity Grid code STUs should maintain voltage ranges between 380-420 KV, 198-245 KV and 119-145 KV in 400 KV, 220 KV and 132 KV lines respectively.

The examination of the records of 220/132 KV bus voltages in five and three divisions of the Patna and Muzaffarpur Zone respectively for the

[5] Biharsharif , Bodh Gaya and Dehri-on-sone.

[6] Jakkanpur.

period from April 2007 to March 2012 revealed that in three 220/132 KV SSs the voltages recorded ranged between 252 KV and 177 KV while in 35 132/33 KV SSs voltage recorded ranged between 154 KV and 98 KV. Thus, the Board failed to ensure the maximum and minimum voltages as per the norms which caused frequent tripping of various transformers installed at SSs.

The Board stated (October 2012) that the voltage was regulated by On Load Tap Changer (OLTC) of transformer and capacitor bank installed at three SSs. Further, the Board also accepted that reactors for stepping down the voltage profile in case of high voltage condition has not been installed in Board's system and was depended on PGCIL's system.

Lines

EHT lines

3.20 As per MTPC, permissible line loading cannot normally be more than the Thermal Loading Limit (TLL). The TLL limits the temperature attained by the energized conductors and restricts sag and loss of tensile strength of the lines. The TLL limits the maximum power flow of the lines. As per MTPC the TLL of 132 KV line with ACSR[7] Panther 210 sq. mm. conductor should be 366 amps.

Loading on lines beyond permissible limit resulted in voltage fluctuations, line losses and interruption / breakdowns in feeders

Scrutiny of the line loadings on the 132 KV feeders revealed that, eight feeders out of 38 feeders in Patna Zone were loaded above 366 amps (367 to 450 amps). Loading of the lines beyond capacity resulted in voltage fluctuations in seven SSs, higher transmission losses in two feeders ranging from five *per cent* to 28.5 *per cent* and 77 interruptions / breakdowns in overloaded 132 KV feeders during the Performance Audit period.

The Board stated (October 2012) that in case of new transmission lines the average loading was done around 70 to 75 MW except in case of very extra ordinary situation the loading pattern is maintained within the limits.

Bus Bar Protection Panel (BBPP)

3.21 Bus bar is used as an application for inter connection of the incoming and outgoing transmission lines and transformers at an electrical Sub-station. BBPP limits the impact of the bus bar faults on the entire power network which prevents unnecessary tripping and selective to trip only those breakers necessary to clear the bus bar fault. As per Grid norms and Best Practices in Transmission System, BBPP is to be kept in service for all 220 KV Sss to maintain system stability during Grid disturbances and to provide faster clearance of faults on 220 KV buses. We observed that out of eight 220 KV SSs (three single bus bar SSs and five double bus bar SSs) where BBPP was required to be installed, the Board provided the panel only at four SSs.

[7] Aluminum Conductor Steel Reinforced.

Maintenance

Performance of Power Transformers (PTRs)

3.22 Power Transformers are one of the most important and cost-intensive components of electrical energy supply networks. Thus, it is of special interest to prolong their life duration while reducing their maintenance expenditure. In order to gather detailed information about the operational conditions of PTRs, various kinds of oil analysis like the standard oil Dissolved Gas Analysis (DGA) tests are generally conducted. For PTRs' insulation, a combination of an insulating liquid and a solid insulation impregnated therewith are used. For an evaluation of the actual condition of this insulating system usually a DGA is used, as failures inside the PTRs lead to a degradation of the liquid insulation in such a way that the compound of the gases enables identification of cause of the failure.

The table below indicates status of failure of transformers during the years 2007-08 to 2011-12:

Year	No. of transformers at the beginning of the year	No. of transformers failed	No. of transformers failed within guarantee period	No. of transformers failed within normal working life	Expenditure on repair and maintenance (₹ in crore)
2007-08	111	06	Nil	06	6.26
2008-09	126	01	Nil	01	8.09
2009-10	139	01	Nil	01	10.33
2010-11	159	01	Nil	01	7.75
2011-12	176	07	Nil	07	8.03

(Source: Information furnished by the Board)

It would be seen from the table that 16 transformers failed during the period covered in the Performance Audit. Out of 16 transformers two (one 220/132 KV of 150 Mva capacity in March 2008 and another 132/33 KV of 20 Mva August 2010) caught fire and burnt due to failure of the installed protection system, four transformers failed (July-2008, August-2009, August-2011 and October 2011) due to failure of buchholz relay and differential relay, two failed (November-2007 and December 2007) due to failure of winding, one failed (May 2011) due to poor insulation and the remaining seven failed due to internal defects which could have been avoided by conducting periodical test.

There was no system in place to conduct periodical test of working transformer to ensure their perfectness

We observed that there was no system in place to conduct periodical test of working transformer to ensure the perfectness of various parameters. During test check of transformers installed at six[8] 220/132 KV SS, DGA test was done only once (July 2008) in SSs at Bodh Gaya. Instead of conducting periodical test, the Board conducts test only after failure of a transformer to assess the damaged parts of the transformers. Reasons for non-conducting of

[8] Biharsharif, Bodh Gaya, Dehri-on-Sone, Fatuha, Khagaul and Gopalganj.

periodical test were non-availability of required infrastructure and adequate shut-downs. Further, as per schedule, maintenance of the transmission equipments was to be taken up twice in a year i.e. summer and winter. However, in none of the SSs schedule maintenance was taken up during Performance Audit period.

The Board stated (October 2012) that Break Down Voltage (BDV) test is carried out to assess the insulation level. In case of low BDV value, filtration of oil is carried out and after that the oil samples are sent periodically in recognised Government laboratory. The reply of the Board was not based on the facts as test was carried out only once in one SS at Bodh Gaya.

Working of hot lines division/sub divisions

3.23 Regular and periodic maintenance of transmission system is of utmost importance for its un-interrupted operation. Apart from scheduled patrolling of lines, following techniques are prescribed in the Report of the Committee under chairmanship of Dr. S Mukhopadhyay for up-dating the best practices of Transmission in the country for maintenance of lines:

- Hot Line Maintenance.
- Hot Line Washing.
- Hot line Puncture Detection of Insulators.
- Preventive Maintenance by using portable earthing hot line tools.
- Vibration Measurement of the line.
- Thermo-scanning.
- Pollution Measurement of the equipment.

None of the hot line techniques (except utilisation of Thermo-vision cameras) was available with the Board

The Hot Line Technique (HLT) envisages attending to maintenance works like hot spots, tightening of nut and bolts, damages to the conductor, replacement of insulators, etc. of SSs and lines without switching off. This includes thermo scanning of all the lines and SSs towards preventive maintenance. HLT was introduced in India in 1958. We observed that none of the above mentioned hot line technique (except utilisation of Thermo-vision cameras) was available with the Board for regular and periodic maintenance during Performance Audit period. Further, separate hot line divisions/sub-divisions in the Board was not found in existence.

The Board accepted (October 2012) the fact and stated that Board would consider setting up of hot line maintenance division and creating the infrastructure.

Transmission losses

3.24 While energy is carried from the generating station to the consumers through the Transmission & Distribution (T&D) network, some energy is lost which is termed as T&D loss. Transmission loss is the difference between energy received from the generating station/Grid and energy sent

for Distribution. The details of transmission losses from 2007-08 to 2011-12 are given in table below:

Particulars	Unit	Year				
		2007-08	2008-09	2009-10	2010-11	2011-12
Power received for transmission	MUs	7961.30	8584.69	9836.58	10882.86	11965.88
Net power transmitted	MUs	7371.44	8144.14	9217.97	9898.16	10799.30
Actual Transmission loss	MUs	589.86	440.55	618.61	984.70	1166.58
	percentage	7.41	5.13	6.29	9.05	9.75
Transmission loss as per the CEA norm	percentage	4	4	4	4	4
Transmission loss as per BERC norms	percentage	4	4	4	4	4
Transmission loss in excess of BERC norm	MUs	271.48	97.01	225.26	548.50	688.04
	Rate per Unit in ₹	2.96	3.12	3.03	3.87	4.64
	₹ in crore	80.36	30.27	68.25	212.27	319.25

(Source: Annual Accounts of the Board, Tariff orders of BERC and information furnished by the Board)

Failure to keep the transmission losses under CEA and BERC norms resulted in excess loss of 1830.29 MUs valued at ₹ 710.40 crore for the period 2007-08 to 2011-12

As would be noticed the transmission losses ranged between 5.13 *per cent* and 9.75 *per cent* and exceeded the CEA and BERC norms of four per cent in all the five years up to 2011-12. The value of transmission loss suffered by the Board in excess of the norms for the period 2007-08 to 2011-12 was 1830.29 MUs valued at ₹ 710.40 crore.

Audit observed that the reasons for excessive transmission loss included idle charging of transmission lines to avoid theft of conductors, non-accounting of energy consumed by sub-station transformers used for sub-station lighting/auxiliary consumption due to non-installation of meters and excessive transformation losses by the old power transformers.

The Board stated (October 2012) that the figures of power received for transmission as per tie-flow plus own generation was less than the figures shown by audit and if the same was considered, the loss would be in the range of 3 to 6 *per cent*. We have, however, taken the figure for power received for transmission from Annual Accounts and the same has been considered for calculation of losses.

Grid Management

Maintenance of Grid and performance of SLDC

3.25 Transmission and Grid Management are essential functions for smooth evacuation of power from generating stations to the State transmission utilities/consumers. Grid Management ensures moment-to-moment power balance in the inter-connected power system to take care of reliability, security, economy and efficiency of the power system. Grid

management in India is carried out in accordance with the standards/directions given in the Grid Code issued by CEA. National Grid consists of five regions viz., Northern, Eastern, Western, North Eastern and Southern Grids, each of these having a Regional Load Dispatch Centre (RLDC), an apex body to ensure integrated operation of the power system in the concerned region. The Bihar State Load Dispatch Centre (SLDC), a constituent of Eastern Regional Load Dispatch Centre (ERLDC), Kolkata, ensures integrated operation of power system in the State. The State Government notified (February 2007) that the SLDC shall be operated by the Board. The SLDC is not assisted by any Area Load Dispatch Centre (ALDCs) for data acquisition and transfer to SLDC and supervisory control of 132 KV and 33 KV equipments.

Infrastructure for load monitoring

3.26 Remote terminal Units/Sub-station Management Systems (RTUs/SMSs) are essential for monitoring the efficiency of the transmission system and the loads during emergency in Load Dispatch Centres as per the Grid norms for all Sub stations.

Only eight (9.3 *per cent*) RTUs were found utilised as on October 2012. As a result real time loads of SSs during emergency could not be monitored and benefit of system could not be achieved

We observed that there were 86 (eight 220/132 KV SSs and 78 132/33 KV SSs) SSs and one[9] generator in the transmission network of the Board, out of which 27 (31 *per cent*) SSs and one generator were provided with RTUs for recording of real time data for efficient Energy Management System. Out of 27 RTUs installed, five RTUs were not integrated with the system due to non-availability of link. Further, 14 RTUs were not in working condition till October 2012. Thus, only eight (9.3 *per cent*) RTUs were found utilised as on October 2012. As a result real time loads of SSs during emergency could not be monitored and benefit of system could not be achieved.

The Board accepted (October 2012) the facts and stated that PGCIL had been requested to do engineering for integration of all running and upcoming SSs with data tele-metering and voice communication.

Grid discipline by frequency management

3.27 As per Grid Code, the transmission utilities are required to maintain Grid discipline for efficient functioning of the Grid. All the constituent members of the Grid are expected to maintain a system frequency between 49 and 50.5 Hertz (Hz) (49.2 and 50.3 Hz with effect from April 2009). Due to various reasons such as shortages in generating capacities, high demand, non-maintaining load generation balance, inadequate load monitoring and management, Grid frequency goes below or above the permitted frequency levels. To enforce the Grid discipline, the ERLDC issues three types of violation messages viz. A, B and C.

- Message 'A' is issued when the frequency is less than 49.2 Hz and over-drawal is more than 50 MW or 10 per cent of schedule whichever is less.

[9] Barauni Thermal Power Station.

- Message 'B' is issued when frequency is less than 49.2 Hz and over-drawal is between 50 and 200 MWs for more than ten minutes or 200 MWs for more than five minutes.
- Message 'C' (serious nature) is issued 15 minutes after the issue of message 'B' when frequency continues to be less than 49.2 Hz and over drawal is more than 100 MW or ten per cent of the schedule whichever is less.

The Board violated the Grid norms during 2007-08 to 2010-11, however, the instances of violation of Grid norms reduced considerably during 2011-12

We observed that the Board received 135 (A type), 71 (B type) and 79 (C type) messages during five years period ending March 2012. Of these, the Board received 131 messages in a year during 2009-10 which included 51 C type (serious nature) messages. The type A messages received by the Board during 2007-08 to 2011-12 ranged between four and 48. Thus, by drawing the power in excess of allocation, the Board violated the Grid norms during 2007-08 to 2010-11, however, the instances of violation of Grid norms reduced considerably during 2011-12.

Planning for power procurement

3.28 The Board draws long term supply plan taking into account the contracted generation capacity, allocation from central sector and future committed projects and evolve net additional requirement of power in consultation with the distribution wing. It also draws day ahead plan for assessing its day to day power requirement. The details of total requirement of the State, total power supplied and shortage of power for the five years 2007-08 to 2011-12 are given below:

(Figures in MUs)

Sl.No.	Details	2007-08	2008-09	2009-10	2010-11	2011-12
1	Total power requirement	11134	12874	14886	17213	19905
2	Total power supplied[10]	7371	8144	9218	9898	10799
3	Power short supplied	3763	4730	5668	7315	9106
4	Percentage of shortage	33.80	36.74	38.08	42.50	45.75

(Source: Report of 17th Electric Power Survey and information furnished by the Board)

It could be seen from the above that the percentage of shortage of power is on the increasing trend i.e., from 33.80 in 2007-08 to 45.75 per cent in 2011-12.

The Board stated (October 2012) that attempts were made to procure power from IPPs, new sugar mills coming in the State as well as construction of new units at BTPS & MTPS to meet shortage of power in the State.

Loss *due to non-drawal of schedule allocated power*

3.29 As per 17th Electric Power Survey of India, total anticipated power requirement for the year 2011-12 in Bihar was 19905 MUs. Further, during 2011-12, total power available to the Board was 12284.83 MUs which

[10] Including generation, short and long term purchases and drawal from Central Generating Stations.

included own generation, scheduled power allocated under Central Sector, power from individual power producers etc. Out of 12284.83 MUs of power available, the Board purchased 12144.44 MUs of power valuing ₹ 4393.44 crore at an average cost of ₹ 3.62/unit.

Scrutiny of records revealed that out of total 12144.44 MUs of power available through purchase, the Board did not draw 664.15 MUs of power which was considered as sale through Unscheduled Interchange (UI). Thus, 664.15 MUs of power valuing ₹ 209.95 crore was sold under UI at an average value of ₹ 3.16/unit which was purchased at an average cost of ₹ 3.62/unit.

We observed that although there was acute shortage of power in the State and the power supplied by the Board was 54.25 *per cent* of the requirement in 2011-12, the Board did not draw the scheduled allocated power and ultimately it was sold under UI at a loss of ₹ 0.46/unit.

Although there was acute shortage of power in the state, the Board did not draw the allocated power and suffered a loss of ₹ 30.32 crore

Thus, due to non-drawal of scheduled allocated power, the Board suffered loss of ₹ 30.32 crore as compared to average cost of power purchase during 2011-12.

The Board stated (October 2012) that power drawal depended on the system conditions and demand. Sometimes due to bad weather i.e. rain, cyclone, wind, breakdown of trunk lines, outage of power transformers, power demand crashes and drawal of power reduced. The reply is not acceptable as the reasons stated by the Board might be accepted for short duration whereas it was noticed that drawal of power by the Board was less than the schedule allocation continuously in nine months from June 2011 to March 2012.

Disaster Management

3.30 Disaster Management (DM) aims at mitigating the impact of a major break down on the system and restoring it in the shortest possible time. As per the Best Practices, DM should be set up by all power utilities for immediate restoration of transmission system in the event of a major failure. It is carried out by deploying Emergency Restoration System, DG sets, vehicles, fire-fighting equipments, skilled and specialized manpower.

Disaster Management Centre, National Load Dispatch Centre, New Delhi will act as a Central Control Room in case of disasters. As a part of DM programme, mock drill for starting up generating stations during black start[11] operations was not carried out by the Board during Performance Audit period.

[11] The procedure necessary to recover from partial or a total black out.

Inadequate facilities for DM

3.31 There is only one generating station (BTPS)[12] in the State. The black start facilities were, however, not available in the Station indicating the inadequacy in the preparedness for DM.

Diesel generating (DG) sets and synchroscopes[13] form part of DM facilities at EHT SSs connecting major generating stations. We observed that DG sets were available in all eight numbers 220 KV SSs (five numbers DG sets in working condition and three numbers not in working condition) while only three synchroscopes were available out of which one was not in use. Further, the Board did not identify vulnerable installations for provision of metal detectors and handing over the security of the sites to the Security Force to meet crisis arising due to terrorist attacks, sabotage and bomb threats.

The Board accepted (October 2012) the fact and stated that attempts were being made to rectify the above mentioned deficiencies.

Energy Accounting and Audit

3.32 Energy accounting and audit is necessary to assess and reduce the transmission losses. The transmission losses are calculated from the Meter Reading Instrument (MRI) readings obtained from Generation to Transmission (GT) and Transmission to Distribution (TD) Boundary metering points. As on 31 March 2012 there were 361 interface Boundary metering points between TD (327) and GT (34). While in test checked divisions, out of 14 GT points, 12 were provided with 0.2S class[14] meter and remaining with 0.5S class meter. Further, out of 242 TD points in test checked division 206 were provided with 0.2S class meters, 29 were with 0.5S class meters and seven were other meters with class not specified.

Energy audit on the meter reading report for ascertaining the feeders with high losses and reasons thereof of various SSs was not conducted

Further, analysis of data for three months period from January 2012 to March 2012 of eight divisions with 38, 132 KV feeders test checked indicated existence of high percentage of losses ranging between 5.9 to 94.69 per cent in 10 feeders, 0.04 to 3.33 per cent in 16 feeders and remaining 12 feeders had defective meters out of which seven were showing negative losses. It was also noticed that the negative losses were due to usage of different class of meters at input and output points, existence of defective meters and replacement of meters without compatibility to Current Transformers and Potential Transformers consequently energy accounting and transmission losses worked out by the Board seems un-realistic.

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[12] Barauni Thermal Power Station.

[13] In an AC electrical power system it is a device that indicates the degree to which two systems (generators or power networks) are synchronised with each other.

[14] Class of meters shows the limits of the permissible error and expressed in *per cent* i.e. for 0.2S class meters, error should not be more than 0.2 *per cent* at power factor 1.

Further, we observed that the activities of the Board were limited to compilation of the information regarding energy received and transmitted. Energy audit on the meter reading report including analysis of the reports for ascertaining the feeders with high losses and reasons thereof of various SSs was not conducted during the period of Performance Audit.

The Board stated (October 2012) that decision was taken to replace all 0.5 class meters with 0.2 class meters. The Board also stated that 200 meters of 0.2 class had been procured out of which 150 had been installed. The reply was silent about existence of high percentage of losses and non-conducting of energy audit.

Financial Management

3.33 One of the major objectives of the National Electricity Policy, 2005 was ensuring financial turn-around and commercial viability of Power Sector. However, the Board was incurring losses during 2007-08 to 2011-12. The accumulated losses of the Board had increased by 303.94 *per cent* from ₹ 2109.41 crore in 2007-08 to ₹ 8520.71 crore in 2011-12. Since the Board has not compiled separate financial data in respect of transmission activity, analysis thereof could not be done in the Performance Audit.

Billing of Extra High Tension consumers

3.34 Supply of electricity to Extra High Tension (EHT) consumers (132 KV level) and billing of the energy consumed by them were provided and monitored by the Transmission wing of the Board through seven transmission Circles. Further, Supply of the electricity and billing thereof were guided by the orders of the BERC issued from time to time. During Performance Audit, the system of supply of electricity and billing were scrutinized and following irregularities were noticed:

Non-enhancement of contract demand of Railway Traction Service (RTS) consumers as per Tariff provisions

3.35 As per the terms and conditions of the Tariff Order issued in December 2010, the transformer capacity of HT consumer shall not be more than 150 *per cent* of the contract demand except Railways where it was fixed 200 *per cent* of the contract demand. It was further elaborated that if consumer found to be utilising transformer of higher capacity than admissible for his contracted load, it will fall under malpractice.

During scrutiny of the records of the Electric Transmission Circles, Patna, Gaya and Biharsharif, it was observed that the four RTS consumers at Danapur-Khagaul Point, Fatuha-Khusrupur Point, Jehanabad point and Mokama Point were having Transformers of 1×21.6 Mva each in violation of provisions of the tariff orders although the contract demand of the above consumer was only seven and half, seven, two and five Mva respectively. Hence as per the provisions of the tariff orders, the contract demand of the above consumers should have been 10.80 Mva to match the provisions of tariff of 200 *per cent* transformers capacity.

Failure of Board to increase the contract demand of the consumer as per provisions of the tariff order resulted in loss of revenue of ₹ 11.67 crore

We observed that the Board failed to increase the contract demand of the consumer as per provisions of the tariff order which resulted in short billing and loss of revenue of ₹ 11.67 crore[15].

The Board stated (October 2012) that Railways were requested to enhance their contract demand as per new tariff but in spite of several requests Railways did not enhance their originally contract demand and stated that the above tariff was not acceptable to Railways. The reply of the Board was not convincing as tariff order issued by BERC was binding on all consumers including railways. Further, in case of new RTS connection at Chhapra in March 2011, the Railways has accepted the provisions of the tariff order and accepted the contract demand of 10.8 Mva.

Short Billing of demand charge

3.36 As per the provisions of the tariff, the Demand charge shall be billed on the basis of maximum demand recorded during the month or 85 *per cent* of the contract demand whichever is higher.

Frequent resetting of recorded by meter resulted in short billing of ₹ 0.54 crore

During scrutiny of the records related with the billing of Railways Traction Service (RTS) consumer (Contract Demand – 7500 KVA) from Karamnasa grid, it was observed that the meter recording the maximum demand was frequently reset and maximum demand recorded till the time of resetting was not utilised for the purpose of billing despite being the maximum during the months in violation of provisions of the tariff. This resulted in short billing of Demand Charges by ₹ 0.54 crore.

The Board stated (October 2012) that due to non-availability of supporting document in this respect billing could not be done. The Board also stated that efforts were being made to get the same from Railway Mugalsarai and as soon as the supporting document was made available, action would be taken accordingly. The reply is not convincing as the billing of contract demand should have been done on the basis of maximum demand recorded by the meter during the month.

Loss of revenue due to delay in agreement for a new connection to Railway Wheel Plant, Chhapra

3.37 As per para 4.78 of the Electric Supply Code (Code), issued by BERC in 2007, the Board shall take up the work of extension required to give supply after the payment of charges and execution of the agreement.

Further, as per clause 1 (b) of the standard form of agreement, the consumer shall commence to take the supply within three months of intimation from the Board to the effect that supply is available, failing which a monthly

[15] Loss on account of Energy Charge = ₹ 39894894 + ₹ 423540 + ₹ 27428508 + ₹ 11109434= ₹ 78856376.
Loss on account of Demand Charge= ₹ 6460080 + ₹ 8883600 + ₹ 14167000 + ₹ 8298541 = ₹ 37809221.
Total loss on account of Energy Charge and demand Charge = ₹ 78856376 + ₹ 37809221= ₹ 116665597 i.e. ₹ 11.67 crore.

charge of 50 *per cent* of the minimum guaranteed by the consumer will be levied after expiry of above period until the service is availed of.

Scrutiny of records revealed that the Board, for providing a new HTS-III connection with contract demand of 26.67 Mva for the Railway Wheel Plant at Chhapra, issued (August 2008) work order for construction of transmission line from Chhapra Sub-station to point of supply.

Further, the work of extension required to give supply was completed by the Board in October 2010. Thus, the Board was ready to provide new connection to the consumer with effect from November 2010 but agreement with the consumer was entered in June 2011 and billing was started from July 2011.

Taking up extension work required to give supply without entering into agreement with the consumer deprived the Board to earn a revenue of ₹ 8.08 crore

We observed that the Board started the work without entering into an agreement with the consumer in violation of the Code and also delayed the process of entering into agreement with the consumer by seven months from the date of completion of the work which deprived the Board to earn revenue of ₹ 8.08 crore during the period from March 2011 to June 2011.

The Board stated (October 2012) that information regarding sanction of contract demand and completion of construction of transmission line for signing of agreement was sent to Railway in May 2010 and November 2010. As the construction work of Rail Wheel factory was not completed, Railway authorities delayed the execution of agreement. The agreement between Board and Railway should have been signed before starting of construction of transmission line as per the provision of para 4.78 of the Electric Supply Code (Code).

Material Management

3.38 The key functions in material management are laying down inventory control policy, procurement of materials and disposal of obsolete inventory. The Board had not formulated any procurement policy and inventory control mechanism for economical procurement and efficient control over inventory. Procurement of the materials was done by the Board on the basis of the requirement sent by the field offices. Scrutiny of the records of the Board revealed the following:

3.39 The details of consumption (per annum), consumption (per month) and closing stocks of the equipments (transformers, cables, breakers, tower members etc.) of transmission system for the period from 2007-08 to 2011-12 are detailed below:

(₹ in crore)

Year	Consumption (per annum)	Consumption (per month)	Net Closing stock (as per Balancesheet)	Closing stock in terms of months consumption
(1)	(2)	(3)	(4)	(5) = (4)/(3)
2007-08	12.97	1.08	20.82	19
2008-09	6.77	0.56	21.95	39
2009-10	24.26	2.02	40.90	20
2010-11	25.79	2.15	54.80	25
2011-12	11.72	0.98	58.22	59

Source: Information furnished by the Board

Huge quantity of the closing stock indicated that the procurement policy of the Board was defective

It is evident from the huge quantity of the closing stock that the procurement policy of the Board was defective. During the period from 2007-08 to 2011-12, the closing stock in terms of months consumption ranged between 19 months and 59 months. Further, the Board had neither made any ABC analysis, nor fixed any standard minimum level or reorder level of their material requirement.

The Board stated (October 2012) that the equipments being vital for system are purchased once for coming three to four years for requirement in case of emergency and since the above equipments were not easily available in the market, the manufacturers had to design and manufacture as per required specification. Hence, it was general practice in the Board to keep stock of such emergency equipments in order to avoid outage. The reply is not convincing as the Board had neither made any ABC analysis, nor fixed any standard minimum level or reorder level of their material requirement and the closing stock in terms of months consumption ranged between 19 to 59 months which indicated defective procurement policy.

Non-conducting of physical verification of stocks in the stores

3.40 As per Para 7.141 of the Financial and Accounts Code of the Board, the verification of the stock would be a continuous process by a special staff of stock verifiers. The Board would draw out a programme of verification annually and fix man days for each store.

There were Seven Transmission Stores under the control of the Board. The Physical Verification (PV) of the stores was, however, not being conducted annually in compliance with the provisions of the Financial and Accounts Code. During 2007-08 to 2011-12, PV was conducted only in 2007-08 and 2011-12. The PV was last conducted in Patna circle store (including sub stores) in January 2008 and in Muzaffarpur store in April 2011.

Further, the reconciliation of the above stock could not be made as the PV of all the stores was not being done annually. The Board had not taken action to conduct survey reports and dispose of the scrap/obsolete material, which could have earned revenue and resulted in creation of space for stocking of other materials.

Excess purchase of materials

3.41 For operation and maintenance of the transmission system of the Board, necessary equipments (Current Transformer, Potential Transformer, Circuit Breaker, etc.) were purchased centrally by the Board on the basis of the requirements received from the field offices.

The Board placed (July 2009) a purchase order (PO) for supply of 184 Current Transformers (CTs) of 132 KV capacity which included 72 of CT of 600/300/150/1-1-1-1 Amp specification.

We observed that the requirement received from the field offices was not properly analysed. As against requirement of 21 CTs in three circles[16], the Board inflated the requirement to 57 CTs without recording any justification for the same.

Test check of records of Circle Store under ETC, Patna, revealed that out of 48 CTs received, 47 purchased for ₹ 0.47 crore were lying idle without use from March 2010 to March 2012 and the guarantee period of the above CTs had also expired.

Thus, purchase of 47 CTs of ₹ 0.47 crore without requirement resulted in blockade of funds for last two years.

The Board stated (October 2012) that the requirement submitted by the Dehri-on-sone was for 15 sets i.e. 45 CTs. Hence, there was no failure in analysing the requirement by the Board. The reply was not based on facts, as the requirement sent by Dehri-on-sone was for five sets only (two sets for Dehri SS, one set each for Sonenagar SS, Karmanasa SS and Dumraon SS). The reply was silent about non-utilisation of CTs in ETC Patna.

Monitoring and Control

3.42 The performance of the SSs and lines of 400/220/132 KV on various parameters like Maximum and Minimum voltage levels, breakdowns, voltage profiles should be recorded /maintained as per the Grid code standards. We observed that the year-wise cumulative performance of the SSs and lines were neither being maintained nor consolidated for evaluation of annual performance of the SSs and lines.

Further, the field Divisions of Transmission lines and Sub-station (TL&SS) units compile the monthly MIS reports indicating the performance of the units as well as equipments installed. Verification of MIS reports of field

[16] 15 by ETC, Dehri-on-sone, three CTs by ETC, Patna and three by ETC, Gaya.

units revealed that details regarding programmed overhaul of equipments like Circuit Breakers, due dates of next oil change, On Load Tap Changer operations, dates of maintenance works, performance of SS batteries, performance of relays, were not being mentioned in the MIS report.

Schedule maintenance of various transmission lines and Grid Sub-stations was not being done by the Board. As a result the transmission lines tripped 432 times, including 196 trippings due to snapping of conductors, during 2007-08 to 2011-12. There were 76 trippings in 2007-08 which increased to 130 trippings (71 *per cent*) in 2011-12.

The Board stated (October 2012) that patrolling of transmission line was regularly done to locate any probability of faults viz. loose jumper, heated point, hardware failures etc. and any probability of fault detected was attended immediately. Further, with respect to tripping of lines, the Board stated that tripping was mainly due to sudden transient fault, loose jumper, disconnected jumpers, snapping of earth wire, etc. and due to sudden puncture of fitted disc insulator which caused earth fault. The reply of the Board is not convincing as all the reasons for tripping as mentioned by the Board could have been avoided by regular/effective patrolling and timely action on the detection of faults. The reply was silent about the deficiencies as pointed out in the MIS report

Review of the envisaged benefits of T&D schemes

3.43 The Board executed and commissioned 19 EHT SSs and erected a total length of 841 CKM of EHT lines during the last five year ending March 2012. While approving the T&D schemes, the Board envisaged benefits in terms of reduction in line losses, improvement in voltage levels and the load growth to be achieved by the new schemes. It was, however, observed that the Board failed to derive the envisaged benefit of the T&D schemes. We noticed that the transmission losses increased from 7.41 *per cent* in 2007-08 to 9.75 *per cent* in 2011-12. Voltage level of 220/132 and 132/33 KV level ranged between 252-177 KV and 154-98 KV respectively which violated the norms of Indian Electricity Grid Code. Thus, the Board failed to achieve the objectives envisaged in the schemes.

Theft of material due to poor monitoring

3.44 Circuit of 132 KV XLPE Cable (Cable) laid along Rajendra Bridge, Hathidah was being utilised for supplying power from Hathidah SS to BTPS via Simaria (from south Bihar to North Bihar). The Board decided (May 2008) to abandon and dismantle the cable and the same was to be kept in stores for further utilisation. Further, for safety of the cable till dismantling, a private security agency was engaged (November 2007). According to the terms of deployment, the agency was to be held responsible for any theft/loss. The work order for dismantling the cable was allotted in January 2011 to two tenderers at a cost of ₹ 15.36 lakh each.

The Board failed to finalise the tender in time for dismantling of cable resulting in loss of ₹ 1.50 crore on account of theft/damage and on security of cable

Audit scrutiny revealed that from the date of decision of the Board to dismantle the cable (May 2008) and award of work (January 2011), 862 meters valuing ₹0.68 crore[17] was stolen and 519.5 meter valuing ₹ 0.41 crore was damaged by miscreants. Further, an amount of ₹ 0.41 crore was also incurred by the Board on payment for security of the cable. Thus, the Board failed to finalise the tender in time and took 32 months in awarding the work for dismantling of cable. As a result, the Board sustained the loss of ₹ 1.50 crore on account of theft/damage of cable (₹1.09 crore) and security of cable (₹ 0.41 crore).

Further, no action was taken by the Board to recover the loss due to theft/damage of cable from the private security agency, although it was provided in the terms of deployment.

The Board stated (October 2012) that several incidents of theft occurred which could not be stopped despite several attempts and the cable was damaged at several spots and was not repairable. The Board also accepted the fact there was delay in finalising the tender for dismantling of cable. The Board, however, did not offer any reply about recovery from the security agency for theft /loss as per terms and conditions of their deployment.

Conclusion

- **The Board had not prepared year-wise plan for addition/augmentation in the Transmission System of Bihar. Instead, the planning was done by the Power Grid Corporation of India Limited on behalf of the Board.**
- **The Board did not comply with the recommendations of the Task Force on transmission projects constituted by Ministry of Power (MoP), Government of India (GoI), as a result, the projects could not be completed within stipulated time and led to cost and time overrun.**
- **Operation of the transmission system was not efficient and effective. As a result, the transmission losses of the Board were in excess of the norms, the voltage level of SSs were not maintained within the limits, 132 KV feeders were found loaded beyond their Thermal Loading Limit.**
- **The Board received several violation messages from the Eastern Region Load Dispatch Centre due to excess drawal of power. Disaster management facilities of the Board were not adequate. There was no system in place to take the periodical test of working transformers.**
- **Energy accounting system of Board was not effective as existence of high percentage of losses and negative losses were found.**

[17] (Calculated at the rate of ₹ 7919.737/meter as replacement cost quoted by supplier in July 2007).