FOURTEENTH KERALA LEGISLATIVE ASSEMBLY

COMMITTEE

ON

PUBLIC UNDERTAKINGS
(2016-2019)

FORTIETH REPORT

(Presented on 18th May, 2017)

SECRETARIAT OF THE KERALA LEGISLATURE
THIRUVANANTHAPURAM
2017

FOURTEENTH KERALA LEGISLATIVE ASSEMBLY

COMMITTEE

ON

PUBLIC UNDERTAKINGS
(2016-2019)

FORTIETH REPORT

On

KERALA STATE ELECTRICITY BOARD LIMITED

(Based on the Reports of the Comptroller and Auditor General of India for the years ended 31st March, 2007, 2008 and 2012)

932/2017.

CONTENTS

COMMITTEE ON PUBLIC UNDERTAKINGS(2016-2019)

COMPOSITION OF THE COMMITTEE

Chairman :

Shri C. Divakaran.

Members :

Shri T. A. Ahammed Kabeer

Shri K. B. Ganesh Kumar

Shri C.Krishnan

Shri S. Rajendran

Shri Thiruvanchoor Radhakrishnan

Shri P.T.A. Rahim

Shri Raju Abraham

Shri Sunny Joseph

Shri C. F. Thomas

Shri P. Unni.

Legislature Secretariat :

Shri V. K. Babu Prakash, Secretary

Smt. P. K. Girija, Additional Secretary

Shri P. B. Suresh Kumar, Deputy Secretary

Smt. Deepa V., Under Secretary.

INTRODUCTION

I, the Chairman, Committee on Public Undertakings (2016-2019) having been authorised by the Committee to present the Report on its behalf, present this Fortieth Report on Kerala State Electricity Board Limited, based on the Reports of the Comptroller and Auditor General of India for the years ended 31 March , 2007,2008 and 2012 relating to the Public Sector Undertakings of the State of Kerala.

The aforesaid reports of the Comptroller and Auditor General of India for the years ended 31st March 2007, 2008 and 2012 , were laid on the Table of the House on 26-2-2008, 23-6-2009 and 18-2-2013 respectively. The consideration of the audit paragraphs included in this report and the examination of the departmental witness in connection thereto were made by the Committee on Public Undertakings constituted for the years 2014-2016 at its meeting held on 18-11-2015.

This Report was considered and approved by the Committee (2016-2019) at its meeting held on 26-4-2017.

The Committee places on record its appreciation for the assistance rendered by the Accountant General (Audit), Kerala in the examination of the Audit Paragraphs included in this Report.

The Committee wishes to thank the officials of the Power Department of the Government Secretariat and Kerala State Electricity Board Limited for placing the materials and information solicited in connection with the examination of the subject. The Committee also wishes to thank in particular the Secretaries to Government, Power and Finance Departments and the officials of the Kerala State Electricity Board Limited who appeared for evidence and assisted the Committee by placing their views before it.

C. DIVAKARAN,
Chairman,
Committee on Public Undertakings.

Thiruvananthapuram,
26th April, 2017.

REPORT

ON

KERALA STATE ELECTRICITY BOARD LIMITED

AUDIT PARAGRAPH

Introduction

2.1.1 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 investment besides efficient and co-ordinated 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 co-ordination of Central/State Transmission Utilities. Transmission of electricity and Grid operations in Kerala State are managed and controlled by Kerala State Electricity Board (KSEB) which is mandated to provide an efficient, adequate and properly co-ordinated grid management and transmission of energy. KSEB started functioning on 31st, March, 1957.

2.1.2 The Management of KSEB is vested with a team of seven members appointed by the State Government. The day-to-day operations are carried out by the Chairman of KSEB with the assistance of Member (Finance), Member (Transmission & Generation Operations), Member (Generation Projects) and Member (Distribution). During 2007-08, 15223.93 Mus of energy was transmitted by KSEB which increased to 19086.93 MUs in 2011-12, i.e. an increase of 25.37 per cent during 2007-2012. As on 31st March, 2012, KSEB had a transmission network of 10459 circuit kilometer (CKM) and 350 Sub-Stations (SSs) with an installed capacity of 16326 MVA, capable of annually transmitting 41470 MUs at 220 kV. The turnover of KSEB was Rs. 7978.05 crore in 2011-12, which was equal to 2.44 per cent of the State Gross Domestic Product (Rs. 326693 crore). It employed 31113 employees as on 31st March, 2012.

A Performance Audit Report on "Transmission System Improvements by KSEB" for the period 2002-2007 was included in the Report of the Comptroller and Auditor General of India (Commercial), Government of Kerala for the year ended 31 March, 2007. The Report is yet to be discussed by COPU (August 2012).

Scope of Audit

2.1.3 The present performance audit conducted from March 2012 to July 2012 covers performance of KSEB during 2007-08 to 2011-12. Audit examination involved scrutiny of records of different wings of KSEB at the Head Office, State Load Dispatch Centre (SLDC), two Transmission Regions headed by Chief Engineers and five out of twelve Circles headed by Deputy Chief Engineers.

KSEB constructed 80 SSs (capacity: 1561.9 MVA) and 94 lines (capacity: 806 CKM) and augmented existing transformation capacity by 1187.3 MVA during the review period. Fourteen SSs (capacity 4640 MVA) were examined in audit. The selection was made ensuring geographical parity and other factors such as performance and execution of major works. The only 400 kV SS in the State, eight out of seventeen 220 kV SSs, three out of one hundred thirty three 110 kVSSs and two out of seventy nine 66 kV SSs located in the selected Circles have been selected. The total transmission capacity (4640 MVA) of all the SSs selected constituted 28.42 per cent of the total capacity.

Audit objectives

2.1.4 The objectives of the performance audit were to assess whether :

- Planning was in accordance with the guidelines of the National Electricity Policy/Plan and State Electricity Regulatory Commission (SERC) and assessment of impact of failure to plan, if any;
- The transmission system was developed and commissioned in an economical, efficient and effective manner;
- Operation and maintenance of transmission system was carried out in an economical, efficient and effective manner;
- Disaster Management System was set-up to safeguard operations against unforeseen disruptions;
- Effective failure analysis system was set-up;
- Financial Management system was effective and efficient;
- Efficient and effective system of Procurement of material and inventory control mechanism existed;
- There was a monitoring system in place to review existing/ongoing projects, take corrective measures to overcome deficiencies identified and respond adequately to Audit/Internal audit observations.

Audit Criteria

2.1.5 The sources of audit criteria were the following :

- Provisions of National Electricity Policy/Plan ;
- Plan Documents of KSEB;
- Standard procedures for award of contracts with reference to principles of economy, efficiency, effectiveness, equity and ethics;
- ARR filed with SERC for tariff fixation, Circulars, Manuals and MIS reports ;

- Manual of Transmission Planning Criteria (MTPC);
- Code of Technical Interface/Grid Code consisting of planning, operation, connection codes;
- Directions from State Government/Ministry of Power (MoP);
- Norms/Guidelines issued/observed by SERC, Central Electricity Authority (CEA);
- "Best practices in Transmission" identified by MoP/observed by Power Grid Co-operation of India Limited (PGCIL);
- Report of the Task force constituted by MoP to analyse critical elements in transmission project implementation; and
- Reports of Southern Regional Power Committee (SRPC)/Regional Load Dispatch Centre (RLDC).

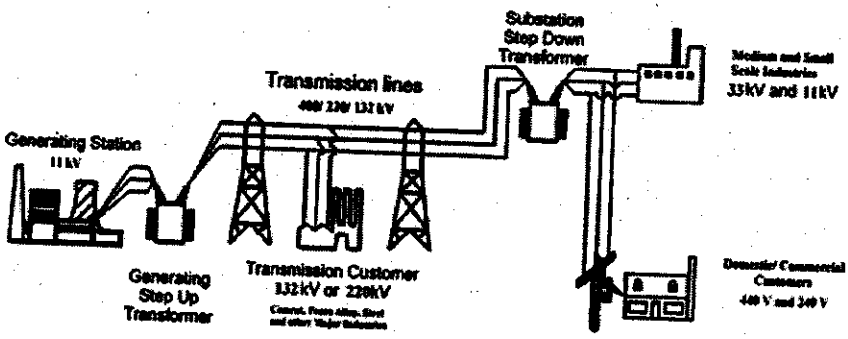
Audit methodology

2.1.6 The methodology adopted for attaining audit objectives with reference to audit criteria consisted of explaining audit objectives to top management, scrutiny of records at Head Office and selected units, interaction with auditee personnel, analysis of data with reference to audit criteria, raising of audit queries, discussion of audit findings with the Management and issue of draft review to the Management/ Government for comments.

Brief description of transmission process

2.1.7 Transmission of electricity is defined as bulk transfer of power over long distances at high voltages, generally at 220/110/66 kV in the State. Some transmission takes place at 33 kV also. 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 are facilities within the high voltage electric system used for stepping up or stepping down voltages from one level to another, connecting electric systems and switching equipment in and out of the system.

Every transmission system requires a sophisticated system of control called Grid management to ensure balancing of power generation closely with demand. A pictorial representation of the transmission process is given below:



Audit findings

2.1.8 We explained the audit objectives to the Management of KSEB during an Entry Conference (May 2012). Subsequently, audit findings were reported to KSEB and the State Government (August 2012) and discussed in an Exit Conference (September 2012). The Exit Conference was attended by representatives of KSEB/State Government. KSEB and the Government replied (October 2012) to audit findings. The replies have been considered while finalising this Performance Audit Report. The audit findings are discussed in subsequent paragraphs.

Planning and Development

National Electricity Policy / Plan and planning by KSEB

2.1.9 The Central Transmission Utility (CTU) and State Transmission Utilities (STUs) have the key responsibility of network planning and development based on the National Electricity Plan in co-ordination with all concerned agencies. As the STU, KSEB was responsible for planning and development of the transmission system in the State. KSEB's planning process consisted of five year and annual plans prepared by its Corporate Planning wing. From the year 2008-09, KSEB has been following a decentralised process for planning. The process involved identification of targets from proposals forwarded by various Circle Offices, which were discussed and finalised by an expert team. The views of the stakeholders were also incorporated after consultations with consumer groups and Government departments. However, the planning process had the following deficiencies:

- Consequent to introduction of the decentralised process from 2008-09, the five year and annual plans did not complement each other as the works in the two types of plans were widely different. Moreover, the quantum of expenditure in the Annual plans (2008-09 to 2011-12) exceeded that in the five year plan by 277 *per cent.* Among the two plans, the projects in the annual plans were implemented. Thus the five year plan lost relevance.
- As against the requirement of ₹ 2743.08 crore for five years, the budget allocation was only ₹ 1062.65 crore (shortage of 61 *per cent*).
- KSEB had not prepared a State Electricity Plan forecasting demand and planning generation, power purchase, transmission and distribution.
- A long-term or perspective plan covering periods in excess of five years was not prepared though the SERC had issued directions (January 2006) for preparation of a perspective plan based on load and energy forecasts for the next ten years.
- During the review period, KSEB did not construct 135 out of 225 SSs originally planned. However, 70 out of these 135 numbers, representing 30 per cent of the works originally planned were not included in the ongoing works as on 31st March, 2012 or in the works proposed in the Annual Plans 2011-12/2012-13.
- A test check revealed instances of inclusion of works in the Annual plans before obtaining administrative sanction/conducting load flow studies.

The above deficiencies resulted in planning of activities in an ad-hoc manner. Absence of proper planning affected capacity creation, both intra-state and inter-state resulting in time/cost overrun as discussed in *Paragraph 2.1.14.*

Government stated that the long term plan prepared (February 2010) upto the year 2022, after conducting Load Flow studies on the proposals up to 2017 was being revised in view of the changes in demand pattern and anticipated Generation additions.

Transmission network and its growth:

2.1.10 A transmission network means Substations and Transmission lines. KSEB's transmission network at the beginning of 2007-08 consisted of 270 Extra High Tension (EHT) SS with a transmission capacity of 13576 MVA and 9652 CKM of EHT transmission lines. Details of capacity addition during the review period were as follows:

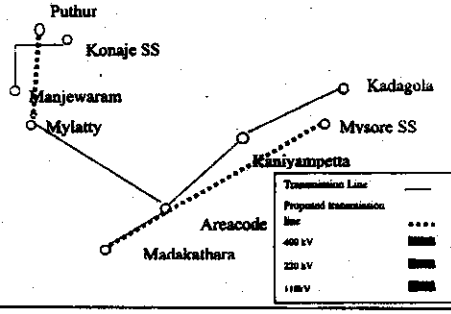
Particulars	*SS New*	*SS upgraded*	*CKM*	*MVA*
Target	184	41	3900	6988

1	2	3	4	5
Achievement	80	10	806	2749
Shortfall	104	31	3094	4239
Percentage of short fall	57	76	79	61

The transmission network as on 31st March, 2012 consisted of 350 EHT SS with a transmission capacity of 16326 MVA and 10459 CKM of EHT transmission lines. The actual capacity creation did not meet the targets. The particulars of capacity additions planned, actual additions, shortfall in capacity etc., during the review period are given in Annexure 7. The shortfall in capacity addition and slippages in achieving the target by KSEB was mainly due to time overrun. The deficiency in capacity addition created a shortage of transmission infrastructure and transmission constraints, which was more severe in Northern districts of Kerala.

Transmission constraints in Northern Kerala :

2.1.11 KSEBs internal notes and correspondence with SRPC revealed that the northern districts of Kasargod and Kannur faced a shortage of transmission infrastructure. This caused shortage of power, low voltages at various SS and frequent interruptions with lengthy restoration time in these districts. Compared to the rest of Kerala, this region had limited generation capacity[2]. Therefore, the main power supply to this region was through two inter-state lines (one major [3] and one minor[4]) and intra-state lines from 400 kV SS Madakkathara. The transmission network in Northern part of Kerala is shown below:



2 Monsoon dependent 228.75 MW-Kuttiyadi Hydro Station & two high cost thermal projects (128 MW Kozhikode Diesel Power Project and 22 MW Kasaragod Power Corporation Limited).

3 220 kv Kadakola-Kaniyampetta (drawal of 120 MW).

4 110 kv SS Konaje-Manjeswaram (drawal of 15 MW).

2.1.12 The major problems in these districts were lengthy feeding circuits, weak transmission network, poor inter-state connectivity, deficient intra-state transmission lines, shortage of transformation capacity for import of central sector power etc. The poor development of transmission network especially the poor inter-state connectivity reflected lopsided planning. The constraints could have been removed by creation of additional transmission capacity through inter-state and intra-state transmission lines either through its own projects or through projects[5] of PGCIL. The action initiated, however, was belated resulting in worsening the situation as detailed below:

Constraints	*Required remedial action*	*KSEB's lapse*	*Impact*
Inadequate transformation capacity at 400 kv SS Madakkathara for import of Central Sector Power.	Installation of 3rd transformer bank of 315 MVA utilising spare available with PGCIL.	Approved project of July 2007 was deferred (May2008) considering the possibility of completion of an alternate project[6]. Deferred project resumed in August 2010.	Loss of savings for three years was ₹ 9.87 crore at the annual estimated savings of ₹ 3.29 crore projected by KSEB.
280 km long inter-state line from Kadagolai (Karnataka) to Kaniyampetta covering an additional 86 km feeding stations upto Mylatty (Kerala) caused additional transmission losses.	Drawing of an alternative 40 km interstate line to Mylatty through non-forest plain terrain from Puthur (Karnataka) where sufficient power[7] was available.	Proposal was made only in August 2011 though Puthur station was commissioned in 2008.	Loss of savings by way of reduction in transmission losses @ Rs. 4.80 crore[8] p.a. (as estimated by KSEB)

5 Projects involving system improvement of the grid as a whole/Central generating stations and inter-state projects.

6 400 kv SS at Palakkad.

7 Udupi STPS commissioned (August 2011) with 600 MW, with additional capacity of 600 MW under creation.

8 Computed for peak hour period of six hours.

Curtailment (March 2011) of drawal of power through Kadagolai-Kaniyampetta line by 60 MW by KPTCL due to sagging of line in Karnataka region.	Insertion of towers in between Karnataka region.	KSEB belatedly agreed (July 2012) to the solution of bearing the cost of the work which was beneficial to Kerala predominantly.	Work yet to start. The annual power loss was 131.4 MUs[9]
Drawal limitation in 110 kV Konaje-Manjeswaram-Vidyanagar SC feeder by 45 MW due to non-availability of double circuit.	Conversion of the single circuit into double circuit.		Caused a potential annual power loss of 98.55 MUs[10]
Absence of a 400 kV inter-state line from Udupi to Areacode with a 400 kv SS enroute for drawing power from a major project at Udupi.	Drawal of the line with a 400 kV SS enroute at Mylatty.	KSEB belatedly proposed (October 2011) the work, after the commissioning of the project at Udupi.	The proposal is yet to be approved by SRPC/Karnataka. Resulted in power shortages and reduced flexibility in operations affecting quality of power supply.

9 60x1000x6hrsx365days/ 10 lakh.

10 45x1000x6hrsx365 days/ 10 lakh.

Absence of 400 kV lines/SS in North Kerala	Construction of 400 kV SS Area code and Mysore Areacode 400 kV line (MAL) by PGCIL.	KSEB's role is limited. Projects held up due to severe ROW problems in Karnataka.	MAL has been delayed by five years. Resulted in power shortages.
Non-completion of evacuation lines for the Koodamkulam Nuclear project from Edamon to Pallikkara and from Mada-kkathara to Areacode.	Construction of the lines by PGCIL.	KSEB's role is limited. For the latter line, KSEB needs to solve a pending dispute[11] with PGCIL urgently.	Both lines are delayed. Resulted in power shortages and reduced flexibility in operation affecting the quality of power supply.

In reply to these observations, Government stated that:

- A number of intra-state and inter-state proposals are completed/ in progress.
- The S1-S2 constraint [12] was worsened by non-completion of the MAL due to ROW problems and surrender of an intra-state line[13] in January 2010.
- The work of 3rd transformer bank at Madakkathara was kept pending in view of sanction for a 400 kV SS (PGCIL) at Palakkad and the same was again taken up in 2010 due to increase in the demand for power.
- The Puthur-Mylatty line work was not proposed earlier anticipating completion of MAL. It was also stated that the availability of power at Puthur was known only after the commissioning of a Power Project at Udupi (August 2011).

---

11 PGCIL has demanded surrender of one of KSEB's three existing ROW at 220 KV for the route. KSEB has demanded retention of its ROW through creation of a multi-circuit route by PGCIL.

12 Inter-state constraints between Karnataka and Kerala.

13 Idukki-Madakkathara (ID-MD) line.

- The under utilisation of Kadagola-Kaniyampetta line was taken seriously and several higher level meetings and a joint inspection of the line were conducted.
- Regarding the delay in construction of DC for Konaje-Manjeswaram line, KSEB could not bear the cost of construction in Karnataka, due to issues related to ownership and tariff.
- The proposal for Udupi-Areacode line was not made earlier anticipating completion of the MAL.

The replies were not acceptable as the deferment (May 2008) of the third bank at Madakkathara was a mistake as it was subsequently determined (April 2010) necessary despite the 400 kV Palakkad SS. Similarly, the line from Puthur was found necessary even with the commissioning of MAL. Further, the anticipated commissioning and scheduling of power from a grid connected power project is known/scheduled much before the actual commissioning. KSEB's stand that under utilisation of Kadagola-Kaniyampetta line was taken seriously was negated by the long delay in proposing the solution. Regarding the Konaje-Manjeswaram line, the issues related to ownership and tariff could be resolved bilaterally through consultations between the States. The reply was also contradictory to the stand taken by KSEB in SRPC meeting, where it had admitted willingness to bear the cost. Not proposing the line from Udupi considering probable commissioning of MAL was wrong as the line was later found necessary even with MAL.

Project Management of transmission system

2.1.13 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 MoP, Government of India constituted a Task Force on transmission projects (February 2005) with a view to suggest a model transmission project schedule of 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 including 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;

- Break-down the transmission projects into clearly defined packages so that the packages can be procured and implemented with least co-ordination and interfacing and at same time attracting competition, facilitating cost effective procurement; and
- Standardise designs of tower fabrication so that 6 to 12 months can be saved in project execution.

Audit noticed instances where KSEB did not follow the recommendations of the task force. Various preparatory activities such as surveys, design and testing, land acquisition, right of way acquisition etc., were not undertaken in advance/parallel to project appraisal and approval phase as recommended by the Task Force Committee. Further, though transmission projects were broken down into packages, KSEB did not allot the packages to different contractors.

2.1.14 Despite the elaborate guidelines given by the Task Force Committee, KSEB did not execute several SSs and Lines within time during 2007-2012 as detailed below:

Capacity in kV	Total No. of SSs & Lines constructed	No. of SSs & Lines test checked by Audit	Delay in construction (Numbers)	Time overrun (range in months)	Cost overrun (₹ in crore)
400	Nil	NA	NA	NA	NA
220/110	56	15	15	3-63	7.90
66/33	128	54	32	6-123	16.74
Total	**184**	**69**	**47**	**3-123**	**24.64**

2.1.15 The main reasons attributed for these delays were delay in acquisition of land and handing over of the site, right of way problems and delay by the contractors in executing the works as discussed below:

Failure to complete evacuation works for a major project due to transfer of own land to a private firm

2.1.16 For evacuation of the State's allotted share of power from the Koodamkulam Nuclear Power Station, the construction of a multi-circuit 6.5 km 220 kV evacuation line from Pallikkara to Brahmapuram by KSEB was required to be completed simultaneously with the 400 kV SS being constructed by PGCIL at Pallikkara. We observed the following lapses on the part of KSEB in the planning and execution of the work.

- After the commencement of construction of PGCIL SS (March 2006) the State Government initiated consultations with KSEB for transfer of 100 acres of KSEB land lying adjacent to the SS to a private entrepreneur (Smart city) to set up an IT park. KSEB gave its concurrence (June 2007) for the transfer. Accordingly, the State Government issued orders (November 2008) for transfer of 100 acres of KSEB land to Smart City. KSEB (8 January 2009) accepted the Government Order. The concurrence for the transfer of land and acceptance of Government Order was made before conducting the survey (February/September 2009) and determining the line route.
- KSEB consulted PGCIL only in January 2009 and determined the line route after conducting survey (February-September 2009) only when the construction of the 400 kV SS by PGCIL was in advanced stage (December 2008).
- After a lapse of one year from the transfer of land, KSEB awarded (January 2010) the line construction work with a scheduled date of completion by 31 July 2010. Though the work was split into two parts for speedy execution, both the parts were awarded to the same contractor as two separate contracts defeating the purpose of bifurcating the work.
- The estimate for the work was originally prepared without proper assessment of the site conditions. This necessitated revision of the scope/estimate of the work after commencement which in turn delayed the execution of the work.
- On actual execution of the line work, it was found that the line passed through 1.8 acres of the surrendered land of 100 acres. Smart City objected the drawal of line through their land and the municipal authorities stopped the work on several occasions since December 2010. The work came to a standstill by August 2011.

Thus, failure of KSEB to put the permission to construct the line as a pre-condition for transfer of its land, delayed the work by 28 months based on KSEB's projected date of completion of work (November 2012). Government stated that the dispute with Smart City was settled by the end of July 2012. There is only one case now pending before the District Magistrate regarding stringing work between two other locations. Failure to complete the line work by the time of commissioning (January 2012) of the SS by PGCIL, resulted in payment of ₹ 6.10 crore towards transmission charges for the idle station to PGCIL during January to November 2012, worked out at the agreed rate of ₹ 55.42 lakh per month.

Idling of SS and line due to non-receipt of ROW

2.1.17 In several works, KSEB commenced construction of the SS/line without obtaining ROW for the entire line route resulting in idle investment on the completed SS/part of the line due to non-completion of the line/remaining part of line as detailed below:

Name of Work	*Work pending completion*	*Idle investment on completed work (₹ in crore)*	*Period of idling*	*Loss of Interest @ 8 per cent[14] (₹ in crore)*
Pathanamthitta -Koodal-Pathanapuram 110 kV line.	Five per cent of Koodal-Pathanapuram line and entire Pathanamthitta-Koodal line	Koodal SS- 1.28	October 2010 - August 2012 (22months)	0.19
Mallapally-Kumbanad 33 kV line	Four km of the 10 km line	Kumbanad SS-2.55	July 2011-August 2012 (13 months)	0.22
Azhikode-Kannur 33 kV line	3.75 km out of 6.65 km	Kannur Town SS-4.03	January 2007 to July 2010 (36 months)	0.97
Kundara-Paripally 110 kV line	One Tower at location 3	Expenditure incurred on balance work-6.13	April 2010 August 2012 (29 months)	1.19
Kakkayam-Vadakara 110 kV line	Pattanippara-Vadakara	Amount incurred on Kakkayam-Pattanippara portion-2.33	April 2012-August 2012 (4 months)	0.06
220 kV SS Kattakada, Pothencode-Kattakada 220 kV line and related works at Pothencode	60 per cent of Pothencode-Kattakada line	Amount incurred on SS works-6.06[15]	April 2010-August 2012	0.60
	Total			**3.23**

14 Lowest borrowing rate of KSEB.

15 ₹ 0.83 crore during 2009-10, ₹ 3.31 crore during 2010-11, ₹ 1.92 crore during 2011-12

Government, in reply to the above observations, stated that;

- Raising of objection by the property owners was beyond its control.
- In the case of the Kannur SS, it was presumed that permission for tree cutting already obtained was sufficient for laying the line as it did not cross railway track/yard. However, the line work was not permitted by Railways necessitating a deviation and consequent delays.
- For the Vadakara-Pattanippara work, the Court ordered deviation of the line route for which survey work was in progress.

The replies are not acceptable as KSEB went ahead with part of the work in all the cases without obtaining ROW for the complete route. In the case of Kannur SS, KSEB committed the lapse of not obtaining clearance of Railways before proceeding with the work. Further, in the case of upgradation works, delay in acquisition of ROW for lines could have been avoided by acquiring adequate ROW for higher capacity lines/adopting multi-voltage level or multi-circuit transmission lines during initial implementation as specified in MTPC 1994/ Best practices in Transmission. As constant enhancement of capacity was a necessity in transmission, the failure to anticipate the same lacked justification.

Other lapses in project management

2.1.18 On scrutiny of other projects the following lapses were noticed in the execution:

Project	*KSEB's lapse*	*Impact*
1	2	3
Kattakada 220 kV SS	Alternately pursued two differing options[16] for land acquisition.	Delay of eight years from project sanction. Cost escalation ₹ 86.34 crore and loss of savings as per project report ₹ 22.72 crore.
Ranni-Perunad and Kumbanad 33 kV SSs along with the related line works contract.	Failed to encash/revalidate Bank guarantee (BG) for ₹ 57.12 lakh held as performance guarantee though contract was terminated at risk and cost. BG expired on 31 January 2008.	Loss of opportunity to realize a part of its losses on an unfinished project.

16 Acquisition by invoking urgency clause negotiation.

1	2	3
Peyad 33 kV SS	Failed to identify land available with the local Panchayat till the same was offered (January 2010). Delayed procure ment of UG cable due to delay in finalisation of purchase proceedings.	Delay in land acquisition of nine years from project sanction caused loss of savings as per project report of ₹ 0.67 crore. Delay in procuring cable by one year caused loss of savings of ₹ 8.97 lakh[17].
DC line from Vidyanagar SS to Mulleria	Delay in charging one out of the two completed circuits for ten years from 2001 to October 2011 due to non- installation of C&R panels and non-clearance of tree touchings.	Idling of ₹ 1.95 crore invested for drawing one circuit for a period of 10 years. Loss of interest of ₹ 1.56 crore (@ 8 per cent).
Re-conductoring of the 33 km Punnapra Mavelikkara 66 kV DC line	KSEB accepted that it had failed to notice collusion of field office with contractor enabling retention of 17.935 MT of copper by contractor. Absence of monitoring of material return by higher offices.	Non-realisation of ₹ 71.11 lakh (value of copper illegally retained by the contractor ₹ 85.19 lakh less dues payable).
Enhancing feeder capacity[18] to 110kV Paruthipara SS by laying DC Under Ground(UG) cable from the 220 kV Pothencode SS.	Failed to determine existence of a better alternative[19] till capacity enhancement works were made at Paruthipara and Pothencode.	Abandonment of UG cable work (January 2012). ₹ 29.14 lakh incurred for erection of bays at Pothencode and ₹ 8.30 crore incurred for capacity enhancement at Paruthipara for power flow from UG cable was rendered waste.

17 253400 units X ₹ 3.54(2010-11 average realisation).

18 The capacity of the existing feeders (110 kV DC lines from Pothencode to Paruthipara and Edamon-Paruthipara to Paruthipara) was insufficient to meet the future load.

19 Construction of a switching station at Pandalakkode where the existing feeders crossed each other would have transmitted more power to Paruthipara through existing feeders.

Government's replies to the above observations were as follows:

- The defaulting contractor for Ranni-Perinad and Kumbanad SS works had given (March 2007) an undertaking that BGs would be kept alive till the accounts relating to the contracts were settled. The matter has now been taken up to adjust the amount of the BG from other amounts due to the contractor.
- For the SS work at Peyad, the UG cable has been purchased and the laying work would be completed soon.
- The delay for the Vidyanagar-Mulleria line was due to diversion of material for more important works.
- The misappropriation of copper during the reconductoring of Punnappra-Mavelikkara line occurred with the collusion of employees. There was delay in forwarding of bills for the work by the subordinate offices. Legal options were being pursued to realize the dues from the contractor.
- Regarding the work of enhancing feeder capacity to Paruthipara SS, the surplus bays at Pothencode could be used for future power allocation works. The enhancement of capacity at Paruthipara SS was to meet the increased load demand.

The replies are not acceptable. In respect of Ranni-Perinad/Kumbanad SS works, KSEB did not encash the available security deposit merely on the basis of an undertaking from a defaulting contractor. In case of cable laying at Peyad and commissioning of second circuit of Vidyanagar-Mulleria line, KSEB failed to synchronize the purchases with the other works resulting in delays and blocking up of investment. In the Punnapra-Mavelikara line reconductoring work, the supervising officers of KSEB failed to investigate the matter despite delay in forwarding of contractors' bills. It was also admitted that the field offices did not ensure prompt transfer of materials returned from site to store. KSEB's admittances bring out the inadequacy of monitoring and internal control. In respect of the work of enhancing feeder capacity to Paruthipara SS, KSEB admitted the idling of bays at Pothencode. The contention that additional capacity was already necessary at Paruthipara was contradictory to the report in the proposal for the capacity enhancement work, that it was required to transform the additional power received at Paruthipara through the UG cable.

Mismatch between Generation Capacity and Transmission facilities

2.1.19 National Electricity Policy envisaged augmenting transmission capacity taking into account the planning of new generation capacities, to avoid mismatch between generation capacity and transmission facilities. The execution

of two[20] generation projects and the related transmission facilities were not proceeding in a synchronized manner. While civil works of the generation projects had been completed to the extent of 45 to 66 per cent, the transmission line works were only in the initial stages of planning/survey without a scheduled date of completion, resulting in scope for mismatch. In addition, construction of a 15 MW Hydro Project[21] by an IPP was allowed to be commenced without ensuring ROW for the transmission works. As a result, while the generation project works were in an advanced stage with scheduled completion by December 2012, the transmission works were yet to be commenced (August 2012) resulting in scope for mismatch. The potential loss of annual generation amounted to 78.84 MU[22].

Government stated that the Vilangad SHEP was scheduled to be commissioned in June 2013. The civil works of the projects were started earlier as it would take more time to complete. The transmission line works were in the tendering stage and would be completed along with the generation projects. The reply is not convincing, as the transmission works are generally more time consuming in KSEB due to delays related to ROW.

Performance of transmission system

2.1.20 The performance of a transmission utility mainly depends on efficient maintenance of its EHT transmission network for supply of quality power with minimum interruption. The performance of KSEB with regard to O&M of the system is discussed in succeeding paragraphs.

Transmission capacity

2.1.21 In order to evacuate power from the Generating Stations (GS) and to meet the load growth in different areas, lines and SSs are constructed at different EHT voltages. 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 SSs. The transmission capacity[23] created vis-a-vis the transmitted capacity (peak demand met) at the end of each year by KSEB during the five years ending March 2012 were as follows:

---

20 Vilangad, Barapole

21 Karikkayam SHEP being developed by Ayyappa Hydro Power Limited.

22 15MW X 60 per cent (load factor) X 24 hrs X 365 days.

23 Initial capacity of transformers stepping down power from 400 to 220 KVA and 220 to 110 KVA only considered as the rest were sub-transmission which involved further stepping down process.

Tranmission capacity (in MVA)				
Year (1)	Installed capacity (IC) (2)	IC less 30 per cent towards margin	Peak demand (4)	Excess shortage(3-4)
2007-08	4890	3423	3050	373
2008-09	4890	3423	3072	351
2009-10	5690	3983	3331	652
2010-11	5690	3983	3446	537
2011-12	5690	3983	3720	263

The table above indicates that the overall transmission capacity was marginally in excess of the requirement for every year. However, in reality the capacity was inadequate for the State as a whole, as there were transmission constraints in some parts of the State, as discussed in ***Paragraphs 2.1.11 and 2.1.12.***

Adherence to standards in Sub-stations

2.1.22 We observed the following deviations/non adherences in the SSs from the standards prescribed/ best practices followed in transmission utilities.

Standards/Best Practices in Transmission	*Lapses in adherence by KSEB and impact thereof*
1	2
Permissible maximum capacity of 220 kV SS shall be 320 MVA [Manual of Planning Criteria (MTPC)]	Maximum capacity exceeded 320 MVA in five [24] out of 17 SSs. Negative impact on operation/control.
In the event of outage of any single transformer, the remaining transformer (s) should supply 80 per cent of the load (Transmission Planning and Security Standards).	Not adhered to in eight [25] out of 14 SSs test checked. Reduced reliability of the station. The quality of power supply would be affected in the event of even a partial failure.

24 Kalamassery, Pallom, Edappon, Kundara, Pothencode.
25 Paruthipara, Pathanamthitta, GIS PH, Kaniyampetta, Kanhirode, Mylatty, Vadakara, Madakathara.

1	2
Alternate source of feeding to be available for SSs to maintain supply/avoid failure of the stations in case of failure of one source.	In thirty[26] SSss there were no alternative sources. Reliability affected due to interruptions in the event of contingencies.
Voltages at SSs to range between 380 420 kV, 198-245 kV, 119-145 kV and 99-121 kV in 400 kV, 220 kV, 132 kV and 110 kV SSs respectively	Lowest voltages recorded were below the minimum in all 14 SSs test checked (October 2011-March 2012) out of 230[27] Sss. This resulted in corresponding lower voltages for the transformer output/poor quality of supply.
Capacitors to be operated to manage fall in voltage. KSEB had installed capacitor banks in 38 SSs with a capacity of 996 MVAR.	35 per cent (345 MVAR) of the capacitors installed were non-working during the last three years. Working capacitor banks were operated only when directed by SLDC. Resulted in annual loss of ₹ 4.4 crore [28].
Power shortages to be managed by load shedding/power cut to reduce consumption of electricity. Tap[29] position of transformers to be raised and capacitors to be operated to increase voltages when there is fall in voltage.	SLDC issued directions not to raise tap position during peak hours despite fall in voltage (Taliparamba, Mundayad SSs,). Two SSs (Vadakara & Mylatty) did not raise tap position despite fall in voltage. Non-operation of capacitors was also noticed. Violated provisions of supply code as voltages fell below the prescribed minimum.

26 Sultan Bathery, Kuthumunda, Sreekantapuram, Edakara, Nilambur, Perumthalmanna, Nenmara, Chittoor, Walayar quarry, Kodungalloor, Mala, Njarakkal, Kochi GIS, Karunagapally, Triveni, Koodal, Ayoor and Vizhinjam (all 66 kv), Punnayurkulam, Irinjalakuda, Melathur, Iritty, Mulleria, Cherupuzha, Mannarcaud, Vadakkancherry, Kollemcode, Kozhinjampara, Mallapally, Ranni (all 110 kV)

27 Of 400 kV, 220 kV, 110 kV, 66 kV voltages.

28 As per the technical study conducted (August 2011) by KSEB, operation of these capacitors would reduce the transmission loss by 15 MW, saving 2.2 MU worth ₹ 4.4 crore p.a.

29 A connection point along a transformer winding that allows a certain number of turns with equivalent voltage variation.

1	2
Utilities not maintaining specified voltages at import/export points have to pay VArh compensation for the increase in reactive energy (CERC regulations).	During the period from 2008-09 to April 2012, KSEB paid ₹ 1.21 crore to KPTCL as VArh compensation. About one-third of the capacitors installed were either not working/ not operated.
As per Grid norms and Best Practices in Transmission System, BBPP[30] 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.	BBPP was not provided in three[31] out of four 220 kV SSs which did not have double bus. BBPP was also not provided in five[32] out of the remaining thirteen SSs where there was double bus. Absence of BBPP causes avoidable tripping of the bus affecting reliability and efficiency/life of related equipment.
BBPP to be installed considering future requirements and maintained properly.	The BBPP provided at Kundara was not in working condition. KSEB failed to install spare module for additional feeders while installing (2006) BBPP at Pothencode. The BBPP did not support the extended bus on commissioning (November 2011) of the new 200 MVA transformer bank. Required modifications costing ₹ 20.99 lakh were pending.
Fire Protection walls should be installed between transformers forming part of a bank erected in a line/erected adjacent to each other (MTPC).	In three 220 kV and one 110 kV SS[33] out of the 14 SSs test checked, fire protection walls were not installed between transformers erected in a line. As a result the chances of spreading of fire cannot be ruled out.

30 Bus bar is an application for interconnection of the incoming and outgoing lines and transformers at the SS. Bus Bar Protection Panel (BBPP) limits the impact of the bus bar faults and prevents unnecessary tripping by selectively tripping only those breakers necessary to clear the bus bar fault.

31 Nallalam, Poovanthuruth, Kaniambetta.

32 Kalamassery, Thaliparamba, Vadakara, Malaparamba, Shornur.

33 Transformer banks at Nallalam, Kalamassery and Pothencode and at Edapally where transformers have been installed adjacent to each other.

1	2
The earthing should be adequate and commensurate with the fault level of the SS.	In five SSs[34] the old earth plate system required replacement with earth mats as it was inadequate/ineffective for the present fault level of the stations. These stations remained vulnerable to earthleaks/ accidents/disruption of supply affecting safety of people and equipments. Deficiencies in earthing caused failure of five 12.5 MVA transformers in Nallalam SS during the period from 2002 to August 2012.
The area, design and layout of a SS should be planned in such a way to include all necessary equipment and lines.	Installation of a Power Transformer (PT) at Pathanamthitta SS and Lightning Arrestors (LA) on the primary side of two transformers at Mankavu SS are not possible due to space constraints exposing the stations to the risk of collision of power[35] and lightning strikes respectively.
The rupturing capacity of circuit breakers should not exceed 80 per cent of the fault level (MTPC).	The rupturing capacity of three ABCB[36] and four MOCB[37] at the Kalamassery and Paruthipara SSs respectively were below the fault level of the stations. This can cause the CBs to fail at fault levels lower than the maximum possible fault levels, leading to a dangerous situation where circuits may not break when needed.

In reply to the above observations, Government stated that:

- Proposals were under consideration/approval for providing alternative source of feeding to ten [38] SSs.
- All efforts were being taken to make available the capacitor banks at local load centres.

34 West Hill, Nallalam, Kalamassery, Pathanamthitta and Sultan Bathery.
35 Necessary to ensure that the line is not live as there is scope for islanding of the connected Perinad SS evacuating power from Ranni-Perinad project in charged condition after power interruptions.
36 Air based circuit breaker.
37 Manually operated circuit breaker.
38 Melathur, Nilambur, Perinthalmanna, Mannarcaud, Vadakkancherry, Kollengode, Kozhimjampara, Panniyurkulam, Irinjalakkuda and Kodungallur.

- The absence of generation support and inter-state lines contributed to the uncontrolled reactive loading in North Kerala. Increasing the generation in North by fully operating the costly thermal stations was not feasible.
- Regarding BBPP, proposals have been initiated for installation of BBPP at Malaparamba, Kalamassery and Nallalam.
- Fire protection walls between 110/11 kV transformers were not provided at any of the outdoor substations. Electrical Inspectorate had not stipulated such a practice.
- Proposals for providing earth mat system was pending sanction for Kalamassery SS and was in tendering stage for Pathanamthitta SS. Present earthing system in Sultan Bathery SS would be replaced on upgradation of the station which was under consideration.
- In Pathanamthitta, instructions were given to the operators regarding precautions in the absence of PT.

The replies are not justified. The proposals for providing alternate feeding arrangements and BBPP and better earthing facilities remain unimplemented. As against the statement that all efforts were taken to make available the capacitors, the fact remains that about one-third of the capacitors are not working. Regarding reactive compensation, the absence of inter-state lines in North Kerala indicated poor planning. The reasons attributed for non-provision of fire walls is not acceptable as this practice is stipulated in the Best Practices in transmission advocated by the MoP.

Maintenance

Performance of Transformers

2.1.23 As Power and Current transformers are the most important and cost-intensive components of electrical energy supply networks, it is necessary to prolong their life duration while reducing their maintenance expenditure.

Transformer Failures

2.1.24 Transformer failures in 127 out of 350 SSs were analysed during audit based on the data furnished by KSEB. The status of failure of transformers in these SSs during the years 2007-08 to 2011-12 are given in Annexure 8. As per the above data, the number of transformer failures and failures within guarantee period for 350 SSs during the year 2011-12 were 17 and three respectively.

Performance of maintenance wings

2.1.25 Maintenance functions on the transmission network including SS was carried out either through the maintenance wings attached to SSs or through external agencies. Usually only routine maintenance was done by the permanent maintenance staff. There are three maintenance wings in KSEB. Testing of equipments for determining/recommending maintenance requirements was conducted by a separate

wing called Power Equipment Testing (PET) wing. Testing and maintenance of relays[39] was carried out by the Relay Testing wing. Maintenance and repairs of transmission lines including periodic ROW clearance works was carried out by the Line Maintenance Subdivisions (LMSD). The summary of the operation of the maintenance wings and the deficiencies therein were as follows:

PET Wing	*Relay Wing*	*Line Maintenance Wing*
1	2	3
Operated six wings. Working potential was 1200 days against a minimum requirement of 1500 days.	Operated 11 Relay Sub Divisions(RSDs). Coverage of testing was limited due to shortage of testing equipments and manpower.	Operated eight LMSDs. Hot line techniques[40] were not carried out by the Line Maintenance Subdivisions. Eight officials imparted (2011) training in hotline techniques at a cost of ₹ 8.40 lakh were deployed for regular duties for want of tools and equipment.
Essential instruments like Sweep Frequency Response analyser, online LA monitor etc., were not available in any of the wings.	Delay in replacing faulty relays ranged from one month to four years.	Kozhikode LMSDs had not carried out tree touchings clearance works for the last five years in seven out of 27 feeders. The ROW clearance work in jungle areas under Kannur LMSD was not carried out after 2009-10.
Shortage of tool kit/testing equipments resulting in limited testing.[41]	58 Nos. of the relays were working with back up relays though the purpose of the backup relays was to support the main relays.	Two LM Sections (Kannur and Kanhirode) shared basic equipments such as pulley, rope and vehicles between them resulting in only one section being active at a

39 Electrically operated switches which sense the system faults and safely switch off the system prior to occurrence of any exigencies.

40 Envisages attending to maintenance works without switching off.

41 Three units (Kannur, Madakkathara and Edappon) tested only power transformers in SSs till 2009-10s.

1	2	3
		time. Three out of eight LMSDs test checked were not provided with fault locators.[42]
Trend analysis not carried out in three units.	Testing data was maintained manually and no software was used by the RSDs to make trend analysis and compilation of data.	On a test check by audit it was noticed that seven accidents occurred due to property owners/others cutting branches of trees or plucking fruits from trees within the ROW, resulting in electrocution of six persons and severe burns and loss of limb to one person.
Adopted standards varying from 1 to 2 for PT/CT against accepted Tan Delta standards of 1/0.7.	Over flux (to arrest over voltage) and under voltage relays were not installed in the transmission system.	59 out of 118 towers in 110 kV KL-AR (Kalamassery-Aroor) feeder and all towers of 110 kV KL-CH (Kalamassery-Chalakudy) feeders did not have earth wire connectivity.
Dew Point meter and Core moisture analysing kit were available at two SSs[43] only.	12 out of 62 Nos. of Auto reclosures installed at various feeders were disabled due to non availability of Carrier Aided Tripping facility and Protection Coupler.	134 towers under LMSD Kannur and 427 out of 1239 towers under LMSD Kozhikode constructed prior to 1947 needed replacement. The towers of the TVT (Trivandrum-Thackalay) feeders at Trivandrum and all the towers in the Manjeswaram-Thoudugoli 110 kV line were in deteriorated condition.

42 Fault locators are used to detect the exact location of the fault in long distance feeders.
43 Dew point meter at GIS, Marine drive and Moisture measuring kit at Kalamassery.

In response to the above observations, Government replied that:

- It was proposed to form two more sub-divisions to make good the short fall of men and equipment in PET wing.
- Strict compliance on standards and recommendations may result in huge investments in a short span of time.
- The preparation of data bank of the test results/relays were in progress in PET/Relay wings.
- The mismatch in the target and achievement of testing works in Relay wing was due to lack of proper/efficient testing kits. Five numbers three phase relay test kits were recently purchased which would improve operations. All disabled auto reclosures would be put back in service on procurement of necessary protection couplers. Under voltage relays were not installed in view of the low voltage situation which if installed would result in denial of power.
- The functioning of hot line maintenance could not be started for want of required tools and trained personnel were deployed for cold line works. More than one clearing of tree touchings in ROW was carried out in a year. Accidents were caused by unauthorised cutting of trees without prior information to KSEB. The public were made aware of the dangers in cutting and removing touchings and the safety precautions for constructing buildings under/near EHT lines.

Despite KSEB's stand that steps were being taken to remove the deficiencies in the maintenance wings, the fact remains that the maintenance wings are functioning with deficiencies. Though accidents were caused by unauthorised removal of touchings by the victims, these were due to failure of KSEB to remove the touchings on the line route where it had ROW. Despite the comparatively high cost, the acquisition of modern equipments for maintenance wings requires priority.

The inadequacy of the PET/Relay wings reduces the quantum of testing and leaves the defects undetected. This would cause accidents, power failures and damage/breakdown of equipments/lines. Inadequacy of line maintenance would also result in snapping of lines, deterioration of towers, earth faults, accidents and power failure.

Instances of poor maintenance including non-compliance with PET directions

2.1.26 On a test check, we noticed instances of postponement of maintenance/overhauling of transformers for reasons such as absence of stand-by equipment, non-availability of materials, perceived need for avoiding power interruptions etc. We also noticed instances of such postponement of maintenance even after PET wing had insisted on the same resulting in equipment failures as stated below:

Name of SS	*Lapse of KSEB*	*Impact*
400 kV Madakkathara	Overhauling of Unit No.2 of transformer bank No.1 recommended by PET Wing (14 August 2010) was not carried out. According to KSEB this was on account of simultaneous poor condition of Unit No. 4 and non-availability of another spare transformer unit.	Transformer bank No.1 tripped (7 August 2011) with fire and severe damage to Unit No.2. Resulted in repair at a cost of ₹ 2.44 crore and power restrictions for eight days.
110 kV Paruthipara	Replacement of R phase CT of 20 MVA 110/11 kV transformer No. II (26 January 2012) recommended by PET was not carried out.	CT caught fire (12 February 2012) resulting in tripping of all transformers and feeders causing power disruption.
220 kV Brahmapuram	The two transformer banks/tie lines were operated separately for intermittent periods on a risky basis with CTs which were tripping repeatedly. Spare Cts available were not of required ratio.	Emergency repair of available CTs to make ratios compatible caused operation of the station in a risky condition with risk to personnel and equipment.

220 kV Nallalam	The Bus coupler Circuit Breaker on 110 kV side of 12.5 MVA transformer failed to act upon detection of a fault on account of low SF6 gas pressure (26 July 2009). Low SF6 gas pressure was due to shortage of gas in the CB.	The transformer caught fire and blasted which caused power interruptions and avoidable repair cost and an emergency situation at the station.
66 kV GIS Power House, 110 kV Edapally	Poor maintenance caused entry of rats in the incomer side of indoor transformer (GIS Power-house) and inside control panel (Edapally).	This resulted in power interruptions in the stations.

In reply, while accepting the observations, Government stated that:

- The overhauling could not be done at Madakkathara SS despite recommendation as only one spare transformer was available at that time when more than one transformer was in poor condition.
- A new CT was not available for replacement at the time of PET recommendation at Paruthipara SS.
- When the existing CTs developed faults, the available spare CT at Brahmapuram which was not as per requirement (ratio difference which needed correction) was modified on a war footing and defective CTs were replaced.
- In GIS Power House the rat entered the incomer side by making a small hole which was earlier closed using packing materials. In Edapally, it was stated that the rat might have entered in switch gear panel during permit work.

The replies substantiated the fact of poor upkeep and maintenance of the critical and vital equipments in the transmission network.

Instances of delay in repairs

2.1.27 On a test check, we noticed the following instances of postponement of maintenance:

Name of SS	Delay in repair
400 Kv Madakathara	Of the 15 CBs (installed during 1992-1995) entrusted (March 2008) for overhauling, only nine CBs were overhauled (August 2012).
220 kV Mylatty	Urgent overhauling of 110/11 kV transformer repeatedly recommended (2010 & 2011) by PET Wing has not been carried out (August 2012).
220 kV Brahmapuram	CTs with high tan delta values recommended for replacement (July 2008/April -May 2010) by PET Wing were not replaced (August 2012).
-do-	Overhauling of one 10 MVA transformer which was non-functional from March 2012 due to low Insulation Resistance (IR) value could not be done (August 2012) as transformer available for replacement was also faulty.
-do-	Replacement of PT of Kandanad feeder recommended for replacement by PET Wing as it showed high loss in watts, was not done (August 2012) for want of a new PT.
220 kV Nallalam	Repair of a blasted (July 2009) 12.5 MVA transformer was not carried out (August 2012), though the core was found (September 2010) to be intact.
220 kV Kalamassery	Non-maintenance of removed transformer bank (3 x 40 MVA) for 11 years resulted in failure of one unit in offline condition.
Azhikode SS and Thalassery SS	Repairs of 12.5 MVA (Azhikode SS) and 10 MVA (Thalassery SS) transformers which failed in August 2004/November 2006 were awarded only in August 2009.

In respect of the above observations, Government replied that:

- The 15 CBs at Madakkathara could not be repaired at a time as it depended upon the availability of supplier's service engineers.
- The overhauling of the transformer at Mylatty would be done after the installation of the new transformer which has been received.
- The CTs with high tan delta value and PT of Kandanad feeder and the defective spare for the 10 MVA transformer at Brahmapuram would be replaced on obtaining new equipment. The failed 10 MVA transformer at Brahmapuram was not overhauled as it was minimally loaded.
- The repairs of the defective transformers (Nallalam) were delayed as KSEB explored several options for cost reduction.
- Salvage value could be realised for the transformer which failed in offline condition at Kalamassery.

The reasons adduced for delay in repair viz. non-availability of supplier's engineers, non-purchase of spares/replacements etc., lacked justification. A suitable clause for subsequent repair should have been included in the purchase order itself. The delay in procurement of new spares/replacements reflects lack of earnestness in the maintenance of vital and critical equipments. As delay in replacement of defective equipments causes accidents and disruption of power, the same cannot be continued on the plea of exploration of options for cost reduction.

Transmission losses

2.1.28 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.

KSEB had worked out and furnished combined T & D losses only to SERC in its tariff proposals. Consequent to the direction of SERC for identification of transmission losses separately, study was conducted (2010-11) based on the power flow simulations on the Transmission Network Model by the Corporate Planning wing. Based on this study, the average peak technical losses for the complete transmission system up to the 11 kV Bus in SSs were estimated at 3.64 per cent for morning peak and 4.17 per cent for evening peak, corresponding to an annual energy loss of 355.37 MU and 553.75 MU respectively. However, the transmission loss of each year was determined as five per cent in the ARR proposals submitted to the SERC before and after the simulation study. The reason for non-adoption of the data as per the simulation study was not explained by KSEB. The actual loss of five per cent exceeded the CEA norm of four per cent for transmission loss.

The details of transmission losses from 2007-08 to 2011-12 (taking into account the power received and assuming transmission loss of five per cent) are given below:

Particulars	*Unit*	2007-08	2008-09	2009-10	2010-11	2011-12
Power received for transmission	MUs	15223.93	15451.34	17094.76	17469.02	19086.93
Net Power transmitted	MUs	14462.74	14678.77	16240.02	16595.57	18132.58
Actual transmission loss	MUs	761.19	772.57	854.74	873.45	954.35
	Percentage	5	5	5	5	5
Target transmission loss as per the CEA norm	Percentage	4	4	4	4	4
Target transmission loss as per SERC	Percentage	NA	NA	NA	NA	NA
Transmisson loss in excess of CEA norm	MUs	152.24	154.51	170.95	174.69	190.87
	Rate per [44] unit in ₹	3.51	3.80	3.38	3.54	3.54[45]
	₹ in crore	53.44	58.71	57.78	61.84	67.57

44. Valued at average realisation per unit
45. 2010-11 rate.

The Report of the 17th Electric Power Survey Committee specified only T & D losses, instead of separately stating Transmission loss. The T &D loss target for the State for the year 2011-12 was 15 per cent. Similar target fixed by SERC was 16 per cent. As against these targets, the actual T & D loss (estimated by KSEB) at the end of the year 2011-12 was 15.56 per cent. Transmission losses result in loss of energy and reduction of the same could have reduced the power shortages and earned additional revenue.

Grid Management

2.1.29 Grid Management is the function of ensuring moment-to-moment power balance in the interconnected power system to take care of reliability, security, economy and efficiency. In the State, the State Load Despatch Centre (SLDC), a constituent of Southern Regional Load Despatch Centre (RLDC), Bangalore, ensures integrated operation of the grid. The main SLDC at Kalamassery is assisted by two Area Load Dispatch Centres (ALDCs) at Thiruvananthapuram and Kannur. The various aspects of grid management and the observance of the same by KSEB were as follows:

Parameter	*Implementation in KSEB*
SLDCs should operate as an independent wing, having own office and state of the art equipment (Electricity Act, 2003).	SLDCs in the State were functioning in the premises of KSEB, under its direct control and supervision.
SLDCs to be integrated facilitating smooth transfer of data.	SLDCs were not integrated as the data acquired at Sub SLDCs were transferred to main SLDC, which in turn transmitted the same to SRLDC.
SLDCs to have data storage/back up facilities.	SLDCs lacked data storage or back up facilities reducing them to observation centres.

State of Art Supervisory Control and Data Acquisition (SCADA) essential for all grid stations (SS/GS) for monitoring the efficiency of the transmission system and the loads (Grid norms).	The existing SCADA arrangement commissioned during the beginning of 2002 under Unified Load Dispatch and Communication (ULDC) scheme by PGCIL had become obsolete on account of deficiencies[46]
Adequate number of Remote Terminal Units (RTU) forming part of SCADA are essential for all grid stations (SS/GS) for monitoring the transmission system.	The total number of RTUs installed was 33 including those at sixteen out of seventeen 220 kV SS (94 per cent) and eight (62 per cent) out of thirteen generators with capacity above 25 MW. This was inadequate.
As per Grid Code, 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 1 April 2009). To enforce the grid discipline, the SLDC issues three types of violation messages for over-drawal at frequencies below 49.2 Hz (A[47], B[48], C[49]).	KSEB received 27 and eight type 'C' messages in the years 2008-09 and 2011-12 which indicated prevalence of frequency violations. Though no penalty was levied for violation of frequency norms, the over drawals resulted in payment of a huge amount of Rs. 2.83 crore as additional UI charges during the period from 2009-10 to 2011-12.
Power procurement should be planned after determining the net additional requirement of power through a supply plan taking into account the planned generation capacity and contracted allocation from central sector and day-ahead plans for assessing its day to day power requirement.	Power shortage during peak hours was widely prevalent and occurred during most of the days in the years 2008-09 to 2011-12. On account of shortages, the demand was substantially met through Unscheduled Interchanges (UI) when the frequency was low, for which UI charges amounting to ₹ 588.63 crore prescribed by SLDC were paid for the audit period indicating that the planning for power procurement was defective.

46. Absence of back up for the data, absence of a metering interface, limited coverage, use of old transducers for transmitting data etc.
47. Overdrawl more than 50 MW or 10 per cent of schedule whichever is less.
48. Over-drawl between 50 and 200 Mws for more than ten minutes or 200MW for more than five minutes.
49. Issued 15 minutes after the issue of message B when over drawl is more than 100 MW or ten per cent of the shceduled whichever is less.

Power purchases from traders and power exchanges can be effected through Short Term Open Access (STOA),[50] Medium Term Open Access (MTOA)[51] and Long Term Access (LTA).[52] STOA is more prone to cancellation compared to the other options in the event of system constraints. Test check of STOA transactions of KSEB for the period from December 2011 to February 2012 revealed curtailments of the load indented by KSEB/Traders by SRLDC due to non-availability of transmission corridor.	There was lack of timely action by KSEB in arranging/filing of application for transfer of power through MTOA. MTOA applications filed (April 2012) by two traders for transfer of power to KSEB for the period from September 2012 to May 2013 was turned down by PGCIL as the entire Available Transfer Capacity of 750 MW under MTOA was already allocated for the period till 15th June, 2013. KSEB thus would have to purchase costly power through STOA/day ahead/ UI purchases.

In reply to the above, Government stated that :

- Agreement for execution of the SCADA upgradation work had been signed between PGCIL and KSEB (June 2012) which was expected to be completed by December 2013. The new project envisaged a main SLDC (Kalamassery) and a back up SLDC (Thiruvananthapuram) with 21 additional RTU locations. The data to both main and back up LDC would be fed directly from the RTUs.

- Additional UI charges were caused by non-availability of transmission corridor for import of power from outside which was cheaper than operating naphtha based generators. Power demand of the State was growing rapidly compared to the availability of power, creating a widening gap between demand and availability. Many of the generation projects were not getting materialized owing to environmental and other objections. KSEB was importing power to the maximum import capability through all inter-state feeders. Major transmission projects were being held up at many places due to ROW issues.

- It lacked the huge financial resources to ensure dynamic stability of the system for developing sufficient generation capacity equipped with

50. Access up to one month at one time.
51. Access for 3 months to 3 years.
52. Access for 12 years to 25 years.

governor system and creating sufficient redundancy in transmission system. Further the hydel generators were constrained by the availability of water and the costly naphtha based projects could not provide immediate additional generation support, and under such a situation, dependency on UI support was inevitable.

Government's replies are not acceptable. As the new SCADA system would come into operation only by December 2013, K.S.E.B. would continue functioning with the current deficient system. Though the drawals causing UI charges were stated as inevitable, the fact remains that K.S.E.B. violated grid discipline by doing so. Further, modernisation of the system (equipping the system with governors) cannot be ignored on the plea of high cost.

Disaster Management

2.1.30 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 and skilled/specialised manpower. Disaster Management Centre, NLDC, 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 [53] operations was being carried out by KSEB every six months.

Inadequate facilities for DM

2.1.31 Though, KSEB stated that it had developed plans and procedures for restoration of the system from blackout for 13 generating stations in four sub-systems, black start facilities were provided only at nine out of 24 major generating stations. Thus, the preparedness of KSEB to meet the occurrence of disasters, if any, was inadequate and gave rise to the risk of accidents and heavy damages in the event of disaster.

Energy Accounting and Audit

2.1.32 Energy accounting and audit is essential to assess and reduce the transmission losses. The transmission losses are calculated from the readings of the Meter Reading Instrument (MRI) at the metering points. These points are at the boundaries between Generation to Transmission (GT) and Transmission to Distribution (TD). To ensure the accuracy, the CEA had specified (June 2010) that

53. Procedure necessary to recover from partial or a total blackout.

the interface meters in the generation/transmission wing shall not be inferior to the accuracy class of 0.2 S. We, however, found that the meters were of inferior accuracy class leading to various problems in energy accounting as detailed below:

- Meters of 0.2 S class were installed at major interstate TD metering points by PGCIL. KSEB had not installed its set of check meters at these points.
- Only meters of 0.5 S class were installed at the substations of KSEB. KSEB had stated that 0.2 S class meters were not installed on account of the huge financial commitment involved. The replacement of meters would be effective only if the related meters of CT/PT were also replaced by those with 0.2 S accuracy class.
- On a test check of meter readings of 220 and 110kV SSs of three circles[54] for the period from October 2011 to March 2012, it was noticed that the incoming meter readings were less than the outgoing meter readings in some months in respect of 20 out of 22 SSs showing that the meters were defective.
- As per KSEB's studies, in case of 18 feeders, the energy received at the sending end (sending to one SS) of the feeders was more than the energy received at the receiving end (receipt from another SS) of the feeders.

Government stated that the requirement for purchasing meters for interface boundary metering points and GT points was under consideration. It was also stated that the meters used in Thiruvananthapuram Circle were of the accuracy class of 1.0 which allowed a percentage error of up to 1.3 per cent. The errors were also due to defects in CTs and PTs. Non-compliance with the recommendations of the CEA rendered the metering ineffective/prone to errors. This can cause excess payment of transmission/power purchase charges.

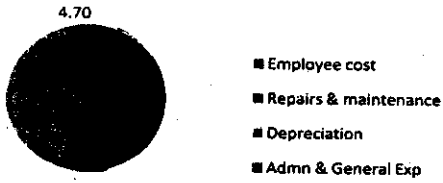
Financial Management

2.1.33 National Electricity Policy 2005, envisaged financial turnaround and commercial viability in each area of Power Sector. Since KSEB functioned as a composite unit without being unbundled into separate profit centres, the details of revenue realization, net surplus/loss and earnings could not be computed separately for transmission.

54. Trivandrum, Kannur, Pathanamthitta.

Elements of Cost

2.1.34 The details of expenditure of the Transmission wing and cost per unit of transmission are given in Annexure 9. Employee cost, Depreciation, and Repairs & Maintenance constituted the major elements of cost in 2011-12 which represented 41.77, 39.58 and 13.94 per cent respectively of the total cost (excluding finance and interest charges of ₹ 0.75 lakh).



The details of fixed cost, variable cost and total cost per unit for the period of five years were as follows:

Cost per unit (₹)	2007-08	2008-09	2009-10	2010-11	2011-12
Fixed cost	0.12	0.13	0.13	0.15	0.15
Variable cost	0.02	0.02	0.03	0.03	0.03
Total cost	**0.14**	**0.15**	**0.16**	**0.18**	**0.18**

It may be seen that the fixed and variable cost showed an increasing trend till the year 2010-11. There was no change in both fixed and variable cost in 2011-12 compared to previous year, as the units consumed increased substantially.

Avoidable expenditure and non-realisation of dues

2.1.35 We noticed deficiencies which led to KSEB paying ₹ 13.69 crore to PGCIL/SRPC as compensation towards unavailed power allocation and share in cost of capitalization of idle infrastructure. At the same time KSEB failed to realize the amounts due to it promptly.

Facts	*Observation*
Compensation for unavailed Power-Rs. 0.41 crore	
135 MW of NTPC's ER power allocated to Tamil Nadu Electricity Board (TNEB) for pooling with the costly RGCCPP[55] power was rejected by TNEB along with RGCCPP power. On 14-9-2011, MoP allocated this quantity to KSEB for 6 days from 15-9-11 and thereafter to Andhra Pradesh. CE, SLDC intimated non-acceptance of the allocation by fax on the day of allocation and by letter on next day on plea that Board's decision was pending. KSEB, however, had to pay Rs. 41.24 lakh as transmission/ POC charges for undrawn power to SRPC and PGCIL.	KSEB did not reject the allocation, but rejected the day ahead scheduling only. KSEB's plea for this was that a decision of its Board was required. KSEB should be able to make outright decisions in emergencies without waiting for a meeting of its Board. The failure to do so caused huge losses and lacked justification.
Share in capitalisation of idle infrastructure-Rs. 13.28 crore	
PGCIL notified commercial operation of a line and SS[56] designed for transmission of power from the Koodamkulam project, w.e.f., 1st January, 2012, despite non-commissioning of the project. KSEB's evacuation lines from the SS were also pending. KSEB accepted (February 2012) its monthly share of transmission charges (cost of capitalisation incurred by PGCIL) of ₹ 55.42 lakh.	KSEB was liable to pay ₹ 6.10 crore[57] for a project which had not been commissioned and from which power was not received. Government stated that PGCIL expected return on investment and may charge interest on deferred capital charges if the commercial operation of the completed infrastructure was not allowed. The reply indicates that KSEB is compelled to bear the cost of evacuation system, despite the non-completion of the related generation project, which is not correct.

55. Rajiv Gandhi Combined Cycle Power Project.
56. Trichur-Cochin 400 kv DC transmission line and the 400 kv SS at Pallikkara.
57. For 11 months from January 2012 till November 2012 when commissioning of KSEB's evacuation lines is expected.

KSEB assessed (September 2010) that the third transformer installed by PGCIL at their SS at Thiruvananthapuram would not be utilised effectively for a period of ten years. Transmission charges of Rs. 7.18 crore was paid (cost of capitalisation incurred by PGCIL) for the third transformer from July 2009 to June 2011. KSEB had not ascertained the amount of excess transmission charges from June 2011.	The matter regarding payment of transmission charges for idle/excess capacity was not taken up with PGCIL. Government replied that PGCIL had constructed these transformers after approval of the matter at various levels including SRPC. It was also stated that the actual demand growth may not tally with the assumption made at the time of planning. Thus, the huge idle expenditure was caused on account of the poor load forecasting by KSEB.
KSEB dues not collected 66 kV SSs at the Air Port, Thiruvananthapuram and the Bharat Petroleum Corporation Limited (BPCL) refinery at Ambalamugal commissioned in May 2010 and May 2012 respectively were operated by KSEB. Maintenance charges were not collected from BPCL due to non-finalisation of agreement. Maintenance charges for the two years from May 2010 amounting to ₹ 2.18 crore was paid (July 2012) by Airport Authority of India (AAI) after a delay of two years.	KSEB had not demanded compensation from AAI for the interest loss on account of the delay in payment though as per the agreement, payment had to be made monthly. The agreement with BPCL remains to be executed. Government stated that the finalisation of the agreement with AAI took two years on account of administrative delays and claiming of interest would not be justifiable. Agreement can be executed with BPCL only after approval of MOU between both parties. The replies are not acceptable as KSEB had rendered maintenance services without compensation. Further administrative delay of two years for finalisation of agreement lacked justification.

Material Management

2.1.36 The key functions in material management are laying down inventory control policy, procurement of materials and disposal of obsolete inventory. We, however, found various deficiencies in the procurement procedure like delay in finalisation of purchases resulting in lapse of offer and consequent re tendering, excess procurement resulting in idling of costly equipment etc.

Purchase of transformers in advance of requirement

2.1.37 Purchase of transformers is made by the Chief Engineer (SCM). Prudent purchase management demanded that purchase of transformers for substations should be synchronised with the progress in completion of other works to avoid idling of costly equipment and loss of guarantee period. We noticed the following instances where KSEB did not comply with these requirements:

- Even before acquiring (August 2005) land for 220kV SS at Vadakara, CE (SC&M) placed orders (April 2005) and procured (March 2006) two 220/110kV three phase 100 MVA transformers from TELK, Angamaly at a cost of ₹ 6.25 crore. The SS was commissioned only in June 2009 and the transformers were idling for about 3 years.

- Though orders were placed (May 2007) on TELK, Angamaly, for four 66.67 MVA 220/110kV single phase transformers for enhancement of capacity of the 220kV SS Kundara at a cost of ₹ 12.88 crore, the equipment was delivered/diverted (October 2007/February 2008) to 220kV SS, Pothencode, on the ground that they were urgently needed at that station. The transformers, however, were commissioned (November 2010) at Pothencode after 33 months. One of the transformers which failed after being in service for six months was repaired at a cost of ₹ 20 lakh due to expiry of guarantee period. Three transformers subsequently procured (January 2009) against orders (June 2008) for Kundara SS at a cost of ₹ 8.87 crore remained idle for 12 months without commissioning (December 2009).

- Against orders placed (December 2006/April 2007) with Indotech Transformers, Chennai, two 5 MVA transformers were purchased (March 2007/August 2007) for the 33 kV SS at Venjaramood at a total cost of ₹ 54.59 lakh before technical sanction (November 2008) of the work. The transformers remained idle till the commissioning of the SS in March 2010.

- Against orders placed (May 2007) with Indotech Transformers, Chennai, four 12.5 MVA transformers procured (September/October 2007) at a cost of ₹ 2.51 crore remained idle for more than one year at three SSs [Ayathil (two Nos.), Kozhinjampara and Pathanapuram] on account of non-completion of related works.

Government replied that procurement in advance of actual requirement occurred due to the need to give time to the suppliers for the manufacture. The reply is not convincing as the maximum time required by leading manufacturers for supplying transformers was 10 months from the date of order. KSEB also pointed out that in these cases, the construction was delayed due to adverse climatic conditions and disputes.

We also found that the transformers supplied were guaranteed by the manufacturers for a period of 12 months from the date of commissioning or 18 months from the date of supply whichever was earlier. Thus, due to the delays, these transformers were installed/operated after the warranty period thereby depriving KSEB of the benefits of free replacement/repair within warranty period. Hence KSEB should ensure proper co-ordination between purchase and other wings.

Non finalisation of tender within the validity period

2.1.38 KSEB invited (January 2011) competitive tenders for procurement of 41km XLPE UG cable for its urgent common requirement. As per the General Conditions of tender, the bid was valid for four months from the date of opening of the price bid or six months from the date of opening of pre-qualification bid whichever was earlier. KSEB however, did not finalize the tender within the validity period of the bid. Subsequently 31 kms of cable were procured at higher rate obtained in fresh tenders resulting in avoidable extra expenditure of ₹ 30.01 lakh[58].

Failure to reform Purchase wing

2.1.39 KSEB assessed (May 2008) that the Supply Chain Management (SCM) was deficient in all areas including forecasting, indenting, procurement, storage and payment. Hence, KSEB awarded (January 2009) the assignment of

58. Rs. 1275943.24 (Subsequent price quoted)- 1179135.90 (original price quoted by Cable Corporation of India, Chennai) x 31km.

optimizing SCM to Deolite Touche Tohmastu India Pvt. Ltd., the lowest bidder at a cost of ₹ 41.29 lakh. Though the consultant submitted final recommendations during February 2010, the software developed by them for the purpose which was the main item in the reformation of the purchase wing was yet (August 2012) to be implemented in Transmission wing even after the lapse of four years. The recommendations for standardization, classification and coding of equipments and materials procured also have not been implemented.

Monitoring and Control

2.1.40 Monitoring by top management is conducted by the Technical Audit Wing (TAW) formed in February 2010 under CE (SO) and the System Study Wing (SSW) formed in July 2010 under CE (Corporate Planning). Technical audit of SSs is conducted by ad hoc audit teams comprising a Chief Auditor (Deputy Chief Engineer rank) and two auditors (Executive Engineers). The system study group monitors the activities of SSs through data collected from Monthly Operation Review (MOR) reports/load flow studies/loss studies. We noticed the following deficiencies in the monitoring functions:

- The coverage of technical audit was not exhaustive and 151 out of 230 SSs were yet (August 2012) to be audited.
- The MORs sent by the SSs included routine data such as operating parameters of transformers and lines, equipment status, details of capacity addition/deletion etc. Details of performance of the equipments installed including SS batteries and relays, maintenance activities,[59] OLTC[60] operations, cause-wise analysis of breakdowns etc., were not called for through the MOR. The year-wise cumulative performance of the SSs and lines were neither maintained nor consolidated for evaluation of annual performance of the SSs and lines. KSEB needs to develop a more comprehensive Management Information System.
- On a test check, we noticed lapses in compliance with recommendations of the system study/technical audit wings.

➢ Replacement of weak and faulty LAs and installation of a capacitor bank on the 110 kV bus at the Chevayur SS (September 2011 TAW).

➢ Replacement of old panels at the SS, Relays of Attingal-Paripally feeder and the Breather of 220/110 kV transformers at Pothencode SS (July 2011 TAW).

59. Maintenance activities carried out, urgent maintenance peding, programme of maintenance activities, due dates of major maintenance activities etc.
60. On Load Tap Changer.

- Overloading of seven[61] SSs and underloading in 37 SSs and 59 transformers remained without rectification. The overloaded transformers comprised 16 Nos. 110/66 kv transformers, 5 Nos. 16 MVA transformers and 17 Nos. 110/11 kv transformers (System study group).
- The idle capacitor lying at the 110 kv Mundayad SS had not been installed at the 220 kV Kaniampetta SS (July 2011 SSW).

Government stated that the deficiencies relating to Pothencode SS and Attingal-Paripally feeder would be corrected soon. A proposal had been prepared for removing the capacitor from Mundayad SS. Thus, the defects remain without rectification. The deficiencies in monitoring affect the overall efficiency and may cause accidents and power disruptions.

Duty timings at SSs

2.1.41 The approved timings of KSEB for duty at its SSs comprise three shifts (07. 00 to 13. 00 hrs., 13. 00 to 21. 00 hrs. and 21. 00 to 07. 00 hrs.). The duration of the third shift was thus for 10 hours. However, in most SSs, the duty was performed in two shifts (09. 00 to 17. 00 hrs and 17. 00 to 09. 00 hrs.). Shift duty in three shifts was observed only in two out of fourteen SSs visited by us. The execution of the second shift for 16 hours continuously would have a negative impact on the quality of performance and monitoring and violates labour laws. KSEB needs to enforce the approved duty timings strictly or formulate shift duty of eight hours duration. Though Government stated that approved shift timings were in practice in almost all stations, the actual shift timings as recorded in the Operator's Diaries maintained at the substations did not support the Board's contention.

Comparison with best practices adopted by PGCIL

2.1.42 Best practice is the method or technique that has consistently shown results superior to those achieved with other means, and that is used as a benchmark. The State of the Art practices for operation, maintenance and monitoring purposes followed by PGCIL, the CTU, as compared with those of KSEB revealed the following shortcomings in KSEB:

Practice followed by PGCIL	*Implementation in KSEB*
Stations were automated/planned for automation.	Automation was not planned for any of the SS of KSEB

61. Vennakkara, Veli, Neyyattinkara, Vizhinjam, Koilandy, Perinthalmanna and Paika.

One and half breaker system[62] was adopted for better reliability at SSs.	Spare breaker system was generally not adopted in KSEB. One and half breaker was adopted in case of one 400 kV SS only (Madakkathara)
Double/transfer bus facility at SS.	Most 110 kV SSs and four 220 kV SSs had single bus facility only. Transfer bus facility was available at one SS only (Brahmapuram)
Only SF6 CBs at EHV SS.	CBs at Kalamassery and Paruthipara SSs included MOCB/ABCB
Operations of isolators and other yard equipments to be remotely controlled at all EHT SSs.	Test check revealed that facility for remote operation was not provided at four 220 kV[63] SSs
GPS based time synchronising equipment and Air conditioning system to be provided in SSs.	GPS based time synchronising equipment and Air conditioning system not provided in most SSs
Advanced relays such as Numerical relays to be used.	Relays used in most of the SSs are mainly electro mechanical. Numerical relays installed are minimal
Use of State of the Art firefighting equipment.	State of the Art firefighting equipment such as emulsifiers/detection lines and spray lines were not used in any of the SSs
History registers to be maintained in the form of a log book for each item of equipment.	Only common equipment registers were maintained for all equipment in most SSs and the entries in these registers did not include a detailed record of all activities relating to operation and repair in the form of a log book
Tests such as tan delta were done at the SS itself.	None of the SSs had facilities for testing of vital parameters such as Tan Delta and these were done only during the visits of the PET Wing

62. Which provides a spare breaker and related bay eqipment for sharing among the buses.
63. Kalamassery, Brahmapuram, Nallalam, Pothencode (facility available at 220 kv side only at Pothencode)

Government stated that the incorporation of most of these practices involved huge financial investment. It was also replied that some of the facilities such as one and a half breaker system, numerical relays, transfer bus, auto re-closures, event logging etc., were available in major substations. However, these facilities were available in a few 220 kV stations only. The Board needs to modernize/improve its level of functioning by adopting the modern techniques/practices of PGCIL to a wider extent.

Failure to Unbundle KSEB

2.1.43 Though, as per Electricity Act 2003, KSEB was to be unbundled into separate profit centres for the three functional areas of generation, transmission and distribution, this remains to be achieved. KSEB functioned as a composite unit executing the functions of generation, transmission and distribution. A company viz., Kerala State Electricity Board Limited (KSEB Ltd.) was incorporated (January 2011) under the Companies Act, 1956 for taking over the functions of KSEB. However, the assets and liabilities of KSEB have not been transferred to KSEB Ltd. till August 2012. The restructuring and creation of separate utilities with separate profit centres would have enhanced the efficiency/performance of KSEB. This caused non-preparation of separate accounts for each of the three wings. On account of non-implementation of unbundling of KSEB, there was no separate tariff for the transmission wing. Only a composite tariff was followed for all the three functional wings. The delay in filing the composite tariff delays the recovery of cost of operations of all the three wings of KSEB including the Transmission wing.

Internal Controls and Internal Audit

2.1.44 Internal control is a process designed for providing reasonable assurance of efficiency of operations, reliability of financial reporting and compliance with applicable laws and statutes. Internal audit relating to the offices under the Transmission wing was confined to financial transactions. Pre-check of contractor's bills was commenced only in April 2012. Other aspects were not audited. Various other matters relating to technical issues were not reviewed in audit. Instances of presentation of the internal audit reports in the meetings of the Board of KSEB were very few on account of the relatively minor level of objections. Thus, the audit was inadequate when compared to the size and volume of operations. KSEB needs to take steps to strengthen its audit wing.

[Audit Paragraph 2.1.1-2.1.44 contained in the Report of the Comptroller and Auditor General of India for the year ended 31 March, 2012]

Notes furnished by Government on audit paragraph is given in Appendix II.

AUDIT PARAGRAPH 4.10 (2007-08)

Avoidable extra expenditure

The delay in conducting inspection of materials by the Board resulted in non-supply of materials and its alternative purchase at an additional cost of Rs. 1.32 crore.

The Board placed (14th February, 2006) purchase order for procurement of 151 kilometres (kms) of various sizes of 1,100 V grade Control Cables on Arun Manufacturing Company, Delhi (AMC), at a total firm price of Rs. 1.46 crore. As per the purchase order, AMC was to commence delivery within two months with a minimum quantity of 17 kms and complete it within six months (13 October 2006) thereafter. The materials had to be inspected and approved by the nominee of the Board before despatch and for this AMC was to give 20 days advance intimation.

AMC intimated (25th March, 2006) the readiness of first batch of 20 kms of cables for inspection. The Board, however, conducted inspection only during 22 to 24 May, 2006. Due to delay in inspection, AMC requested (7th June, 2006) the Board for extension of delivery schedule by eight months and demanded (3rd August, 2006) enhancement of price by 50 per cent on the ground that raw material cost had increased more than 100 per cent from the offer date. The Board extended (4th August, 2006) the delivery schedule up to 14th February, 2007 without imposition of penalty. AMC, however, did not supply the material.

Consequently, the Board terminated (November 2006) the purchase order placed with AMC and arranged (March-May 2007) purchase of 151 kms of control cables through two other suppliers at an additional expenditure of ₹ 1.39 crore at the risk and cost of AMC, which was not accepted (27th July, 2007) by AMC. Thus, the undue delay on the part of Board in conducting inspection of materials provided by AMC and subsequent termination of the purchase order resulted in procurement of material from alternate source at an additional cost of Rs. 1.32 * crore.

* As reduced by Security deposit of Rs. 7.30 lakh

The Management stated (April 2008) that delay in inspection was due to delay in execution of agreement by AMC and steps were in progress for recovery of Rs. 1.32 crore from AMC. The reply is not relevant to the point as the execution of agreement was a pre-condition for payment and not for conducting inspection of material. The delivery was to begin within two months from the date of purchase order and AMC had intimated readiness of materials in time for inspection. The Board also had the option of withholding payment in the event of non-execution of agreement.

[Audit paragraph 4.10 contained in the report of the Comptroller and Auditor General of India for the year ended 31st March 2008]

Notes furnished by Government on audit paragraph is given in Appendix II.

AUDIT PARAGRAPH 3.1-3.35 (2006-07)

Introduction

3.1 The transmission system which forms an essential link between power generating/receiving source and load centres/distribution point plays a vital role in power management. All the power stations are connected with different sub-stations set-up for supply of power to consumers through 220 KV, 110 KV, 66 KV and 33 KV network. For efficient functioning of transmission system, it has to be ensured that, there is minimum loss in transmission of power. Electricity generated at 11 KV in generating stations is stepped up to 33/66/110/220 KV and transmitted to transmission and distribution substations which in turn stepped down to 11 KV for ultimate distribution to consumers. The State Government signed (August, 2001) a Memorandum of Understanding (MoU) with the Union Government (GoI) for power sector reforms which inter alia stipulated reduction of system losses to 17 per cent by December, 2004. In order to achieve this objective, the Board decided (March, 2002) to complete within two years all spillover works from previous five year plan, with more than 25 per cent progress and various system improvement works, such as upgradation of all 66 KV system to 110 KV, wherever possible, withdrawal of 66 KV system within five to ten years in a phased manner, optimization of transformer capacity and installation of capacitors in transmission system, etc. The Board also introduced 33 KV sub-transmission system envisaging addition of 149 sub-stations within a period of two years.

A review on Transmission and Distribution Loss in Kerala State Electricity Board was included in the Report of the Comptroller and Auditor General of India for the year ended 31 March, 1996 (Commercial), Government of Kerala.

The review was discussed by Committee on Public Undertakings (COPU) and the main recommendations contained in the 11th Report presented (July 2002) to the Legislature were:

- Restructuring of the entire system of transmission and distribution and a detailed study to analyse the various factors that contributed to the high percentage of loss.
- Implementation of suitable schemes to bring down the transmission and distribution loss to the stipulated level.
- Implementation without delay of all pending works in the system improvement as well as new works to bring down transmission and distribution loss.

The Board failed to fully implement the above recommendations since there was enormous delay in completion of system improvement works and the desired level of reduction of transmission and distribution loss could not be achieved as is evident from the audit findings infra.

Scope of Audit

3.2 This review conducted during December 2006 to March 2007 covers the performance of the Board during 2002-03 to 2006-07 in the implementation of all the 114 completed transmission system improvement projects like construction of new substations and transmission lines, upgradation of existing substations and capacity enhancement, installation of capacitors, etc. Audit reviewed the records available with the offices of the Chief Engineer Transmission South, North and Systems Operation, Deputy Chief Engineers of all the ten* transmission circles and 10 out of 30 Divisional offices selected on the basis of number and value of works executed.

Audit Objectives

3.3 The audit objectives of the performance review were to ascertain whether:

- the Board undertook transmission system improvement works systematically to achieve economy, efficiency and effectiveness in execution of transmission system improvement;

---

* Alappuzha, Kalamasseri, Kanjikode, Kannur, Kottarakkara, Kozhikode, Malappuram, Poovanthuruthu, Thiruvananthapuram and Thrissur.

- the available resources were utilized effectively for earmarked purposes; and
- the Board was successful in reduction of transmission and distribution losses as envisaged and thereby increasing the revenue.

Audit Criteria

3.4 The following audit criteria were adopted:

- provision of Memorandum of Understanding (MoU), plan documents, project reports/feasibility study for various schemes;
- prescribed procedure for inviting tenders, their evaluation, award of contracts, terms and conditions of agreements for works, etc.;
- environmental laws, land acquisition procedures, etc.;
- monitoring system for implementation and timely completion of projects; and
- norms fixed by Central Electricity Authority for Transmission and Distribution loss and targets fixed by GOI as per MOU.

Audit Methodology

3.5 The audit adopted following mix of methodologies :

- review of agenda notes and minutes of Board, administration reports and annual accounts;
- scrutiny of loan files, physical and financial progress reports, reports on transmission system improvement schemes, etc.;
- review of tenders, contracts, work orders, payment details, etc.; and
- formal interaction with the Management at various levels.

Audit Findings

3.6 Audit findings emerging from the performance review were reported (May 2007) to the Board/Government and discussed in the meeting (30th July, 2007) of the Audit Review Committee for State Public Sector Enterprises (ARCPSE). The meeting was attended by the Deputy Secretary, Power

Department, representing Government of Kerala and the Board was represented by its Chairman. The views expressed by the members have been considered while finalizing the review.

Audit Findings are Discussed in Succeeding Paragraphs:

Transmission network :

3.7 The Board had two sources of power viz., own generation from Hydel/Thermal projects and purchase from Central pool, other State Electricity Boards, Power Trading Corporation of India Limited (PTC) and Independent Power Producers. Power purchased from Central pool and from outside the State was being transmitted into the State through 400/220 KV inter-state lines and sub-stations. There were two 400 KV sub-stations in the State one at Pallipuram owned by Power Grid Corporation of India Limited (PGCIL) and the other at Madakkathara constructed by the Board. The Board transmits power received from these sub-stations as well as own generation through its network of 220,110, 66 and 33 KV substations. As of March 2007 the Board had 287 substations (400 KV-1, 220 KV-14, 110KV-114, 66KV-99 and 33 KV-59).

Growth of Transmission Network

3.8 Transformer capacity, installed capacity for transmission, length of transmission lines, total power handled, total power supplied and transmission loss during 2002-2007 are given in *Annexure 15.* As against the transmission loss of four per cent fixed by Central Electricity Authority (CEA), transmission loss ranged between 4.4 and 6 per cent during 2002-2007. The delays in execution of transmission system improvement (TSI) works contributed towards transmission loss of 685.78 MU in excess of the norm, during 2002-07 as discussed in the succeeding paragraphs.

Targets and Achievements

Physical targets and achievements :

3.9 The Board had been framing a five year plan for transmission system improvement such as construction of new substations, transmission lines, upgradation of existing substations and lines and capacity enhancement. While the Board fixed annual targets, incomplete works were being carried forward from

year to year. Targets and achievements in physical terms during 2002-2007 were as given in *Annexure 16.*

It was noticed that:

- Against the overall target of 9674.40 MVA for capacity addition in 309 sub-stations with 3214.98 CKM transmission lines, the achievement was 2081.90 MVA (22 per cent) in 114 substations with 1142.824 CKM (35 per cent) transmission lines.
- Achievement against new substations was 22 per cent and transmission lines was 32 per cent.
- Achievement against upgradation of existing substations and capacity enhancement of substations was 20 per cent and 23 per cent respectively.

The shortfall in achievement was due to delay of the Board in identifying/purchase of land and giving various approvals, inept decision making in respect of Right of Way (RoW) disputes, delay in conducting line route survey, delay in making payments to contractors and also partially due to delay in execution of work by contractors as discussed in succeeding paragraphs. Achievement of the targets was extremely low despite the fact that there were no financial constraints as 90 per cent of the schemes/works taken up were financed by Rural Electrification Corporation Limited (REC) and Kerala State Power and Infrastructure Finance Corporation Limited (KPFC).

Financial Outlay and Actual Expenditure

3.10 The Board prepared annual budget for capital expenditure on various works including transmission schemes and system improvement based on physical targets fixed in the annual plans without any reference to the amount required as per five year plans.

The budgeted (original/revised estimates) and actual expenditure on TSI works during 2002-2007 were as follows:

(₹ in crore)

Particulars	*2002-03*	*2003-04*	*2004-05*	*2005-06*	*2006-07*
Budget Estimate	269.32	274.10	269.68	297.53	218.50
Revised Estimate	228.55	255.50	275.54	230.20	200.18

Actual expenditure for the year	183.48	204.86	253.23	228.35	227.12*
Percentage of revised estimate to budget estimate	84.86	93.21	102.17	77.37	91.62
Percentage of actual expenditure to revised estimate	80.28	80.18	91.90	99.20	113.46
Amount required as per five year plan proposed	507.43	500.83	106.17	101.90	72.94

It would be seen from the above table that :

- the budgeted/revised estimates and actual expenditure in each year was not having any relation to requirement as per five year plan proposals given to State Government/Planning Board;
- even though revised estimates were being prepared in the month of December in each budget year after considering the original budget estimates and actual expenditure incurred up to that date, the actual expenditure for the year was on the lower side except 2006-07, indicating that the assessment lacked accuracy.

Transmission System Improvement Schemes

3.11 The REC and KPFC sanctioned (1998-2001) loans amounting to Rs. 808.31 crore (REC Rs. 683.94 crore and KPFC Rs. 124.37 crore) at 13.5 per cent interest, in respect of 59 schemes involving 207 substations with transformation capacity of 4748.69 MVA during 1998-2007. Targets and achievements against

* Provisional figures since expenditure is yet ot be seggregated and booked by Board.

the 59 (REC 54 and KPFC 5) schemes having projected cost of Rs. 854.96 crore were as given below:

Source of finance	Capacity in MVA (Number of substations)									
	220 KV		110 KV		66 KV		33 kV		Total	
	Target	Actual	Target	Actual	Target	Actual	Target	Actual	Target	Actual
REC	1666.69 (7)	337.5 (3)	1350 (54)	411.50	112.0 (5)	20.0 (1)	1035.0 (112)	295.00 (35)	4163.69 (178)	1064.0 (54)
KPFC			167.5 (11)	115.5 (9)	48.5 (2)	48.5 (2)	369.0 (16)	247.00 (6)	585.0 (29)	411.00 (17)
Total	**1666.69 (7)**	**337.5 (3)**	**1517.5 (65)**	**527.00 (24)**	**160.50 (7)**	**68.50 (3)**	**1404.00 (128)**	**542.00 (41)**	**4748.69 (207)**	**1475.0 (71)**

The Board, however, could draw only Rs. 613.99 crore of the sanctioned loan of Rs. 808.31 crore. Owing to the slow pace of work, against the targeted 207 substations with transformation capacity of 4748.69 MVA the achievement was 71 substations with transformation capacity of 1475 MVA (31.1 per cent) only up to 31st March, 2007. Achievement of transmission lines under these schemes was also low (41.1 per cent) i.e. 755.45 CKM as against targeted 1883.18 CKM.

Audit analysis revealed as under :

- Out of 61 schemes (₹ 775.66 crore) originally sanctioned, 7 schemes were withdrawn (2003-04) by REC as there was no progress during 1998 to 2003. Out of ₹ 683.94 crore sanctioned against remaining 54 schemes, the Board could avail of only ₹ 489.62 crore up to 2005-06. Further, 27 REC schemes with sanctioned loan of ₹ 260.76 crore were foreclosed against which the Board had availed ₹ 235.16 crore only and the balance ₹ 25.60 crore was not drawn.
- Out of 27 ongoing schemes of REC, ₹ 5.35 crore relating to four schemes remained unutilised (March 2007). The Board completed 5 out

of 17 substations envisaged under the schemes (March 2007). In respect of one scheme (Pullanpara), the loan drawn (March 2001) by the Board amounting to ₹ 1.12 crore was required to be refunded to the REC as the land acquisition was not completed (March 2007). Avoidable interest due to delayed refund of unutilised loan amounted to ₹ 67.20 lakh for the period from March 2001 to March 2007 at ten per cent *per annum.

- Out of five schemes financed by KPFC, in respect of one scheme (involving Changanassery, Chathannur and Karunagapally) ₹ 34.39 crore sanctioned had been fully drawn by the Board (March 2005) for 29 substations. Against this the loan amount of ₹ 27.76 crore in respect of 12 substations remained unutilised/diverted for other purposes (March 2007).

The loans sanctioned by REC and KPFC carried interest at the rate of 13.5 per cent per annum with a repayment period of seven years and moratorium (implementation) period of two years. Had the Board commissioned the substations and lines within the targeted period of two years it could have repaid the loan out of the additional revenue generated. The Board, however, failed to complete/ commission the substation in time whereby anticipated benefits such as additional revenue due to reduction in transmission and distribution loss, stable transmission of power and supply of better quality power to consumers could not be derived as discussed in para 3.14 to 3.34 infra.

The Management stated (August 2007) that shortfall in achievement was due to delay in getting various clearances, litigation in land acquisition, contract failures and Right of Way problems. Fact remains that such type of hindrances are common in construction work of substations and transmission lines. Board though fixed targets for completion of works and tied up funds with financial institutions, failed to control these foreseable factors.

Monitoring

3.12 The proposals for installation of new substations, transmission lines and augmentation works with the object of reduction of transmission and distribution loss and improvement of voltage profile, were approved by the Board based on feasibility report submitted by the planning and project department. The five

* Worked out at mean of the interest rates of REC loan availed during 2002-2007.

year/annual plans for implementation of the projects were prepared taking into account availability of finance from institutions such as REC, KPFC, etc. It was noticed that even though periodical progress reports on TSI projects along with details of bottle necks were put up to the Planning Department of the Board, no effective corrective action was taken to address the problems/bottle necks with a view to facilitate timely completion/ commissioning of the projects. The abnormal delays in completion of the projects were not being analysed for corrective action.

The Management stated (August 2007) that monthly review of the progress and evaluation of pros and cons is being made as far as possible and corrective measures were taken within the limitations of the Board. The reply is not tenable since transformers and other equipments were procured in advance and remained idle due to non-identification/purchase of land and poor progress of work while in other locations substation works were held up for want of transformers and other equipments.

Time and Cost Overrun

3.13 In respect of 114 substations and allied works completed by the Board during 2002-2007 against an investment of ₹ 372.02 crore, the delay ranged between eight months to nine years. In 22 cases where the cost has been booked completely, the cost overrun was ₹ 31.61 crore (60.10 per cent) against project cost of ₹ 52.61 crore. In the remaining 92 cases completed up to March 2007, the cost has not been booked immediately after its commissioning as envisaged under the Electricity Supply (Annual Accounts) Rules, 1985.

The Board does not have any system of

- booking substation-wise cost of ongoing works and capitalizing the cost of substations commissioned in the year of commissioning itself; and
- comparing the actual cost of the completed substation with the estimated cost and obtaining the approval of the Board Members for cost overrun or analyzing the variations.

Non-Synchronisation of Works

3.14 The works of substations/transformer bays, feeder lines and beneficiary substations were required to be carried out simultaneously so as to achieve the anticipated benefits. The Board, however, failed to complete the associated works simultaneously. *Annexures 17 to 19* give the details of mismatch in construction. It can be seen that:

- Three 33 KV transmission lines constructed at a cost of ₹ 4.13 crore remained idle for periods ranging from 10 to 48 months due to non completion of associated substation works (*Annexure 17*).
- Two 110/33/11KV and nine 33 KV substations constructed at ₹ 14.51 crore remained idle for periods ranging from 10 to 33 months due to non-completion of associated line works (*Annexure 17*).
- Forty seven 110/33 KV transformers and two 66/33 KV transformers erected at 30 locations, at ₹ 66.33 crore remained idle/underutilized for periods ranging between 3 and 67 months due to mis-match between feeder substations and other substations (Annexure 18). This had resulted in loss of envisaged benefits by way of reduction in line loss of ₹ 34 crore.*
- Seven 33 KV transformers, four 110/11 KV transformers, four 110/33 KV transformers and other equipments purchased at an aggregate cost of ₹ 6.75 crore remained idle at site for periods ranging from 6 to 74 months (*Annexure 19*).

The Management stated (August 2007) that delay in getting land, litigation, public objections, delay in making available materials, poor performance of some of the contractors, etc., were the main reasons for the delay/non-commissioning of the projects. The reply is not tenable as the Board had taken into consideration these hindrances at the time of fixation of target dates for completion of substations and lines.

Idling of 220 KV Transformers at Kalamassery Substation

3.15 The Board took up (February 1999) the work of capacity enhancement of 220 KV substation at Kalamassery from 440 MVA to 800 MVA, in order to cater to anticipated additional demand. This was to be done by replacing the existing four transformers of 440 MVA with 12 new transformers of 800 MVA. Accordingly twelve 66.67 MVA transformers were procured (March 2001) at a cost of ₹ 11.36 crore. Capacity of the substation was enhanced (June 2003) to 720 MVA only, by replacing three transformers of 320 MVA with nine transformers of 600 MVA. Due to slow pace of growth of load requirements (1999-2003),

* Worked out at 15 per cent per annum on investment expected by way of additional revenue due to reduction in line losses as envisaged by REC while sanctioning the loans

further work on enhancement in capacity of the substation was not implemented. The remaining three transformers costing ₹ 1.87 crore had been idling for the past six years (March 2007), and was not diverted to other substations. This resulted in loss of interest on the blocked funds amounting to ₹ 1.12 crore#.

Construction of Substations and Lines on Turnkey Basis

3.16 The Board undertook (2000-2004) construction of 45 substations to be completed within five to nine months (April 2000 to July 2003), envisaging capacity addition (new substations, upgradation and capacity enhancement in existing substations) of 458 MVA with 658.13 CKM transmission lines on turnkey basis, at a contract price of ₹ 90.76 crore as detailed below:

Substation	*No. of turnkey contracts*	*Substations (Target)*			*Substations (achievement)*		
		No.	*Capacity (MVA)*	*Line length (CKM)*	*No.*	*Capacity (MVA)*	*Line length (CKM)*
110/11kv &	5	7	143	106.00	3	64 (44.8)	Nil
110/33kv 33/11 kv	8	38	315	552.13	23	195 (61.9)	425.93 (77.1)
	-	45	458	658.13	26	259	425.93

Note : Figures in bracket indicate percentage.

Against capacity addition of 458 MVA with 658.13 CKM transmission lines targeted, the turnkey contractors completed the work of 26 substations with a capacity of 259 MVA (56 per cent) and 425.93 CKM (64.7 per cent) lines, with a delay ranging between 17 and 59 months. As at the end of 2006-07, 19 substations with aggregate capacity of 199 MVA and 232.20 CKM lines remained incomplete. The delays upto March 2007 ranged from 56 to 74 months.

Worked out at the mean of the interest rates on REC loans availed during 2002-2007

The delayed/non-completion of 25 substations resulted in loss of envisaged savings by way of reduction of line loss amounting to Rs. 23.95 crore*. Loss of envisaged benefit in respect of 20 remaining substations is discussed in paragraphs 3.17 to 3.19.

The reasons for non-completion/delayed completion of substations ranging between 17 and 74 months, in respect of works undertaken on turnkey basis as analyzed in audit were due to delay in acquisition of land/handing over site for substation and line route, giving approval for designs and layouts of substations, earthmat design#, sanction for excavation, obtaining approval from Railways for line route, making payment to the contractors, absence of quick and apt decision making in the case of Right of Way disputes of line route, lack of proper planning, monitoring, co-ordination and supervision of the work.

Against the REC stipulation of two years, the Board had stipulated five to nine months for completion of substations and lines on turnkey basis. But the Board itself had taken 32 months to 11 years for completion of substation works. Procurement of transformers on the basis of unrealistic time schedule, coupled with dispute with contractors, delay in payments, foreclosure of contracts, abandonment of work, etc., resulted in idling of transformers and other equipments as discussed in paragraph 3.14 supra. A few illustrative cases are discussed in the succeeding paragraphs:

Contract with Andrew Yule and Company, Kolkata

3.17 The Board awarded (April-August 2000) two works for construction of three 110/33 KV transformer bays and eight 33 KV substations with associated lines at Balussery Project and Edaricode Project to Andrew Yule and Company (AYC) for a contract price of Rs. 19.81 crore, on turnkey basis. The work was stipulated to be completed within six months from the date of handing over site. There was delay attributable to the Board, ranging from 7 to 27 months (April 2000-October 2002) in handing over sites of seven substations and one bay. The work was progressing slowly due to poor financial position of the contractor, as well as delay in releasing payments by the Board. Transformers and other substation equipments valuing ₹ 5.87 crore were supplied (December 2000, December 2001) by the contractor. Despite giving extension of time (September 2002-February 2005) on three occasions the progress of work was very poor.

* Worked out at 15 per cent per annum on investment expected by way of additional revenue due to reduction in line losses as envisaged by REC while sanctioning the loans.
# Earthmat design is the floor design for sub station switch yard.

The Board terminated (September, December 2005) two contracts at the risk and cost of the contractor and the bank guarantees given by the contractor in respect of two projects amounting to ₹ 1.98 crore were adjusted (December 2005) against the payments made (December 2000, August 2004) to the contractor amounting to ₹ 3.92 crore. On taking (November 2006) inventory of material lying at site in respect of Balussery Project, the serviceability of the material valuing ₹ 2.50 crore was reported to be doubtful and out of this, material valuing ₹ 15 lakh was lost in fire.

Audit noticed that AYC was incurring huge losses since 1996-97 and became a sick Company in 2003-04. The Board entrusted the works for ₹ 19.81 crore to AYC without ensuring the financial credibility. There was also delay in handing over sites, approval of drawings of substation, change in site of one transformer bay necessitating extra work, delays in handing over line routes and non-payment of bills, and resultant blockage of ₹ 3.92 crore in the two projects, for a period of five years (December 2000-December 2005). After adjustment of (December 2005) bank guarantee given by the contractor the balance investment of ₹ 1.94 crore remained blocked up for one year and three months (January 2006 to March 2007). Non-commissioning of the substations, even after a lapse of six years (February 2001 to March 2007) from the scheduled date (February 2001) of completion resulted in loss of envisaged benefits of reduction in line loss and anticipated revenue amounting to ₹ 14.82 crore *.

Contract with IComm (ARM) Limited

3.18 The Board entrusted (August 2000 to May 2001) the work of construction of one 110/33 KV transformer bay and seven 33 KV substations with associated lines on turnkey basis to IComm (ARM) Limited, Hyderabad at a contract price of ₹ 14.94 crore. Name of work, date of contract, period of completion, scheduled date of completion, deficiencies noticed in audit, etc., are as follows:

* Worked out at 15 per cent annum on investment expected by way of additional revenue due to reduction in line losses as envisaged by REC while sanctioning the loan.

Sl. No.	Name of Work	Date of contract (period of completion)	Scheduled Date of completion	Deficiencies Noticed
(1)	(2)	(3)	(4)	(5)
1	110/33 kv Bay Pazhayannur	31-5-2001 (6months)	November 2001	Even though the contractor had identified (March 2001) the land as envisaged in the contract, the Board took 36 months (March 2001 to March 2004) to take a decision as to whose name the land was to be registered and purchased (May 2006) another plot.
2	33 kv SS Chelakkara, 11 km SC Line	-do-		
3	33 kv SS Mullurkara, 17 km SC Line	-do-		Transformers and other materials supplied (December 2003) valuing ₹ 65.06 lakh were lying idle for 3 years and 3 months (December 2003-March 2007) and the contractor was paid ₹ 25.15 lakh. The work remained incomplete (March 2007)
4	33 kv SS Parappukara, 11.6 km DC Line, 7.2 km 11 kv feeders.	28-8-2000 (6 months)	March 2001	There was delay in giving approval for deviation in route of 11 KV lines proposed by the contractor and sanction for changing 11 KV over head lines to under ground cable by 11 months (August 2000-July 2001). The progress of work also was very slow and the substation was completed (August 2003) after a lapse of 29 months from the scheduled date of completion. The

				contractor had not completed (March 2007) two 11 KV feeders and the substation could not be utilised involving idling of investment of ₹ 2.25 crore for 43 months from August 2003 to March 2007
5	33 kv SS Ananthapuram, 12 km SC line	19-3-2001 (5 months)	September 2001	The contractor had stopped (August 2001) the work, due to paucity of funds accentuated by non-payment of bills by the Board by five to eight months. The work was restarted (March 2003) but the progress was very poor. The contract was terminated (September 2006) at the risk and cost of the contractor after a lapse of five years. The contractor had supplied transformer and other material (₹ 1.19 crore) and had completed other works amounting to ₹ 83.71 lakh and was paid (September 2006) only ₹ 78.08 lakh. There was no further progress in the work (March 2007)
6	33 kv SS Perla, 12 km SC line			
7	33 kv SS Belur, 12 km DC line	-do-		
8	33 kv SS Bediaduka, 24 km SC line	-do-		
		-do-		

Non-completion (March 2007) of the above substations, even after a lapse of more than five years from the scheduled dates of completion (March/September/November 2001) resulted in loss of envisaged benefit of reduction in line losses amounting to ₹ 11.68 crore*.

Contract with SPIC SMO Limited:

3.19 The Board awarded (March 2000) construction work of one 110/33 KV substation at Melattur and 19.6 Km associated Double Circuit line to SPIC SMO

*Worked out at 15 per cent annum on investment expected by way of additional revenue due to reduction in line losses as envisaged by REC while sanctioning the loan.

Limited, Chennai at a contract price of ₹ 5.43 crore. The target date of completion was December 2000 for substation and January 2001 for line work. The substation work was completed in December 2000 itself incurring ₹ 3.96 crore.

The construction of associated line was commenced by the contractor only in October 2000 due to delay in settlement of Right of Way dispute of land along the line route. While the case relating to the ROW of a stretch of 1.653 km of land was in progress, the contractor completed (July 2002) 17.9 km out of 19.6 km of line work, at a cost of ₹ 1.79 crore. On the pending dispute of land Additional District Magistrate (ADM) had passed orders (August 2001) directing the Board to divert the line route along 1.653 km which involved an additional cost of ₹ 36 lakh. The Board, however, filed (November 2001) appeal against the decision which was rejected (January 2005) by the Hon'ble High Court. Thereafter the balance portion of line work was completed (January 2006) and substation commissioned (January 2006) after a delay of five years from the targeted date (December 2000) of completion. The decision to go on appeal against the order of ADM for an additional expenditure of ₹ 36 lakh, delayed the implementation of the project for five years from December 2000 to January 2006 leading to loss of envisaged benefit of ₹ 4.07 crore*. Stoppage of line work (July 2002) after investing ₹ 1.79 crore for resolving the dispute resulted in idling of substation costing ₹ 3.96 crore for five years with consequent interest loss of ₹ 2.59 crore♦ on the idle investment for the period December 2000 to January 2006.

Departmentally executed substations and lines :

3.20 The Board had completed 78 substations (excluding Gas Insulated Switch Yard Substations) with a capacity of 1,629.50 MVA and 1,094.26 CKM transmission lines (new substations and upgraded substations) during 2002-2007. Out of these, 24 substations of 258.0 MVA capacity and 456.33 CKM

* Worked out at the mean of the interest rates on REC loans availed during 2002-2007.

transmission lines were executed on turnkey basis. The remaining 54 substations completed (commissioned) departmentally were delayed by 8 to 109 months as indicated below:

Voltage ratio of substations	*No. of substations*	*Capacity in MVA*	*Length of lines in CKM*	*Delay in months*
220 KV	3	457.50	40.77	18-45
110 KV	22	665.00	260.08	8-53
66 KV	7	74.00	40.23	17-109
33 KV	22	175.00	296.85	9-45
Total	54	1371.50	637.93	

The reasons for delay as analysed in audit were delay in identification and purchase of land, arranging funds, giving approvals for various stages of works, providing transformers, other substation equipments, yard structures, line materials, defective route survey, revision of estimate, awarding stage-wise work, tree valuation in line route, making payment to contractors, inept decision making on disputes and matters of court cases relating to ROW and splitting of substation and line works into too many small units involving preparation of estimate, tendering, approval, negotiation, acceptance, execution of agreement, measurement of works, preparation of bills in respect of various works which were time consuming process as per the procedures and practices prevalent in the Board. The delay arising from mismatch in completion of substation work with that of related lines for transmission of power resulted in blockage of funds, deprival of better voltage and power factor to targeted consumers and loss of envisaged benefits (savings in line losses) to the Board. Out of the 54 cases, in 48 cases the Board lost envisaged benefits amounting to ₹ 67.84 crore♦ and the major deficiencies noticed in six cases are discussed in succeeding paragraphs:

♦ Worked out at the mean of the interest rates on REC loans availed during 2002-2007.

Award of work without detailed survey and soil test :

3.21 The Board decided (August 1998) to upgrade the 110 KV substation at Kundara and Edappon to 220 KV substations at an estimated cost of ₹ 30.25 crore and ₹ 18 crore respectively. The work of substations were carried out departmentally from July 1999 (Kundara) and May 1999 (Edappon) onwards, using Board's own funds. The projects were subsequently included (May 2000) under Project System Improvement Finance Scheme of REC revising the estimated cost of substations as ₹ 57.43 crore (Kundara ₹ 33.21 crore and Edappon ₹ 24.22 crore) and the scheduled date of completion was revised to March 2003. The Kundara project was commissioned (January 2006) at a cost of ₹ 10.15 crore and Edappon substation remained incomplete (March 2006) after investing ₹ 8.70 crore, due to non-completion of the associated line works.

In the meantime the construction of associated Loop In Loop Out (LILO) line of Kundara substation was entrusted (May 2001) to Tata Projects Limited (TPL), Chennai on turnkey basis at a contract price of ₹ 13.88 crore with scheduled date of completion as May 2002. The detailed survey and soil test reports were submitted during November 2001. The Board, however, revised the contract price for Kundara on the basis of soil test as ₹ 36.21 crore only in October 2003 involving a delay of 21 months. TPL completed the line work in January 2006.

On completion of the above line work, the substation was commissioned (January 2006) by installing six (33.33 MVA) 29 year old transformers removed from Kalamassery substation, overhauled and transported at a cost of ₹ 44.62 lakh. The transformers eventually failed twice (February/March 2006) and were not able to meet the anticipated load requirement (April 2006). Thereupon the Board decided (June 2006) to shift three new 66.67 MVA transformers purchased in 2001 for ₹ 1.87 crore, from its store at Kalamassery to Kundara. Thus, the earlier decision to install old transformers proved to be imprudent and resulted in avoidable expenditure of ₹ 44.62 lakh on overhaul and transportation.

It was further noticed that work at Kundara substation completed (March 2003) to the extent of 80 per cent by investing ₹ 10.15 crore also could not be commissioned (January 2006) due to delay in completion of associated Kundara line arising from award of work without conducting detailed survey and soil test.

In the case of Edappon line, the Board retendered (January 2006) and awarded the work for ₹ 17.83 crore. The progress of line work was only 5 per cent (January 2007) whereas, the corresponding Edappon substation was 95 per cent complete in March 2006 itself. Due to delay in completion of line work the investment of ₹ 8.70 crore had been idling since March 2006.

As per administrative sanctions issued (August 1998-May 2000) by the Board, the capacity of Edappon substation was 200 MVA (2x100 MVA). Transformers purchased (466 MVA) for Kundara substation (440 MVA) at a cost of ₹ 4.36 crore, however, was erected (March 2006) at Edappon substation without obtaining Board sanction. This resulted in wasteful investment of ₹ 2.49 crore in the additional capacity of 266 MVA created and resultant interest loss of ₹ 1.60 crore * for the period from October 2000 to March 2007 at the rate of 10 per cent per annum.

Delay/non-completion of the above two substations resulted in loss of envisaged benefits through reduction in line losses amounting to ₹ 403.82 crore as per project report.

Non-synchronisation of work:

3.22 The Board decided (May 2000) to upgrade the Shoranur 110 KV substation to 220 KV including 4.26 km double circuit associated LILO line by installing two transformers at an aggregate estimated cost of ₹ 13.66 crore. The targeted date of completion was March 2003. The work of substation and the LILO line started during August 2000. After completion of 40 per cent work and investment of ₹ 4.36 crore, work had to be stopped for six months (November 2002-May 2003) on account of non-availability of substation equipments, yard structures and conductors since the Board did not synchronize the procurement of materials with the execution of substation and line works. The substation and line works were completed (September 2003) and the substation was partially commissioned (September 2003) with one transformer and single circuit LILO line. Delay in completion of work resulted in blocking of ₹ 4.36 crore for a period of six months (November 2002 to May 2003) and unproductive interest of ₹ 21.80 lakh at the rate of ten per cent per annum. The envisaged benefit to consumers by way of better quality of power supply was also delayed accordingly.

* Worked out at the mean of the interest rates on REC loans availed during 2002-2007.

The Management stated (August 2007) that there was no deliberate delay in any of the projects as the delays were caused mainly due to Right of Way ROW) problem, court cases, objection from public and delay in acquisition of land. Audit however noticed that substantial portion of the delays arising from ROW problems and acquisition of lands was avoidable through better follow up action. Splitting of substation and line works into too many small contracts also contributed to the delay in completion of work.

Delay in providing statutory clearances :

3.23 Based on the request (August 1993) of Travancore Devaswam Board (TDB) the Board decided (October 1994) to construct a 66 KV substation (estimated cost ₹ 3.59 crore) at Thriveni and associated lines (12.30 Km) from Pamba to Thriveni to ensure uninterrupted power supply with better voltage in Sabarimala Sannidhanam. The TDB agreed (August 1993) to bear 25 per cent (₹ 87.25 lakh) of the estimated cost and remitted (August 1993) ₹ 35 lakh.

The work of construction of the associated lines awarded (August 1995) at a contract price of ₹ 3.28 crore and commenced in August 1995, was targeted for completion in June 1996. The line work was completed (October 2002) after a delay of more than six years. The delay was attributable to obtaining clearance from Ministry of Environment (MoE) by more than three years (June 1996-October 1999), supply of towers and payment to contractor by the Board.

The construction of substation commenced in July 1996 and was targeted for completion in December 1996. The contractor stopped (October 1997) the work and demanded (August 1999) revision of rates citing delay on the part of the Board in effecting payment of bills and failure in making available materials in time. Thereupon, termination notice was issued (August 1999) by the Board, the contractor approached (October 1999) the Hon'ble High Court of Kerala and further action to defend the case was initiated by the Board only in March 2003 involving a delay of three years and resultant idle investment of ₹ 3.28 crore in line works and interest loss of Rs. 98 lakh on the investment at 10 per cent per annum.

The work of substation was completed through alternate arrangement and was commissioned (November 2005) after a lapse of more than nine years (October 1996-November 2005). Delay in commissioning of substation resulted in

non-achievement of the envisaged benefits through reduction in line loss involving revenue of ₹ 4.92 crore*. The Board also could not ensure the interest of Sabarimala pilgrims by providing uninterrupted supply of better quality power and failed to claim ₹ 52.25 lakh towards 25 per cent cost from TDB.

The Management stated (August 2007) that in view of the long delay in execution of work the Board could not claim the balance amount due from TDB.

Defective site plan and design :

3.24 The Board decided (December 1994) to construct a 66 KV substation on its own land at Nedumkandam and associated LILO lines (11 Km) from Nirmala city to Nedumkandam substation at an aggregate estimated cost of ₹ 6.42 crore. The site for substation under the control of Civil wing was identified (August 1999) and handed over (May 2000) to Transmission wing after a lapse of nine months. The approval of design and lay out of substation was delayed by 22 months (March 1996 to January 1998) and the site plan and design of retaining wall by nine months (April 2001-January 2002). The estimated cost was revised (July 2001) to ₹ 7.22 crore. The work relating to LILO lines and substation which were scheduled for completion in July 2001 and March 2002 commenced only in January 2001 and March 2002 respectively. The construction of yard structure required for the substation was slated for completion in January 2004 but was completed only to the extent of 70 per cent by the contractor up to April 2005. Since the drawings of another substation (Punnapra) was unauthorisedly used (March 2002) by the Assistant Executive Engineer of the Board, the above foundation yard structure had to be demolished (July 2004) involving an avoidable delay of 28 months. There after, the work was carried out (November 2004) departmentally and the substation was commissioned (December 2006) after 57 months (March 2002-December 2006) of the scheduled date.

In the mean time the construction of (11 Km) 66 KV LILO line (feeder) to the Nedumkandam substation (estimated cost ₹ 3.08 crore) commenced in January 2001 and was scheduled for completion in July 2001. The work was delayed by 24 months due to non-payment of tree cutting compensation (January 2003-May 2004) and for want of tower parts and line stringing materials

* Worked out at 15 per cent per annum on investment expected by way of additional revenue due to reduction in line losses as envisaged by REC while sanctioning the loan.

(November 2004-July 2005). The substation with line was commissioned (December 2006) after an overall delay of 57 months (March 2002-December 2006) leading to loss of envisaged benefit by way of reduction in line loss and revenue amounting to ₹ 4.57 crore*. Investment of ₹ 1.30 crore in the substation remained idle for 29 months (July 2004-December 2006) resulting in unproductive interest of ₹ 31 lakh♦ .

Deviation from approved proposals :

3.25 The Board decided (October 1998) to departmentally construct a 33 KV substation at Pathanapuram by installing two transformers of 5 MVA each along with 12 km 33 KV single circuit line from Punalur to Pathanapuram at an estimated cost ₹ 3.09 crore. Two transformers intended for the substations were purchased (September 2000) at a cost of ₹ 80 lakh. The 33 KV substation yard structures were transported (September 2000) to the site, earthmat was laid (May 2001), column foundation and transformer plinth constructed (August 2001). When construction of control room was progressing (November 2001) the Minister for Electricity and Minister for Transport, Government of Kerala, convened a meeting of Board officials and decided to convert the 33 KV substation to 66 KV as a temporary measure with the intention of upgrading it to 110 KV in future. The transformers available at a decommissioned substation at Punalur were used in the 66 KV substation. The substation was commissioned (December 2003) with a reduced capacity of 4 MVA instead of 10 MVA.

It was observed that the decision (November 2001) to convert the 33 KV to 66 KV substation without technical assessment resulted in increase in transmission loss by 0.03 per cent in 66 KV as compared to 33 KV as per technical data prepared afterwards (June 2002); the expenditure of ₹ 34.24 lakh on the construction of yard structures and masonry works for the 33 KV substation was rendered wasteful; and the Board also suffered interest loss of ₹ 26 lakh on the funds blocked in the transformers which remained idle for more than three years (September 2000-December 2003) till these were diverted (December 2003) for use in another substation.

Failure in timely selection of land :

3.26 The Board decided (March 1999) to construct a 33 KV substation at Kallettumkara and associated Single Circuit Line (11.5 Km) from Chalakkudy to

* Worked out at 15 per cent per annum on investment expected by way of additional revenue due to reduction in line losses as envisaged by REC while sanctioning the loan.

♦ Worked out at 10 per cent, the mean of the interest rates on REC loans availed during 2002-2007

Kallettumkara at an estimated cost of ₹ 2.34 crore in the land offered (December 1999) by a private party for ₹ 16.26 lakh. The scheduled date of completion of work was September 2003. For constructing substation, land (one acre) offered by Kerala Feeds Limited free of cost was not found (December 1999) suitable as it required construction of additional two Km of 33 KV line, three numbers of 11 KV outlets, etc., at a cost of ₹ 19.78 lakh. The matter regarding finalization of the site for the substation remained pending till October 2002 when it was decided to go for the free land offered by Kerala Feeds Limited on the ground that the land offered by the private party required earth filling at a cost of ₹ 30 Lakh. The Board departmentally commenced the work in May 2003. After commencing the work there was also delay in providing materials for substation and line by 17 months (April 2004-September 2005). The substation and associated line was commissioned in November 2005. The project was delayed by 26 months (September 2003-November 2005) due to delay in deciding the site of substation and providing materials. This had resulted in loss of envisaged benefits of ₹ 76 lakh* by way of reduction in transmission and distribution loss for 26 months.

Defective design :

3.27 The construction of 4.5 KM 110 KV DC line from Kumbalangi to 110 KV substation Chellanam was entrusted (November 2000) with Penta Constructions at a contract price of ₹ 39.91 lakh for completion by July 2001. The design and method of construction was changed (December 2000) attributing weak sub soil conditions. No soil test was conducted before awarding the work even though it was a pre-requisite for preparation of estimate. The foundation design adopted was also based on type of design used in the nearby area for similar line which was not suitable for the work. Due to this, the estimate had to be revised to ₹ 99.51 lakh involving increase of 149.3 per cent for which approval was not taken. The contractor was then directed (June 2001) to stop the work for want of approval for the revised estimate which was granted (May 2004) after a lapse of three years. The work was entrusted (June 2005) to the same contractor with a price escalation of rupees eight lakh raising the estimated cost to ₹ 1.08 crore involving an additional cost of ₹ 68.09 lakh and was completed in December 2006. The substation was commissioned only in December 2006.

* Worked out at 15 per cent per annum on investment expected by way of additional revenue due to reduction in line losses as envisaged by REC while sanctioning the loan.

It was noticed that the construction of line was delayed by five years and six months (July 2001-December 2006) due to defective estimate prepared without conducting soil test and delay in giving approval of revised estimate. The line work was 80 percent complete (June 2001) after incurring an expenditure of ₹ 80.67 lakh. Delay in completion of the balance work of line resulted in investment of ₹ 80.67 lakh in line works remaining without use for 66 months from June 2001 to December 2006. Unproductive interest on blocked funds for the period worked out to ₹ 44.37 lakh♦.

Incomplete substations and lines :

3.28 As of March 2007, 76 departmentally executed works of construction of substations and lines involving capacity addition of 2129 MVA and 953.56 CKM line (new substations, up gradation and capacity enhancement) excluding Gas Insulated Switch yard (GIS) substations and turnkey works remained incomplete. In these cases the targeted dates of completion were already over by periods ranging from 12 to 66 months as indicated below:

Substation	*No*	*Capacity in MVA*	*Length of line CKM*	*Delay in months*
220 KV 36 -	5	1025	121.41	36-66
110 KV	21	579	262.68	12-60
66 KV	3	75	11.00	66
33 KV	47	450	558.47	36-60
Total	76	2129	953.56	

Of the 76 cases of delay, in 25 cases the work was not started (March 2007) due to delay in purchase of land required for the substations; in six cases the work was just initiated and in the remaining 45 cases the physical progress ranged from 10 to 99 per cent. The Board has not analysed the reasons for abnormal delay and slow progress in the completion of these projects indicating lack of monitoring by the Board as already discussed in paragraph 3.12 supra.

♦Worked out at 10 per cent per annum, the mean of the interest rates on REC loans availed during 2002-2007

As of March 2007 the Board had incurred expenditure of ₹ 292.02 crore on these incomplete works. Loss of envisaged benefit by way of reduction in line losses arising due to delay in completion of 73 substations up to March 2007 worked out to ₹ 168.21 crore.* A few cases of delay in completion of work are discussed below:

3.29 The Board decided (June 2000) to construct a 110 KV substation at Thrikkodithanam (2x10 MVA) for an estimated cost of ₹ 7.14 crore including cost of land ₹ 75 lakh. The project was scheduled for completion in March 2004. Land for the project was identified (May 2001) at a cost of ₹ 70 lakh but not purchased on the ground of high cost. Another plot of land was acquired (November 2005) at a price of ₹ 39.42 lakh. The substation work remained to be completed (March 2007). Delay of over 54 months (May 2001- November 2005) in acquiring a new site involving savings in price amounting to ₹ 30.58 lakh correspondingly delayed the commissioning of the substation. The imprudent decision of the Board has resulted in loss of envisaged benefit of ₹ 16.42 crore by way of reduction in line losses and additional revenue as per project report during May 2001 to November 2005.

Under estimation of line work and change of design:

3.30 The Board decided (April 1999) to upgrade the 66 KV substation Mavelikkara to 110 KV substation and to construct 4.66 Kms of associated double circuit line (Estimated cost ₹ 11.58 crore) departmentally. The work of substation commenced in December 2000 and was targeted for commissioning in March 2004. Subsequently (December 2002) the financing of the work was changed over from REC to KPFC loan and estimate revised to ₹ 12.55 crore. The substation was 93 per cent complete (June 2005) with an investment of ₹ 6.06 crore and had not been commissioned (March 2007).

The reasons for non-commissioning were revision of earthmat design for want of materials and initial underestimation of line work. Due to this there was blocking up of ₹ 6.06 crore on the substation work for a period of 21 months (June 2005- March 2007) with eventual loss of benefit by way of reduction in line loss and revenue amounting to ₹ 5.65 crore# (March 2004-March 2007). Unproductive interest on blocked up funds amounted to ₹ 1.06 crore♦.

---

* Worked out at 15 per cent per annum on investment expected by way of additional revenue due to reduction in line losses as envisaged by REC while sanctioning the loan.

Worked out at 15 per cent per annum on investment expected by way of additional revenue due to reduction in line losses as envisaged by REC while sanctioning the loan.

♦Worked out at 10 per cent per annum, the mean of the interest rates on REC loans availed during 2002-2007.

Delay in completion of gas insulated switch yard substations:

3.31 Non-completion of master plan scheme, implemented with the World Bank assistance aimed at improving the power system in the three cities of Thiruvananthapuram, Kochi, and Kozhikode targeted for completion in 1991-92 and consequent blockage of funds amounting to ₹ 52.62 crore and interest payment of ₹ 49.35 crore thereon in respect of five GIS substations at Thiruvananthapuram (two) Kochi (two) and Kozhikode (one) were reviewed and included in Report of the Comptroller and Auditor General of India for the year ended 31 March 2002 (Commercial) Government of Kerala.

The substation at Kozhikode targeted for completion in 1993 was partially (March 2004)/fully commissioned (January 2006) and the two substations at Thiruvananthapuram targeted for completion in 1992 were commissioned in May/June 2005. The two substations at Kochi originally targeted for commissioning in 1993 were not commissioned so far (March 2007). The reasons for delay in commissioning as well as non-commissioning of the substations by 11 to 14 years are discussed below:

- Work of laying underground cable in two spans 4.35 km and 6.75 km in respect of two substations at Thiruvananthapuram was delayed by four years (January 2001-June 2005) due to delay in obtaining clearance/approval from Public Works Department, Kerala State Road Transport Corporation and National High Ways Authority. The abnormal delay could have been avoided by constant follow up by the Board at highest level.

- Work of substation building at Fort Kochi was carried out by five contractors due to change of contractors for various reasons. Change of design on four occasions resulted in escalation claims, legal suites, termination of contracts and delay of more than nine years (September 1995- November 2004) in completion.

- Change of design of pile foundation, consequent escalation claim and termination of contract in respect of Marine Drive substation at Kochi, resulted in a delay of more than five years (November 1997-January 2004).

- Work of under ground cable laying in four spans of 3.85 km, 4.2 km and 4.3 km in respect of the two substations at Kochi was delayed by six years (January 2001-December 2006) due to delay in obtaining clearance from Public Works, Irrigation and Police Departments, Municipal Corporation of Kochi and Bharat Sanchar Nigam Limited.

- Work of laying underground cable in two spans 4.37 km each in Kozhikode substation was delayed by 15 months (December 2000-March 2002) due to delay in obtaining clearance from Public works and Irrigation Departments.

- Eight separate feeders of 11 KV cables for a total length of 19 km from GIS substation Puthiyara (Kozhikode) completed (July 1998) at a cost of ₹ 4.5 crore, remained idle for more than five years (July 1998-March 2004) due to non completion of the substation. Unproductive interest payment on blockage of funds amounted to ₹ 4.08 crore at the rate of 16 per cent * per annum.

- Two feeder lines (3.9 km) from Fort Kochi GIS Substation completed in December 1999 incurring ₹ 94 lakh remained idle for seven years and three months (December 1999-March 2007) due to non-completion of the substation. Interest paid on blockage of funds amounted to ₹ 92 lakh at 13.5* per cent per annum.

- Delay in commissioning of these five substations resulted in prolonged storage of 16 numbers of imported bushings purchased in 1992 which became unserviceable and the validity period of composite contract for supply and erection of substation equipment with VA TECH Elin Holic High Voltage BV, Netherlands expired (December 2002). On account of this, the Board had to import (October 2006) the bushings afresh by renewing the contract for erection of equipments involving avoidable expenditure of ₹ 7.99 crore.

- Against the estimated cost of ₹ 40 crore, total expenditure incurred on these five substations stood at ₹ 73.51 crore up to 2007.

Loss of potential generation:

3.32 The power generated from four## Chinese aided (micro hydel) Projects were proposed (August-December 2002) to be evacuated to Agasthyamoozhy 110/33/11 KV substation through Chembukadavu-Thiruvambady 33 KV single

* Borrowing interest rate for the project

* Chembukadavu Stage-I (2.7MW), Stage-II (3.75 MW), Urumi Stage-I (3.75 MW) and Stage II (2.40MW)

Chembukadavu stage-I (2.7MW), Stage-II (3.75 MW), Urumi stage I (3.75 MW) and stage II

circuit line, Thiruvambady Agasthmoozhy double circuit line and Urumi-Thiruvambady single circuit line of aggregate length of 25.6 km. The line works were targeted for completion in May 2003.

Delay in commissioning of the 33 KV lines due to ROW disputes forced (May 2004) the Board to evacuate power generated from these projects in 2004 monsoon season (May-December 2004) through 11 KV lines to Thamarassery 66 KV substation, involving an additional expenditure of ₹ 0.92 crore. This, however, had resulted in many technical problems and tripping of lines. As a result, generation from Chembukadavu I, II and Urumi II had to be stopped during June-September 2004. Due to this there was loss of generation for 41 days at Chembukadavu I & II and 104 days at Urumi II. Thus, due to failure to undertake line works in time the Board suffered revenue loss of ₹ 1.88 crore on 6.06 MU of power not generated at the average sales realization of ₹ 3.11 per unit for 2004-05.

- Management stated (May 2006) that the work on 33 KV lines was delayed due to obstruction from public demanding rerouting of line and delay in settling tree cutting compensation. The reply is not tenable as the delays occurred in deciding on alternate substation at Thiruvambady (February 2000-December 2002), surveying alternate route (September 2002-April 2003) and reverting to original route considering the increase in expenditure.

Non-compliance with mutual obligations:

3.33 The Board decided (September 2001) to install 350 MVAR♦ shunt capacitor in fifteen 220/110/66KV substations in the State on turnkey basis. The proposal envisaged reduction of line loss of 19.859 MW equivalent to 28.954 MU per annum, with a capital investment of ₹ 8.32 crore. The turnkey contract was awarded (December 2001) to Shreem Capacitors, Kolhapur at a price of ₹ 8.48 crore. The work was scheduled for completion in May 2003 but completed during March 2004 to December 2005. The delay was due to various reasons such as delay in execution of agreement with the contractor, approval of drawings and handing over site to the contractor. The delay in completion ranged between 300 to 940 days resulting in loss of savings of 51.1996 MU equivalent to ₹ 15.07 crore.

♦ MVAR = Mega Volt Ampere Reactive

On a further review of the performance of the capacitors installed in fifteen substations it was observed that in three 110 KV substations at Chalakudy, Sasthamcottah and Kunnamangalam, the capacitor banks installed were not working or tripping off or switched off due to over load, leakage, problem with the relay, etc., with the result the capacitor banks were out of service for 730 days, 576 days and 536 days respectively during April 2004 to March 2007. Loss of envisaged savings due to failure of capacitor banks was 11.6838 MU equivalent to revenue of ₹ 3.63 crore as per project report.

Non-adherence to transmission and distribution loss norms :

3.34 Based on the MoU (August 2001) between the State Government and GOI the Board had initiated various system improvement measures such as addition of transmission lines, substations, distribution transformers, capacitors, anti-power theft activities and metering of transmission and distribution transformers with a view to reduce the Transmission and Distribution (T&D) losses to 17 per cent by December 2004.

Due to various measures taken by the Board, the T&D loss was reduced from 30.4 per cent in 2002-03 to 23.4 per cent in 2006-07. When compared to the targeted loss of 17 per cent the shortfall in reduction of loss of 6295.25 MU (including transmission losses 685.78 MU) of power involving revenue loss of ₹ 1899.43 crore during 2002-2007, mainly due to delay in implementation of transmission system improvement works as targeted.

The Management stated (August 2007) that the main reason for maximum T & D loss in the State was high ratio (1:6) in respect of high tension and low tension lines as compared to ideal ratio of 1:1 arising from nature of topography in hilly areas and dispersed pattern of housing. The Board also agreed that intensive measures would also be taken to reduce T & D loss in future.

Short account of power purchases:

3.35 On a comparison of the quantity of power purchased from Central power stations reckoned for working out T&D loss with energy billed during 2002-2006, it was observed that the quantity reckoned as purchases during 2003-04 and 2005-06 were lesser than the quantity billed and paid for

(Annexure 20), resulting in short account of T&D loss by 209.23 MU (1.54 per cent) in 2005-06 involving aggregate amount of ₹ 64.65 crore. Due to this the achievement against reduction in transmission and distribution loss as reported in the Annual Statement of Accounts does not convey the correct position. The Board had not investigated the above short-account of quantity of power purchased.

The above matters were reported to the Government (May 2007); the reply had not been received (September 2007).

[Audit Paragraphs 3.1 to 3.35 contained in the report of the Comptroller and Auditor General of India for the year ended 31 March 2007].

Notes furnished by Govt. on Audit paragraph is given in Appendix II.

The Committee enquired about the operation and maintenance of transmission system in northern, central and southern region of the state and the activities in the transmission sector. The Director (Transmission), KSEB explained that National Electricity Policy Plan of 2005 consisted of generation, transmission and distribution sectors which are interlinked. Central Electricity Authority prepared detailed Electricity Plan based on the National Electricity Policy, 2005. The original intention was to export power to various parts of India on the assumption that by 2008-09, the Southern grid will become power surplus. Based on this, Power grid Corporation of India laid interstate lines. But by 2008, the situation changed and other sectors became power surplus and Southern grid turned huge power deficit and only in 2015, the interlink between Southern grid & North East-West grid could be completed and power transmission materialised.

The witness added that the Raichur-Sholapur line was intended for transmission of 400 MW based on a thermal plant situated in that region. But now 4000 MW is transmitted through that line. The power production out of gas discovered in Krishna-Godavari Basin also did not materialize due to various issues.

The witness informed that the Central Electricity Authority conducts power surveys periodically and based on the demand so arrived, transmission distribution system of the state is planned. The state has not yet reached the demand calculated

in the Power Survey on 2015-16, the forecasted demand was 4386 MW while the expected demand is 3900 MW only. The projection of Power Survey are very much conservative. Demands are arrived with a projected growth of 5%. But in Northern Sector, the actual increase was 13% which was not expected. By 2020-21, the projected demand would be 5754 MW.

Maximum demand is from Ernakulam due to huge industrial demand and in other districts domestic demand is in the lead.

Out of about 6 crore units per day of electricity consumption, only 1.2 crore units are produced within the state. The most critical element is how to bring electricity from outside. This happens mainly through Kaniyambatta link (Wayanad), Palakkad, Edomon (Pathanamthitta), Mysore-Areekode link. These links are fully saturated and there is no possibility to bring extra units of electricity. Kochi-Edamon transmission line has to be commissioned to meet the demand. In next 5-6 years, 1000 MW import capacity generation has to be planned to avoid crises. Kochi-Edamon line, if commissioned can bring 500MW of electricity.

The committee enquired the reasons for the delay in commissioning of Kochi-Edamon line. The witness replied that local issues with reference to laying of line is the main problem and in the case of Mysore-Areekode line, Kerala part is complete but there were some objections from plantation owners in Karnataka but finally with Police protection the electric line was laid and charged. The High Tension, Extra High Tension and Transparent lines could not be laid through cable. The Right of Way for 220 KV line is 35 m & for 400 Kv line is 70 m. A power highway can be created only when a link between Mylatti (Kazaragod) and Areekode Madakkathara is obtained. Being a densily populated state it would be practically impossible to acquire land of 90M width and to obtain full Right of Way clearance. To lay 400 KV line through the Right of Way of 220 KV line hasn't been experimented in India yet, but studies and experimentation is going on with reference to lines above internal water ways, medians of new roads etc.

2.1.9-National Electricity Policy/Plan and Planning by KSEB :

To a query of the Committee regarding the mismatch between the five year and annual plan of the Board consequent on the introduction of de-centralised process from 2008-2009, the witness replied that Five Year Plan targets prepared for longer times required correction for actual implementation on a year to year basis. The committee observed that the Board did not prepare State Electricity

Plan forecasting demand, generation, power purchase, transmission and distribution. Moreover, the Board never had a perspective plan based on load and energy forecasts for the next ten years despite SERC directions for the preparation of perspective plan. The committee pointed out that the Five Year Plan lost its relevance by the implementation of annual plans which are formulated not keeping in view of the target fixed in Five Year Plan.

When the Committee enquired whether any action was taken by the Board to formulate state electricity plans, the witness disclosed that the Board had already increased the number of substations and lines and increased the transformation capacity in the load area.

2.1.10-Transmission network and its growth :

The Committee enquired about the shortage of transmission infrastructure and transmission constraints due to the deficiency in capacity addition. The witness replied that the reply of the Board was accepted and the issue was dropped by the Comptroller and Auditor General of India.

2.1.11-Transmission constraints in Northern Kerala :

The Committee enquired about the measures taken by the Board to overcome the shortage of transmission infrastructure prevailing in the northern districts like Kasaragod and Kannur. The witness replied that since the transmission line was going through Uduppi Mangalapuram Town from the generation point of Uduppi, state of Karnataka did not get the benefit of Uduppi-Maylatti line and permanent solution of this issue was a 2000 MW coal plant at Cheemeni. He added that out of 102 cancelled coalfields, Baitharany coalfield was situated in 50 coalfields and the Board could apply the coalfield only when there were constraints and the Board should return it with fine if the Board cannot start the power generation after getting the coalfield.

2.1.12 When enquired about the audit para, the Secretary, Power department pointed out that in electricity plan, transmission projects and power projects should be considered together and six transmission projects remained unfinished.

The committee further enquired the way to overcome the crisis. The Secretary replied that out of six proposals, the proposal of Mysore-Areecode line

alone could be fulfilled. The capacity enhancement of the line could only be possible if new generation link comes at Mysore region. Since Puthur Mylatti was in forest area, Uduppi-Mylatti was suggested.

He added that decision regarding new lines were taken by SRPC after discussion. The consent of Karnataka and Tamil Nadu had to be obtained to construct new lines to bring power to Kerala. Since it was not practical to use power from outside Kerala, internal generation through gas or coal projects was much essential to overcome the power crisis, and for that the Board had to depend on either coal or gas.

When the committee enquired about the possibility of coal Plants in Kerala, the witness replied that double advantage was obtained if coal had been selected. He also added that in Cheemeni, the land possessed by the Plantation Corporation could have been utilised. Even though improved technology for advanced filtering was used in new generation plants, some local objections were raised regarding pollution. Moreover, since the coal was transported through ships, cost would be less. To a query of the committee, the witness replied that even though SRPC has cleared the Uduppi-Mylatti line, Karnataka raised objections against this project.

The committee remarked that due to various factors under and beyond the control of the Board, many projects were getting delayed. There were various Central-State-Political-Environmental-Public awareness interlinked factors influencing this.

The Accountant General pointed out that frequent change of plans and proposals resulted in delay as in the case of Madakkathara Projects.

The committee criticised the Board in not replacing a nonfeasible transformer which resulted in an explosion. The witness replied that there were issues regarding switching off of lines during repair. Even though the Board expected to take power from 12 Kms of Mysore-Areekode line at the time of switching off of transformer it could not be materialised and the transformer to be repaired was kept functioning resulting in explosion. Moreover, 40-60% of equipment used in the transmission systems were old and had to be replaced.

The committee also enquired whether officers were liable with respect to the explosion of transformers at Madakkathara. The witness replied that eventhough measures were taken to replace the transformer, that was not fruitful.

2.1.13-Project Management of transmission system :

The committee enquired why the Board did not follow the recommendation of the Task Force which was constituted by Government of India on transmission projects. The witness replied that the task force committee at the commencement of a project directs KSEB to undertake the survey, design and testing, land acquisition, right of way acquisition etc, either in advance or in parallel to the implementation of the project. But on seeing the practical difficulty faced in the field at the time of land acquisition, they came up with suggestion to alter alignment and design.

2.1.14 & 2.1.15-The committee observed that despite the guidelines of Task Force Committee, the execution of work for the construction of sub stations and Lines were delayed during 2006-07 due to the delay in acquisition of land, handing over of the site, Right of Way issues, delay by the contractors in executing the works etc.

2.1.16-Failure to complete evaluation works for a major project due to transfer of own land to a private firm.

The committee enquired why the Board decided to transfer 100 acres of land to Smart City before conducting survey for determining the line of route and awarded the line construction work after a lapse of one year from the transfer of land which resulted in the payment of ₹ 6.10 crore towards transmission charges for the idle station to PGCIL. The witness replied that regarding the transfer of land to Smart City, the Government took the decision and informed the Board.

The Accountant General pointed out that the delay was occurred since the Board did not conduct the survey for ascertaining the path of line. The Committee opined that if the Board conducted survey in time an amount of ₹ 6.10 crore could have been saved by the Board.

2.1.17-Idling of SS/ and line due to non-receipt of ROW :

The committee enquired why the KSEB commenced the construction of sub station without obtaining ROW for the entire line route which resulted in the idling of substations. The witness replied that even though the sub stations were made on the basis of the hope that electricity line could be drawn, it became idle

due to the objections of persons and due to the failure of laying of Kochi-Edamon line. He added that since the Board lacks large generation projects other than 2 MW and 3MW, it could not be decided by the Board to start the work of substation only after the completion of lining. Moreover, even though the Board earlier awarded the work by tender process, according to the direction that tender process and land acquisition process should be completed simultaneously, now the Board decided to invite tender only after obtaining the plant and cost escalations were not permitted. Due to these reasons for the last three years, no new projects were tendered.

2.1.18 -Other lapses in project management :

When the Committee enquired about the lapses in various projects, the witness admitted the lapses occurred in Kattakada, Ranni-Perinad and Punnappra-Mavelikkara projects.

2.1.19 - Mismatch between Generation Capacity and Transmission facility.

2.1.20 - Performance of transmission system

2.1.21 - Transmission capacity

2.1.22 - Adherence to standards in Sub-Station

The committee noticed the audit observation that out of the capacitors which were intended to set up voltage during operation, about 1/3 of the capacitors were not working at all and more over, alternative feeding arrangements were not implemented. The witness replied that damaged capacitors were rectified later and the capacitors bank which were intended to correct the voltage if there was any shortage in voltage, were activated only according to the directions of State Load Despatch Centre or Southern Region Load Despatch Centre.

Maintenance:

2.1.23 - Performance of Transformers

2.1.24 - Transformers failures

To a query of the Committee regarding performance of transformers, the witness replied that since transformers were purchased from TELK and KEL based only in L1 rates quoted in tenders, quality problems occurred. The Committee observed that one should not make light of the figure and must treat that as a serious issue.

2.1.25-Performance of maintenance wings

When the committee enquired about the deficiencies in the maintenance wing, the witness replied that shortage of staff and modern equipments were there at all the three wings of maintenance. viz., equipment testing, relay and lines.

2.1.26-Instances of poor maintenance including non compliance with PET directions

2.1.27-Instances of delay in repairs

The committee enquired whether the Board took necessary steps to maintain the machineries in a good manner and enquired about the efficiency of the employees who are deployed for conducting repair and maintenance works.

The witness replied that technical training had already been given to the staff. Even though it was risky, Board trained a team for line wire maintenance of high voltage transmission lines. He added that transfer of trained team adversely affected the maintenance.

2.1.28 -Transmission losses

With regard to the transmission loss, the Secretary replied that energy from generating station was collected through Exbus and when it reached the state border, transmission loss had already occurred. He added that since the loss occurred on the way, the Board was not responsible for it. The committee opined that the reply was highly technical and if the Board made the payment to that effect, loss would be suffered by the Board itself.

2.1.29 -Grid Management

When the committee enquired about the Grid Management, the witness replied that the overall grid management did not come under the control of the Board.

Regarding the completion of work for the upgradation of SCADA system, the witness replied that the SCADA system which was intended to store the data from all generating station in the control room cannot be upgraded by the Board alone since it was interconnected. He added that as the transmission was connected to the main grid it was the responsibility of the Board to implement SCADA in the distribution system, but in transmission system SCADA is to be upgraded jointly by the Board and RLTC.

2.1.30-Disaster Management

The witness to a query of the Committee informed that disaster management was the part of the Board itself and on an occasion of total power failure, DG sets were required to re-energize the system and measures were already taken to install it in all major stations.

2.1.31 Inadequate facilities for DM

2.1.32-Energy Accounting and Audit

When enquired about energy accounting and audit, the witness informed that since installation of 0.2S class meter, CT/PT, CTG were highly expensive, it could not be done by using the funds of the Board alone. He added that since there was Power system Development fund of the Government of India, the Board planned to make the energy accounting to 0.2S class meter accurately by submitting a request and utilised the said fund for this purpose.

2.1.33-Financial Management

2.1.34-Element of cost

2.1.35-Avoidable expenditure and non-realisation of dues

When the committee enquired about the payment of ₹ 13.69 crore on compensation towards unavailed power allocation and non-realization of dues, the witness informed that even when the Board abstained from demanding power, they offered it and thereby the Board was forced to pay charges to unused energy. When the Accountant General pointed out that PGCIL purposefully gave it to the Board and the Board was forced to pay the amount, the committee remarked that extra burden arising out of this, must be borne by Central Government.

The Audit pointed out that in the case of lines constructed for Koodamkulam projects, the beneficiary states were forced to bear the cost even if it had not been materialized.

2.1.36-Material Management

2.1.37 -Purchase of transformers in advance of requirement

2.1.38 -Non finalisation of tender within the validity period

The committee enquired why the Board did not finalize the tender within the validity period, which resulted in an avoidable expenditure of ₹ 30.01 lakh. The witness replied that due to the delay in taking decision in a tender it got lapsed. Since the rate quoted was excess at the next tender, the Board had to pay excess amount of ₹ 30 lakh. The Committee criticized the Board for not taking timely decision. The Secretary, Power Development informed that the decision should be taken at three levels according to the delegation of power and the decision of the particular tender might be taken in the meeting of full time Directors. He added that after taking the decision, delegation of power had been enhanced by the Board.

2.1.39-Failure to reform Purchase wing

When the committee enquired about the failure of the Board to reform its purchase wing, the witness informed that even though developed software for the modification of purchase wing had been implemented in distribution wing, it could not be implemented in the transmission wing.

2.1.40 Monitoring and Control

When the committee enquired about monitoring and control, the witness informed that the Technical Audit which was constituted in 2010 in order to monitor the activities of substations was not able to cover the entire substations. He added that in a year the technical audit team could cover only almost 30 substations. The committee remarked that improper monitoring would affect the overall efficiency which resulted in accidents and power disruptions.

2.1.41-Duty timings at SSs

Regarding the duty timings at substations, the committee pointed out that reduction in the number of shifts by increasing the duration of shifts adversely affected the efficiency, quality of performance and monitoring.

2.1.42-Comparison with best practices adopted by PGCIL

With regard to the comparison with best practices adopted by PGCIL, the witness informed that re-capital investment should be necessary in order to modernize or improve the level of functioning of the Board by adopting modern techniques or practices of PGCIL.

2.1.43-Failure to unbundle KSEB

With regard to the failure to unbundle KSEB into three functional areas of generation, transmission and distribution, the Committee remarked that decision in this regard should be taken by the Board itself.

2.1.44-Internal Control and Internal Audit

When the Accountant General pointed out that the Internal Audit Wing was not functioning well in transmission sector, the committee suggested that the Board should take necessary steps to strengthen the audit wing.

4.10 (2007-08)

The committee observed that undue delay of the Board in conducting inspection of materials provided by Arun Manufacturing Company, Delhi and subsequent termination of purchase order forced the Board to procure material from alternate source which resulted in an additional cost of ₹ 1.32 crore.

3.1.3-35 (2006-07)

The committee observed that transmission system improvement scheme of the Board could not achieve its aims due to the belated decisions, deficiency of proper contract and delay in acquisition of land required for substations and transmission lines. The committee remarked that if the Board paid a little attention in financial management, the payment towards interest could have been avoided.

Conclusions/Recommendations

1. The Committee observes that in 2008 all power grids in India except Southern Grid became power surplus as expected in the Electricity Plan of Central Electricity Authority and the Southern grid turned highly power deficient. The Committee finds that it was due to the laxity in formulating the plan according to the Central Electricity Plan and its improper implementation. The situation indicates the limitation of the plan of KSEB and the Committee therefore recommends that the power plan adopted here in this regard should be re-examined with respect to the change of situation and it should be upgraded from time to time.

2. The Committee is of the observation that the Board failed to prepare State Electricity Plan (SEP) forecasting demand and generation, power purchase, transmission and distribution. The Committee further notes that the Board lacked a perspective plan based on load and energy forecasts for the next 10 years despite SERC directions for the preparation of a perspective plan.

3. The Committee observes that there exists a shortage of transmission infrastructure in the northern districts of Kerala like Kasaragod and Kannur. The Committee directs to furnish a detailed report to the Committee regarding major problems faced by the Northern districts of Kerala such as lengthy feeding circuits, weak transmission network, poor inter-state connectivity, etc.

4. The Committee pointed out the inexcusable lapses that occurred in Kattakkada, Ranni-Perinad and Punnappra-Mavelikkara Projects. The committee directs that KSEB should immediately submit the details of the officers responsible for such serious lapses so as to fix liability upon them.

5. The Committee notices that about one-third of the capacitors installed at various substations were non-working and also notes that alternative sources of feeding were not arranged at sub-stations to maintain supply/avoid failure of the stations in case of failure of one source. The Committee understands that one of the main reasons for the malfunctioning of capacitors and substations was that their quality were not up to the mark. Therefore, the Committee directs that the Board should refrain from installing substations, including capacitor banks, that are substandard.

6. The committee considers transformer failures a serious issue and directs the Board to take effective action to reduce the rate of occurrence of transformer failures and also remarks that quality should also be made a parameter along with the price while procuring transformers through tender process.

7. The Committee is concerned about the deficiencies noted in the maintenance wings in KSEB. The Committee is also worried to note instances of accidents which resulted in loss of life and also notes with concern the delay in repairs due to delay in procurement of spare parts. The Committee also noticed that supplier's service engineers were not available for prompt repairs as they were

not bound to do the service because suitable clauses for subsequent repairs after installation were not included in the purchase order of equipments.

8. The Committee views all these lapses seriously and sternly directs the Board to take precise steps to avoid delay in maintenance, make sure to replace equipments which is beyond repair, make available service engineers in time by incorporating suitable clauses to that effect in the purchase order/agreement and thus ensure proper maintenance of transformers. The Committee directs the Board to upgrade technology and acquire modern equipments required for the maintenance wings of the Board necessary for the better functioning of the present system in KSEB.

9. The Committee recommends that adequate training in latest technology should be provided to the existing staff. The Committee observes that a payment to the tune of ₹ 13.69 crore was forced on the KSEB as compensation towards unavailed power allocation. The Committee views this as a very unfair practice to compel KSEB to pay to PGCIL/SRPC for the power it has not utilised. Since this is not an issue that could be solved internally, Committee is of the view that this matter must be brought to the notice of the Centre and discussed during general Plan.

10. The Committee expresses dissatisfaction at the Board's delay in finalisation of tenders within the stipulated period which resulted in an avoidable expenditure of ₹ 30.01 lakh. The committee directs the Board to be vigilant and avoid delay in tender processes in future.

11. The Committee expresses its apprehension over the reduction in the number of shifts at KSEB substations and observes that increased duration of shifts adversely affects the efficiency and quality of performance and monitoring. The Committee suggests that the Board should either enforce the approved duty time or formulate shift duty of 8 hour durations.

12. The Committee remarks that the decision with regard to unbundling of KSEB into separate profit centres for the 3 functional areas of generation, transmission and distribution should be taken by the Board itself.

13. The Committee observes that the Internal Audit Wing of the Board was not functioning properly in the transmission sector. The Committee suggests that the Board should take necessary steps to strengthen the audit wing.

14. The Committee observes that the transmission system improvement scheme of the Board could not achieve its aims due to belated decisions, deficiency of proper contract and delay in acquisition of land required for substations and transmission lines.

15. The Committee points out that the failure of the Board to provide uninterrupted better quality power supply to targeted consumers was on account of lack of adequate planning, monitoring, co-ordination and abnormal delay in commissioning and completion of scheme.

Thiruvananthapuram,
26th April, 2017.

C. DIVAKARAN,
Chairman,
Committee on Public Undertakings.

APPENDIX I

SUMMARY OF MAIN CONCLUSION/RECOMMENDATIONS

Sl. No.	Para No.	Department Concerned	Conclusions/Recommendations
1	2	3	4
1	1	Power	The Committee observes that in 2008 all power grids in India except Southern Grid became power surplus as expected in the Electricity Plan of Central Electricity Authority and the Southern grid turned highly power deficient. The Committee finds that it was due to the laxity in formulating the plan according to the Central Electricity Plan and its improper implementation. The situation indicates the limitation of the plan of KSEB and the Committee therefore recommends that the power plan adopted here in this regard should be re-examined with respect to the change of situation and it should be upgraded from time to time.
2	2	Power	The Committee is of the observation that the Board failed to prepare State Electricity Plan (SEP) forecasting demand and generation, power purchase, transmission and distribution. The Committee further notes that the Board lacked a perspective plan based on load and energy forecasts for the next 10 years despite SERC directions for the preparation of a perspective plan.
3	3	Power	The Committee observes that there exists a shortage of transmission infrastructure in the northern districts of Kerala like Kasaragod and Kannur. The Committee directs to furnish a detailed report to the Committee regarding major problems faced by the Northern districts of Kerala such as lengthy feeding circuits, weak transmission network, poor inter-state connectivity, etc.

4	4	Power	The Committee pointed out the inexcusable lapses that occurred in Kattakkada, Ranni-Perinad and Punnappra-Mavelikkara Projects. The committee directs that KSEB should immediately submit the details of the officers responsible for such serious lapses so as to fix liability upon them.
5	5	Power	The Committee notices that about one-third of the capacitors installed at various substations were non-working and also notes that alternative sources of feeding were not arranged at sub-stations to maintain supply/avoid failure of the stations in case of failure of one source. The Committee understands that one of the main reasons for the malfunctioning of capacitors and substations was that their quality were not up to the mark. Therefore, the Committee directs that the Board should refrain from installing substations, including capacitor banks, that are substandard.
6	6	Power	The committee considers transformer failures a serious issue and directs the Board to take effective action to reduce the rate of occurrence of transformer failures and also remarks that quality should also be made a parameter along with the price while procuring transformers through tender process.
7	7	Power	The Committee is concerned about the deficiencies noted in the maintenance wings in KSEB. The Committee is also worried to note instances of accidents which resulted in loss of life and also notes with concern the delay in repairs due to delay in procurement of spare parts. The Committee also noticed that supplier's service engineers were not available for prompt repairs as they were not bound to do the service because suitable clauses for subsequent repairs after installation were not included in the purchase order of equipments.

8	8	Power	The Committee views all these lapses seriously and sternly directs the Board to take precise steps to avoid delay in maintenance, make sure to replace equipments which is beyond repair, make available service engineers in time by incorporating suitable clauses to that effect in the purchase order/agreement and thus ensure proper maintenance of transformers. The Committee directs the Board to upgrade technology and acquire modern equipments required for the maintenance wings of the Board necessary for the better functioning of the present system in KSEB.
9	9	Power	The Committee recommends that adequate training in latest technology should be provided to the existing staff. The Committee observes that a payment to the tune of ₹ 13.69 crore was forced on the KSEB as compensation towards unavailed power allocation. The Committee views this as a very unfair practice to compel KSEB to pay to PGCIL/SRPC for the power it has not utilised. Since this is not an issue that could be solved internally, Committee is of the view that this matter must be brought to the notice of the Centre and discussed during general Plan.
10	10	Power	The Committee expresses dissatisfaction at the Board's delay in finalisation of tenders within the stipulated period which resulted in an avoidable expenditure of ₹ 30.01 lakh. The committee directs the Board to be vigilant and avoid delay in tender processes in future.
11	11	Power	The Committee expresses its apprehension over the reduction in the number of shifts at KSEB substations and observes that increased duration of shifts adversely affects the efficiency and quality of performance and monitoring. The Committee suggests that the Board should either enforce the approved duty time or formulate shift duty of 8 hour durations.

12	12	Power	The Committee remarks that the decision with regard to unbundling of KSEB into separate profit centres for the 3 functional areas of generation, transmission and distribution should be taken by the Board itself.
13	13	Power	The Committee observes that the Internal Audit Wing of the Board was not functioning properly in the transmission sector. The Committee suggests that the Board should take necessary steps to strengthen the audit wing.
14	14	Power	The Committee observes that the transmission system improvement scheme of the Board could not achieve its aims due to belated decisions, deficiency of proper contract and delay in acquisition of land required for substations and transmission lines.
15	15	Power	The Committee points out that the failure of the Board to provide uninterrupted better quality power supply to targeted consumers was on account of lack of adequate planning, monitoring, co-ordination and abnormal delay in commissioning and completion of scheme.

Appendix II

Notes Furnished by Government on the Audit Paragraphs

Audit paragraph	Reply furnished by the Government	Lines of enquiry suggested

to 2011-12. Audit examination involved scrutiny of records of different wings of KSEB at the Head Office, State Load Dispatch Centre (SLDC), two Transmission Regions headed by Chief Engineers and five out of twelve Circles headed by Deputy Chief Engineers.

KSEB constructed 80 SSs (capacity: 1561.9 MVA) and 94 lines (capacity: 806 CKM) and augmented existing transformation capacity by 1187.3 MVA during the review period. Fourteen SSs[1] (capacity 4640 MVA) were examined in audit. The selection was made ensuring geographical parity and other factors such as performance and execution of major works. The only 400 kV SS in the State, eight out of seventeen 220 kV SSs, three out of one hundred thirty three 110 kV SSs and two out of seventy nine 66 kV SSs located in the selected Circles have been selected. The total transmission capacity (4640 MVA) of all the SSs selected constituted 28.42 *per cent* of the total capacity.

Audit Objectives

2.1.4 The objectives of the performance audit were to assess whether:

- Planning was in accordance with the guidelines of the National Electricity Policy/ Plan and State Electricity Regulatory Commission (SERC) and assessment of impact of failure to plan, if any;
- The transmission system was developed and commissioned in an economical, efficient and effective manner;
- Operation and maintenance of transmission system was carried out in an economical, efficient and effective manner;
- Disaster Management System was set up to safeguard operations against unforeseen disruptions;
- Effective failure analysis system was set up;
- Financial Management system was effective and efficient;
- Efficient and effective system of Procurement of material and inventory control mechanism existed;
- There was a monitoring system in place to review existing/ ongoing projects, take corrective measures to overcome deficiencies identified and respond adequately to Audit/ Internal audit observations.

Audit Criteria

2.1.5 The sources of audit criteria were the following:

- Provisions of National Electricity Policy/Plan;
- Plan Documents of KSEB;
- Standard procedures for award of contracts with reference to principles of economy, efficiency, effectiveness, equity and ethics;
- ARR filed with SERC for tariff fixation, Circulars, Manuals and MIS reports;
- Manual of Transmission Planning Criteria (MTPC);

[1] 400 KV Madakkathara, 220 KV at Pothencode, Brahmapuram, Kalamassery, Kaniyampetta, Kanjirode, Mylatty, Nallalam,Vadakara, 110 KV at Edapally, Pathanamthitta, Paruthipara and 66 KV at Trivandrum Power House and Sulthan Bathery.

	Both the annual plans and the five year plan were prepared after collecting information about the field level requirements. The concept of decentralized planning is more applicable to the distribution sector, whereas the transmission planning is more of a centralised nature. The decentralized concept was applied in the transmission planning mainly to scale up the capacity addition and system strengthening requirements from the distribution sector to the transmission sector. Whatever additional requirements emerged from the field were included in the plan and implemented only after analyzing the technical and commercial aspects of the proposals by conducting load flow analysis and cost benefit analysis. In fact, all the transmission projects are now funded by availing long term loans from financial institutions, which extend the assistance only based on the techno-economic feasibility of the proposals. The five year plan targets prepared for such longer time horizon required corrections for actual implementation on a year to year basis. Thus the annual plan targets could not be the exact replica of the targets projected in the live year plan. The annual plan targets were finalized by taking the five year plan targets as a basis and making fine tuning based on the latest requirements and practical considerations Moreover, implementation of transmission projects mostly depended on availability of land for substations and right of way for transmission lines which were often entangled in litigations and local resistance. Thus the original time lines planned in the five year plan got upset and hence the same project appeared in more annual plans than originally estimated. This is why the sum total of the estimates in the annual plans exceeded that in the five year plan. The reason for the difference between the estimated requirement of Rs. 2743 Crore for the five years (by adding together the projected expenditure in annual plans) with the actual budget allocation .of Rs 1294 Crore (not Rs. 1062 Crore mentioned in the audit Para) is also the same as described above. The expenditures projected in the annual plans were based on the expectation that the projects would take off smoothly without any hindrances. However, many a time the projects got entangled in litigations on land acquisition and right of way related issues. Hence, the project was to be rescheduled to the next year and its projected expenditure was also shifted to the next year's plan. However, the budget estimates were always restricted so as not to upset the revenue requirements in the ARR & ERC. There is always the scope for increasing the budget	d..Any action was taken to formulate State electricity plan?

estimate for a project any time during the course of the year either in the Revised Estimate or through re-appropriations. Thus, the difference between the projected expenditure in the annual plan and the budget estimates is an inevitable consequence.

Even though KSEB had not yet prepared a State Electricity Plan as *a* report, the decisions on planning the generation and power purchase and building the transmission and distribution infrastructure were always taken based on sound judgments originating from the forecasted demand of the State. For this purpose, KSEB depended on the Electric Power Survey reports published by the Central Electricity Authority every five year. The reports contain the projected peak demand and energy requirement of the State for the ensuing five year plan period and the perspective demand for the next five year period. As the survey results are fairly accurate these are adopted by almost all the utilities for their planning purposes.

KSEB had already prepared a long term transmission plan covering the ten year period 2013-2023 to streamline the investment and activities in the transmission sector.

Audit has pointed out that KSEB did not construct 135 out of 225 substations originally planned. In fact, during the review period of 2008-09 to 2011-12, sum total of the number of substations included in the respective annual plans of KSEB is 241 nos. (not 225 nos. as mentioned by the audit) as detailed below:

	2008-09	2009-10	2010-11	2011-12	Total
220 KV	2	2	2	2	8
110KV	15	19	27	16	77
66KV	5	4	7	4	20
33KV	49	38	31	18	136
	71	63	67	40	241

108 substations out of the above 241 nos. are actually spill over of previous years' targets and hence are duplicated while counting the total number. For example, out of 63 substations planned during 2009-10, 44 nos. are spillover of 2008-09, out of 67 substations planned during 2010-11, 28 nos. are spill over of 2008-09 and 2009-10, while 40 substations planned during 2011-12 include 36 nos. of spill over projects. Thus, the number of substations actually

	planned during the review period of 2008-09 to 2011 -12 is only 133 nos.. out of which 70 substations were commissioned during the review period itself. Most of the remaining 63 substations are included in the annual plans of subsequent years from 2012-13 to 2015-16, while a few proposals are being-re-considered with alternate proposals because of difficulty in land acquisition and"right of way related issues. It is true that there are some instances where works were included in the annual plans before obtaining administrative sanction for the ' same. This was done to fast track the project implementation by enabling the field offices to start with the preliminaries so as to be ready to start the implementation as soon as the administrative sanction is received. Such proposals are included in the plan only in case of urgencies and after submitting the project proposals to the Board for issue of administrative sanction.	

	2.1.11 OVERVIEW OF THE KERALA POWER SYSTEM The maximum recorded peak demand of the State is 3348MW and the maximum recorded energy demand is 63.4515 MU. Due to issues related to getting environmental and Forest clearances, addition of new hydel project is very difficult, The main challenges in the implementation of new schemes are delay in getting forest clearance, RoW problems, land acquisition issues, environmental problems etc: Since the present day installed capacity is difficult to meet the demand the State is heavily dependent on interstate import of power.	

	Transmission Planning philosophy has evolved over lost few decades keeping pace with developments and needs of the electricity sector The transmission planning has been aligned with the new Electricity Act, National Electricity Policy Tariff policy, regulations and market orientation of the electricity sector. Based on the perspective plan developed by the CEA and depending upon as to which generations are likely to be available during the next 2-3 years and taking in to account the load growth in particular areas, CTU or STUs prioritize, review (if required) and take up their transmission system expansion programme for implementation To fulfill this objective and carry out integrated planning through coordination and consultation with transmission utilities and other stake holders, CEA has constituted regional Standing Committees for Power System Planning (SCPSP) to firm up transmission addition proposals. These standing Committees for Power System Planning have representation of CEA, CTU, STUs of the constituent States, Regional	W hat steps have been taken to impleme nt the poposals of the Board to get rid of Transmis sion constrain t? 2. W hat is the progress ?

[1] Monsoon dependent 228.75MW -Kuttiyadi Hydro Station & two high cost thermal projects (128 MW Kozhikode Diesel Power Project and 22 MW Kasargode Power Corporation Limited).
[2] 220kV Kadakola- Kaniyampetta (drawal of 120 MW).
[3] 110kV SS Konaje-Manjeswaram (drawal of 15MW).
Projects involving system improvement of the grid as a whole/Central generating stations and inter-state projects.
[4] 400 kV SS at Palakkad.

		Power Committee (RPC) of the concerned region and representatives of Central Sector Generating Companies in the region. Power Grid Corporation of India (POWERGRID) was set up as the CTU to give thrust to implementation of transmission system associated with central generating stations and inter regional transmission programme based on perspective planning done by **Standing Committee on Power System Planning of Southern Region** (SCPSP) under the aegis of Central Electricity Authority (CEA). Any proposal for inter state.lines required towards system strengthening in the southern region are to be forwarded to CEA for discussion and approval in the SCPSP meetings after conducting system studies.Once recommended and approved in the SCPSP, the proposals are placed in the Southern Regional Power Committee (SRPC) for approval to take up construction activities. As recommended by the empowered committee and after consideration by the Government of India, the transmission projects are implemented through the tariff based competitive bidding process. TRANSMISSION SYSTEM IN THE SOUTHERN REGION OF THE COUNTRY	

[†] Udupi STPS commissioned (August 2011) with 600 MW, with additional capacity of 600 MW under creation.
[*] Computed for peak hour period of six hours.
[‡] 60x1000x6hrsx365days/10 lakh.
[**] 45x1000x6hrsx365 days/10 lakh.

	Transmission System in the southern region consists of Interstate Transmission System (ISTS) & Intrastate Transmission System. ISTS is mainly owned and operated by Central Transmission Utility, i.e. Power Grid Corporation of India Ltd (POWERGRID). In the Southern Region the main corridors for power transfer between constituent States are formed by 400kV lines and are divided into two areas viz SI and S2. Kerala, Taminadu and Pondichery are in S2 area whereas Karnataka and Andhra Pradesh in SI area. The main power transmission corridor between the SI and S2 area consists of 7 nos. of 400kV lines with an Available Transmission Capability (ATC) of 4000 to 5300 MW which, in turn is declared/ updated periodically by SRLDC. The S1-S2 corridor is often getting congested due to the overloading of Vijayawada - Nellore (SI area) and Somanahally-Salem, Hosur -Salem (S2 area). And also the delay In commissioning of the new generation projects, commissioning of projects without the associated transmission lines, aggressive inter regional short term open access power purchase etc further worsened the congestion. Transmission System of Kerala State The main transmission system for power delivery within the State consists of a 220kV	

[11] PGCIL has demanded surrender of one of KSEB's three existing ROW at 220 KV for the route. KSEB has demanded retention of its ROW through creation of a multi-circuit route by PGCIL.
[12] Interstate constraints between Karnataka and Kerala.
[13] Idukki-Madakkathura (ID-MD) line.

	backbone network with 110kV and 66kV subtransmission systems for delivery of bulk power up to load centers. As our installed capacity is insufficient to meet the demand coupled with the difficulties in establishing new projects, State is dependent on CGS and power through exchanges /traders which in turn results in dependency on Interstate transmission network for import of power in the region. Most of the generation assets in the State are located in South and Central Kerala. At present there are two major connectors at 400kV & 220kV level, i.e. 400kV Cochin East - Madakkathara DC line and 220kV Lower Periyar- Madakkathara DC line connecting the major connection point of North Kerala with generation points in South / Central Kerala. As the load in the Malabar area is being increased considerably, without a 400 KV substation at north, even a minor failure in Madakkathara ; 400kV substation may lead to total failure of supply in Northern Kerala and restoration of supply may take time. The Board has taken up the issues relating to the construction of new Inter State lines and strengthening of existing interstate lines in various SRPC meetings and Standing Committee meetings. The maximum demand of Kerala is showing an upward trend and. non availability of transmission network for availing power from Central Generating	

	Stations and through Exchanges as per Merit Order as per the requirement , usually results in shortage of power especially, in the Northern Region of Kerala. For relieving the congestion for transfer of power from the SI to S2 region, the KSE Board has proposed the following new ISTS lines and strengthening the existing ones:	

Reply

	• 400kV Mysore - Kozhikode line: The works of 400kV Areacode substation is almost completed and the 400 kV line in Kerala portion has also been completed by PGCIL. The construction of the Mysore -Areacode 400KV line is held up in Karnataka portion of the coffee plantation region in Coorg area. With the commissioning of this 400kV line from Mysore to Areacode- and 400kV Areacode substation, the power situation in Northern Kerala will improve considerably as this will provide a direct 400kV link between SI region and Kerala(at present there is no 400kV direct link available between SI and Kerala).- • 400kV Double Circuit link from Nagarjuna Power Corporation Ltd Thermal Power Plant (NPCL, Uduppi) to 400kV substation at Kozhikode (Areacode) and to setup a 400kV substation at Mylatty (Kasargode) by LILOing one of the circuit. The 35th meeting of the Standing Committee has approved this scheme. Land compensation for Right of Way (RoW) for the tower footing, is under consideration of the Government. • 220kV Puthur - Mylatty Double line: This proposal is dropped due to: a) Issues related to forest clearance b) Load flow study conducted by SRPC shows that power cannot be drawn during peak hours as the 220kV s/s Puthur is getting overloaded c) KPTCL informed that they do . not agree to the construction of 220kV Mylatty - Puthur line as there is no capacity in their transmission network to supply power beyond Puthur. • Doubling of existing 110kV Konaje - Manjeswaram Single Circuit feeder: The KPTCL supply extends from Konaje substation in Karnataka to Kerala border at Thoudugoli and from Thoudugoli to Manjeswaram. This cannot be fully utilised due to line restriction. Therefore it is proposed to convert the existing 110kV Konaje (from Thoudugoli at Kerala Border) - Manjeswaram - Mylatty Single Circuit feeder to double circuit for availing the allocated power from KPTCL and also for utilising the increased power availability in	

	Northern region consequent to the commissioning of 400kV Mysore- Areacode line, • Power restrictions in 220kV Kadakkola- Kaniyambetta line: Strengthening of this line would help to reduce the S1 S2 congestion • Construction of 400kV Trichur Kozhikode line (Madakkathara Areacode): This line is proposed under Regional Strengthening scheme. KSEB is also adopting several demand side management measures . Inadequate transmission capacity at 400kV substation Madakkathara for import of Central Sector power. The proposal for enhancing the transformation capacity of Madakkathara was discussed in the 24th Standing Committee meeting on Power System planning during June 2007.In the meeting it was suggested that the 3rd transformer planned for installation at Trivandrum North substation of PGCIL could be shifted to Madakkathara. Considering the technical risk factors pointed out by PGCIL and Member Secretary, CEA with respect to shifting of the transformer, as it would adversely affect its life the proposal was kept in abeyance in view of the proposed commissioning of the 400kV Elappully substation (PGCIL). In the mean time KSEB has also resorted to demand side measures to reduce the peak demand. Later due to the delay in commissioning of the above substation and after assessing the load growth in the area and from a reliability point of view considering the age of the existing transformers the proposal for installation of the 3rd transformer was again revived. So there was no loss to Board in deferring the project. The works are in progress. KSEB has already taken proactive steps to improve the network. Requirement of a number of Interstate Transmission lines have been taken with SRPC & CEA. 400kV MAL is not yet completed due to issues on RoW in Karnataka. The 400kV S/s at Areacode and 400kV line from Areacode to Kerala Boarder (Baveli) has already been completed. 220kV Puthur - Mylatty line was already proposed by KSEB in various forums. The above proposal has been dropped due to (i) Route of the line was passing through thick forest in Karnataka and also passing through difficult hilly terrain. Hence, forest clearance will be more difficult, (ii) SRPC conducted Load Flow studies and informed that power can not be drawn during peak Hours, as the 220kV S/S at Puthur is getting over loaded, (iii) KPTCL has objected construction of this line in various forum. Hence, the new proposal for 400kV line Udupi- Areacode through Mylatty along the costal area has been proposed. The same was approved in the standing committee meeting held at Delhi during Jan.2013. K.S.E.Board has taken all efforts to augment the interstate transmission capacity by taking up the issue in proper forum. The 400/220kV transformer banks at 400kV Substation, Madakkathara were loaded to about 91%, at times and hence it was proposed in 2007 to install a 3rd unit transformer bank to meet the immediate load requirement. The proposal was discussed in the 24th standing committee on Power System Planning in Southern Region held on 18.06.2007 and Central Electricity Authority agreed to the proposal. The requirement of additional transformer was of short duration as the load at Madakathara was expected to come down with the commissioning of 400kV substation, Areacode, which was held up due to RoW problems. A proposal for a 400kV substation at Palakkad was also being considered, which would reduce the load at Madakkathara further. The Central Electricity Authority suggested that the transformer procured by PGCIL for Pothencode could be taken on loan by KSEB and may be installed at 400kV Substation, Madakkathara so that the drawal capacity from Central Grid will be enhanced. Later on, PGCIL did not accept the proposal and insisted on KSEB to pay the full amount or replacement of the transformer. As the duration of utilization was limited, the proposal was not pursued further. Meanwhile to tide	

over the load growth, split bus operation at Idukki and LP buses was resorted to for enhancing the 220kV . support at .Madakkathara bus as immediate alternative solution and was continued until 400kV substation, Palakkad was commissioned. The rate of system growth is 13% against the anticipated growth of 5%.

Hence the proposal to install the 3rd transformer bank was revived. It is also considered prudent to arrange a new transformer as the present transformers are 20 years old and any failure, will have catastrophic effect as the state power system depends on import of power to the extent of more than 60% of the total demand. Hence there was no loss sustained to Kerala State Electricity Board on account of deferring the investment for the 3rd Bank transformer in 2007 itself. But now since it is the right time. KSEB has resorted to installation of 3rd Bank transformer. Works are in progress and, 315MVA ICT and associated equipments will be commissioned by 31st August2013.

The requirement of inter State Transmission Lines from Karnataka including 100-150MW power from Nagarjuna Power Plant, Udupi, Karnataka has been taken up in many SRPC meetings. Because of the regular follow up from KSE Board, the standing committee meeting held at Delhi on 4-1-2013 the new 400kV Udupi- Mylatty -Areacode ISTL has been approved. On completion of MAL and the new ISTL the existing issues of S1-S2 congestion can be reduced considerably.

KSEB has proposed 220kV Puthur - Mylatty ISTL in many SRPC meetings and the main objection -was from KPTCL. In the special SRPC meeting held on 13th July 2012, KPTCL completely objected the above 220kV line as the 220kV Puthur S/S could not feed any power to Kerala during peak Hours. Route of the line was passing through thick forest in Karnataka and also passing through difficult hilly terrain. Hence, forest clearance will be more difficult. CEA studied the load flow studies and not recommended the above 220kv line. Moreover, after construction of, 400kV Udupi- Mylatty -Areacode ISTL, importance of the 220kV Puthur - Mylatty line is very less. KPTCL has insisted to limit drawal to 150MW in the 220kV Kaniyambetta-Kadakola ISTL.

Though KSEB paid much effort to construct the inter state transmission line, the same has not been materialized due to the non receipt of sanction from KPTCL and SRPC in right time.. Hence the losses estimated based on the line construction/ transmission losses saving cannot be achieved. Board is proposing to setup a well mechanized apex committee constituted by the Central Government for resolving such issues in future to evaluate the merits of Transmission sector especially to reduce the T&D losses.

Hence auditors may consider these technical parameters and constraints at par with their observations.

2.1.13 and 2.1.14

The observations made by the auditors are not fully correct. KSEB had taken into account of the task force committee report in the year 2008 and had initiated action to implement three pilot projects in time bound manner in

	true spirit which includes Kattakada project, Punnappara Project and Kakkayam-Pattanippara Transmission line projects. However the same are not fully materialized due to the stringent opposition from public and further delay in settling disputes in apex courts. Also the auditors were not even considered about the peculiar geographical scenario of Kerala. Please note that at present KSEB is carrying out the preparatory activities of line surveying, design and testing etc. in parallel, however land acquisition and right of way - clearance etc, are done only after the Project approval and the issue of statutory gazette notification. Please also note that for KSEB the acquiring of the Right of way is very difficult due to shortage of land across Kerala and also due to very precious high cost involvement. Hence KSEB's RoW issues and land acquisition has to be evaluated totally different from other states or utilities. Here geographic consideration is the most valid reason. 12th plan onwards the project has been sanctioned with series of stages includes necessity derived from Annual working group plan, data collection and feasibility study by the Board Planning wing, DPR preparation and final approval. S/S construction activities start only after resolving of Row issues pertains to Line construction. The Board had planned to implement the project as a single or split wise Turnkey execution with a dedicated team of Project	

	Managers. **2.1.15** The auditor's observations are purely based on the practice followed by M/s PGCIL and Task force committee reports. Please note that KSEB has its own construction procedures and practices which have been followed. KSEB is also at the stage of implementing modern techniques and managements. Board has taken steps to constitute a team for preparing the Construction standards and practices. The geographical and demographical constraints of Kerala have to be considered regarding the RoW and Land acquisition issues. Being Kerala is a very densely populated State obtaining full Right of Way clearance before starting a project is practically impossible. During the course of project execution, many litigations will be filed in Court against RoW clearance in connection with transmission line construction and land acquisition for S/S. Final settlement from court takes many years, which is beyond the control of KSE Board. KSEB has proposed to GoK to form a dedicated committee including District Collector, Power secretary and LA &DAO and concerned Dy. CE Transmission for speedy settling issues related to RoW and land acquisition. **2.1.16** The KSEB had handed over 100 Acres of land to GoK as per order No. GO(MS)No.13/07/PD dated 05.07.2007, based	

	on the direction of Govt, of Kerala. At the time of transferring the land KSEB has not been foreseen any objection from the side of Smart City Authority being an initiative of GoK.. The Establishment of 220kV Pallikkara-Brahmapuram feeder is possible only through the smart City area (along the boundary). More over the construction of the above 220kV DC line through Smart City area will not make any technical issues to Smart City activities. Later litigation aroused by M/S Smart City Authority and the project delayed. Due to the involvement of State Government the cases has been settled amicably and KSEB has completed the work in the smart city area by applying Cl. 16(1) of Telegraphic act. • In addition to the above litigation, a Private complaint was lodged by Dr. Pulikkan which is. disposed by the Honorable High court during May/June 2012. Still another case is pending in the Honorable court for final disposal. Unexpected litigation is very common while drawing transmission line which cannot be foreseen at the time of project proposal. The speedy settling of the litigation is the driving mechanism for the timely completion of the projects. None of the Board officials made any willful negligence in carrying out their duties in connection with this project execution. The cost overrun estimated occurred due the delay in settling the cases from the Hon'ble. Courts	

[4] Lowest borrowing rate of KSEB.

	which are beyond the control of the Board. The downstream Power evacuation works - from 400kV Pallikkara S/S of PGCIL will be completed by 31.3.2013. A committee has been constituted by KSEB & PGCIL to settle the issues of RoW of 400kV Pallikkara Edamon line. Many hearings were already conducted and efforts are continuing to settle the issue by paying additional compensation on RoW. **2.1.17** Reply to this query is as same as in para 1 &2 of the answers made in query 2.1.15 and may read from the same para. We already replied that obtaining of ROW prior to project execution or acquisition of land in the right of way of any transmission line is not practical in Kerala scenario and we request the Auditors to evaluate the geographical condition rather comparing with other states where plenty of vacant lands are available. KSEB is adopting multi circuit's construction wherever possible, however all the line switching over to Multi circuit is not practical. Kannur Substation:- In the case of line construction of Kannur 33 KV Substation, Board had submitted a request to the Railway authorities for sanction for drawing 33 KV line parallel to the railway boundary with very minimum interference. Accordingly railway agreed the proposed line route and to draw the line. Also sanction was	

[9]₹ 0.83 crore during 2009-10, ₹3.31 crore during 2010-11, ₹1.92 crore during 2011-12.

	obtained from Railways for cutting and removing the trees in the railway land. -Based on the sanction of the Railway, K S.E.Board started the work in the presence of Railway authorities. When the line work was on progressing stage Additional Divisional Engineer, permanent way, Kannur objected issued stop notice. In spite of several request to the Divisional Manager, sanction was not obtained for further drawal of the line. As the substation works were already completed and considering the delay in obtaining sanction from Railways, Board decided to draw the line through an alternate route. Despite of several objections from the public and after settling the same through ADM's order, work was completed and the Substation was commissioned on 12-7-2010. **2.1.18** The Board has accorded sanction to release the security deposit pledged (As BG) by.M/S ICON for the transmission line work awarded for the Ranni-Perunad project. The action taken based on Board decision to drop the work awarded to the Turnkey contractor and allowed to complete the other Project under Transmission Circle, Kannur (Mulleria and Badiyadukka projects). The final bill of the projects is till not settled. Also the Contractors BG for the above work still is not	

mulia the details

[a] acquisition by invoking urgency clause/negotiation.
[b] 253400 units x ₹ 3.54(2010-11 average realisation).

		released. Hence direction has been sought to the Board for settling the issues with M/S ICON from the field office including the realization of the security deposit as BG pledged for the Ranni - Perinad works. Hence the Board can realize the losses from the contractor upon the settlement of the final bills. Peyad and Vidyanagr- Earlier materials procurements made from the O/o the CE, SCM was through manual mode of purchasing which has not been synchronized with the actual requirement. Recently SCM had started modern Inventory Management with IT and hence the project delay due to non availability of materials in real time will be resolved. Punnapra-Mavelikkara- KSEB has ordered departmental enquiry about the incident, which is in completion stage. Crime Branch of Police department has registered a criminal case against the AE, AEE & Contractor (involved with the case) which is under final stage of decision. In addition, KSEB has filed a case in the Alappuzha Sub-Court against the Contractor, AE & AEE through a special counsel for cost recovery. KSEB is hopping to realize the losses sustained to the Board from the culprits. Capacity enhancement work at Pothencode:- Based on the Board sanction the capacity addition at 220 kV s/s has been completed	

[*] The capacity of the existing feeders (110 kV DC lines from Pothencode to Parathipara and Edamon- Parathipara to Parathipara) was insufficient to meet the future load.

[**] Construction of a switching station at Pandalakode where the existing feeders crossed each other would have transmitted more power to Parathipara through existing feeders

	during the month of 11/2010. Two number of 110 kV additional bays were constructed to feed the 2 numbers of proposed UG cable to 110 kV S/s Paruthippara end. Later the Board (on 2011) had dropped the UG cable proposal being number of alternative circuits were constructed in City area and interconnection.of 110 kV circuits were planned. Also to construct a 110 kV substation at Panthencode. Hence the two bays constructed at Pothencode become idle: The works amounting to Rs. 8.30 crore has-not been executed and hence no expenditure incurred; Moreover the work corresponds to Rs. 8.30 crores is not for connecting the UG cable only at Paruthippara end. Defiantly the same can be used for providing supply to EHT consumers and we already received request from different consumers includes M/s Techno city, M/S Techno park and Indian Railways. **2.1.19** The geographical and demographical constraints of Kerala have to be considered regarding the RoW and Land acquisition issues. Being Kerala is a very densely populated State obtaining full Right of Way clearance before starting a project is practically impossible. - During the course of project execution, much litigation will be filed In Court against RoW clearance in connection with transmission line construction and land acquisition .for S/S. Final	

	settlement from court takes many years, which is beyond the control of KSE Board. KSEB has proposed to GoK to form a dedicated committee including District Collector, Power secretary and LA &DEO and concerned Dy. CE Transmission for speedy clearance of issues. Please note that power evacuation from none of the Generation were delayed due delay in completing evacuation facility. The 7.5MW Vilangad SHEP is expected to be commissioned by June 2014. The evacuation system is by laying 15km 33 kV UG cable to 110KV substation Nadapuram Cable laying 12.8 KM completed.	

[21] Karikkayam SHEP being developed by Ayyappa Hydro Power Limited
[22] 15MW x 60*per cent* (load factor) x 24 hrs x 365 days

	The geographical and demographical constraints of Kerala have to be considered regarding the RoW and Land acquisition, issues. Being a very densely populated state obtaining full clearance before starting a project is practically impossible. During project execution, much litigation will be filed in the Court against RoW and land acquisition for S/S plot. Final settlement from court takes many years, which is beyond the control of KSE Board. KSEB has proposed to GoK to form a dedicated committee including District Collector, Power secretary and LA &DAO and concerned Dy. CE Transmission for speedy settlement of RoW and land acquisition issues.: **2.1.22** The auditor's observations are based on the Best Practices that has been followed adopted by M/S PGCIL The state utility had commissioned the 220 kV Substation in single or double bus arrangement based on the load to be transmitted and other important	

[1] **Initial capacity of transformers stepping down power from 400 to 220 KVA and 220 to 110 KVA only considered as the rest were sub-transmission which involved further stepping down process.**

Standards/Best Practices in Transmission	Lapses in adherence by KSEB and impact thereof	
Permissible maximum capacity of 220 kV SS shall be 320 MVA {Manual of Planning Criteria (MTPC)}.	Maximum capacity exceeded 320 MVA in five[24] out of 17 SSs. Negative impact on operation/control.	parameters. Hence have substation with single and double, bus arrangements. Since the system load growth is enormous, changing the system feeding arrangement or modification of Bus arrangements is required in many stations. Initial estimates were already taken and it is seen that the modifications require huge expenditure and hence the same can be done only in phased manner being KSEB facing acute financial crunch. The modification of 220kV stations into double bus system and implementing BBPP has already been taken up with SRPC for funding as this may require an amount of around Rs.100 Crore minimum.
In the event of outage of any single transformer, the remaining transformer(s) should supply 80 *per cent* of the load (Transmission Planning and Security Standards).	Not adhered to in eight[25] out of 14 SSs test checked. Reduced reliability of the station. The quality of power supply would be affected in the event of even a partial failure.	
Alternate source of feeding to be available for SSs to maintain supply/avoid failure of the stations in case of failure of one source.	In thirty[26] SSs there were no alternative sources. Reliability affected due to interruptions in the event of contingencies.	Absence of alternative sources in Substations: In all stations 100% back feeding facility available at 11kV level and consumers are not affected. Capacitor bank status is that only 12 capacitor out of 50 capacitor banks are faulty as on 1-
Voltages at SSs to range between 380420 kV, 198-245 kV, 119-145 kV and 99121 kV in 400 kV, 220 kV, 132 kV and 110 kV SSs respectively	Lowest voltages recorded were below the minimum in all 14 SSs test checked (October 2011- March 2012) out of 230[27] SSs. This resulted in corresponding lower voltages for the transformer output/poor quality of supply.	
Capacitors to be operated to manage fall in voltage. KSEB had installed capacitor banks in 38 SSs with a capacity of 996 MVAR.	35 *per cent* (345 MVAR) of the capacitors installed were non-working during the last three years. Working capacitor banks were operated only when directed by SLDC. Resulted in annual loss of ₹4.4 crore[28].	
Power shortages to be managed by load shedding/power cut to reduce consumption of electricity. Tap[29] position of transformers to be raised and capacitors to be operated to increase voltages when there is fall in voltage.	SLDC issued directions not to raise tap position during peak hours despite fall in voltage (Taliparamba, Mundayad SSs). Two SSs (Vadakara & Mylatty) did not raise tap position despite fall in voltage. Non-operation of capacitors was also noticed. Violated provisions of supply code as voltages fell below the prescribed minimum.	

[24] Kalamassery, Pallom, Edappon, Kundara, Pothencode
[25] Panthipara, Pathanamthitta, GIS PH, Kaniyampetta, Kanhirode, Mylatty, Vadakara, Madakathara.
[26] Sultan Bathery, Kuthanunda, Sreekantapuram, Edakara, Nilambur, perumthalmanna, Nenmara, Chittoor, Walayar quarry, Kodungalloor, Mala, Njarakkal, Kochi GIS, Karunagapally, Triveni, Koodal, Ayoor and Vizhinjam (all 66 kV), Punnayurkulam, Irinjalakuda, Melathur, Iritty, Mullena, Cherupuzha, Mannarcaud, Vadakkancherry, Kollemcode, Kozhinjampara, Mallapally, Ranni (all 110 kV)
[27] Of 400 kV, 220 kV, 110 kV, 66 kV voltages.
[28] As per the technical study conducted (August 2011) by KSEB, operation of these capacitors would reduce the transmission loss by 15 MW, saving 2.2 MU worth ₹ 4.4 crore p.a.
[29] A connection point along a transformer winding that allows a certain number of turns with equivalent voltage variation

	03- 2013. Direction has already been issued to Transmission wing for repairing/ replacing faulty Capacitor Bank. The status is regularly monitored from the office of CE (Tr. & SO). About the firewalls, as stated in 2.1.15, construction practice now adopted in KSEB does not includes firewalls in S/S below 220kV. KSEB is in the process of preparing a construction standard in accordance with CEA guide lines and specific requirement of the state. In future Projects firewall construction will be considered. An estimate amounting to 98.5 crore has been approved for providing earth mat, BBPP replacing of old protection equipments and started implementation in phased manner.	

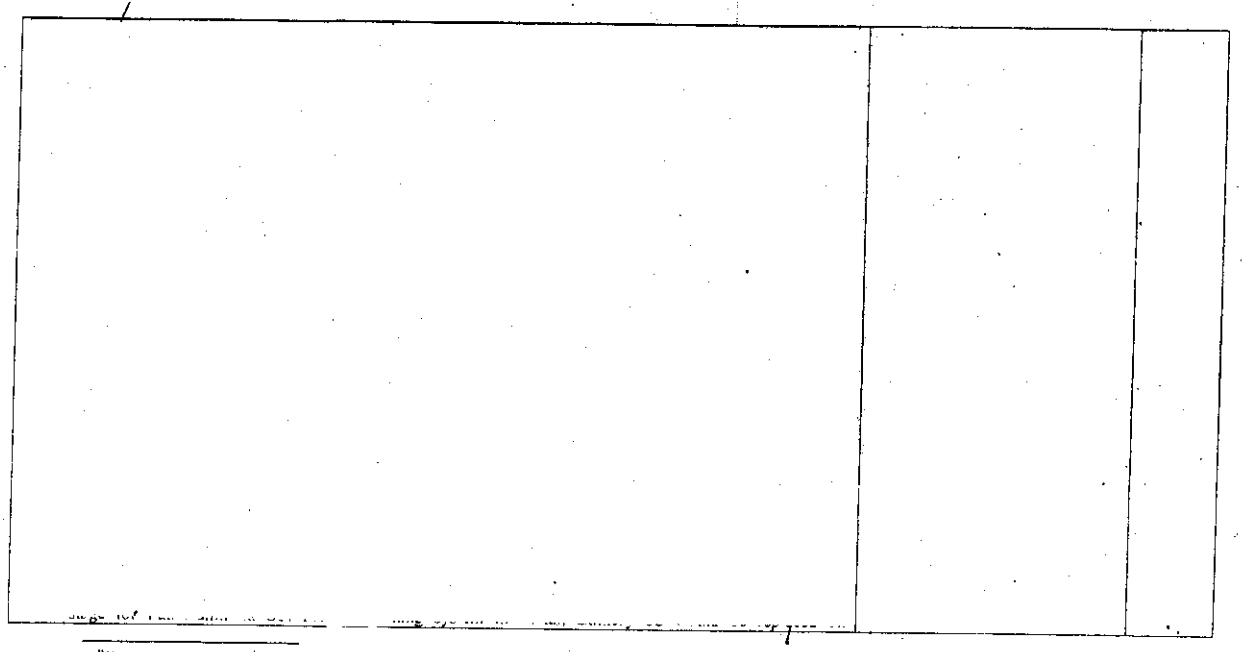
[30] Bus bar is an application for interconnection of the incoming and outgoing lines and transformers at the SS. Bus Bar Protection Panel (BBPP) limits the impact of the bus bar faults and prevents unnecessary tripping by selectively tripping only those breakers necessary to clear the bus bar fault

[31] Nallalam, Poovanthuruth, Kanlambetta

[32] Kalamassery, Thaliparamba, Vadakara, Malaparamba, Shornur

[33] Transformer banks at Nallalam, Kalamassery and Pothencode and at Edapally where transformers have been installed adjacent to each other

[34] West Hill, Nallalam, Kalamassery, Pathanamthitta and Sultan Bathery



[a] Necessary to ensure that the line is not live as there is scope for islanding of the connected Perinad SS evacuating power from Ranni-Perinad project in charged condition after power interruptions
[b] Air based circuit breaker
[c] Manually operated circuit breaker
[d] Melathur, Nilambur, Perinthalmanna, Mannarcaud, Vadakkancherry, Kollengode, Kozhinjampara, Panniyurkulam, Irinjalakkuda and Kodungallur

upgradation of the station which was under consideration.

- In Pathanamthitta, instructions were given to the operators regarding precautions in the absence of PT.

The replies are not justified. The proposals for providing alternate feeding arrangements and BBPP and better earthing facilities remain unimplemented. As against the statement that all efforts were taken to make available the capacitors, the fact remains that about one-third of the capacitors are not working. Regarding reactive compensation, the absence of inter-state lines in North Kerala indicated poor planning. The reasons attributed for non-provision of fire walls is not acceptable as this practice is stipulated in the Best Practices in transmission advocated by the MoP.

Maintenance

Performance of Transformers

2.1.23 As Power and Current transformers are the most important and cost- intensive components of electrical energy supply networks, it is necessary to prolong their life duration while reducing their maintenance expenditure.

2.1.24 Transformer Failures

Transformer failures in 127 out of 350 SSs were analysed during audit based on the data furnished by KSEB. The status of failure of transformers in these SSs during the years 2007-08 to 2011-12 are given in **Annexure 8.** As per the above data, the number of transformer failures and failures within guarantee period for 350 SSs during the year 2011-12 were 17 and three respectively.

Performance of maintenance wings

2.1.25 Maintenance functions on the transmission network including SS was carried out either through the maintenance wings attached to SSs or through external agencies. Usually only routine maintenance was done by the permanent maintenance staff. There are three maintenance wings in KSEB. Testing of equipments for determining/recommending maintenance requirements was conducted by a separate wing called Power Equipment Testing (PET) wing. Testing and maintenance of relays[39] was carried out by the Relay Testing wing. Maintenance and repairs of transmission lines including periodic ROW clearance works was carried out by the Line Maintenance Subdivisions (LMSD). The summary of the operation of the maintenance wings and the deficiencies therein were as follows:

PET Wing	Relay Wing	Line Maintenance Wing

2.1.24 Adequate measures taken to improve the quality while purchasing and warranty period increased to 36 months. Maintainance and monitoring facility also improved.

2.1.25,2.1.26& 2.1.27 KSEB already noticed certain deficiencies in Transmission maintenance wing including strengthening of the testing crews. KSEB has taken steps to strengthen the testing wing and the

[39] Electrically operated switches which sense the system faults and safely switch off the system prior to occurrence of any exigencies

Existing should be completed, technology upgradation

	maintenance wing. In order to ensure the quality of the materials procured and to avoid frequent failures, KSEB decided to make specifications more stringent and in accordance with IEC/IS standards. In connection with the above decision, a special committee has been constituted for revising the specification standards of Substation equipments at par with the standards adopted by CEA. Upon the finalization of standards future procurement will be done based on the new standards and there by system failures will be reduced. Equipment purchase for Testing wing (PET and Relay) has been already initiated from the office	

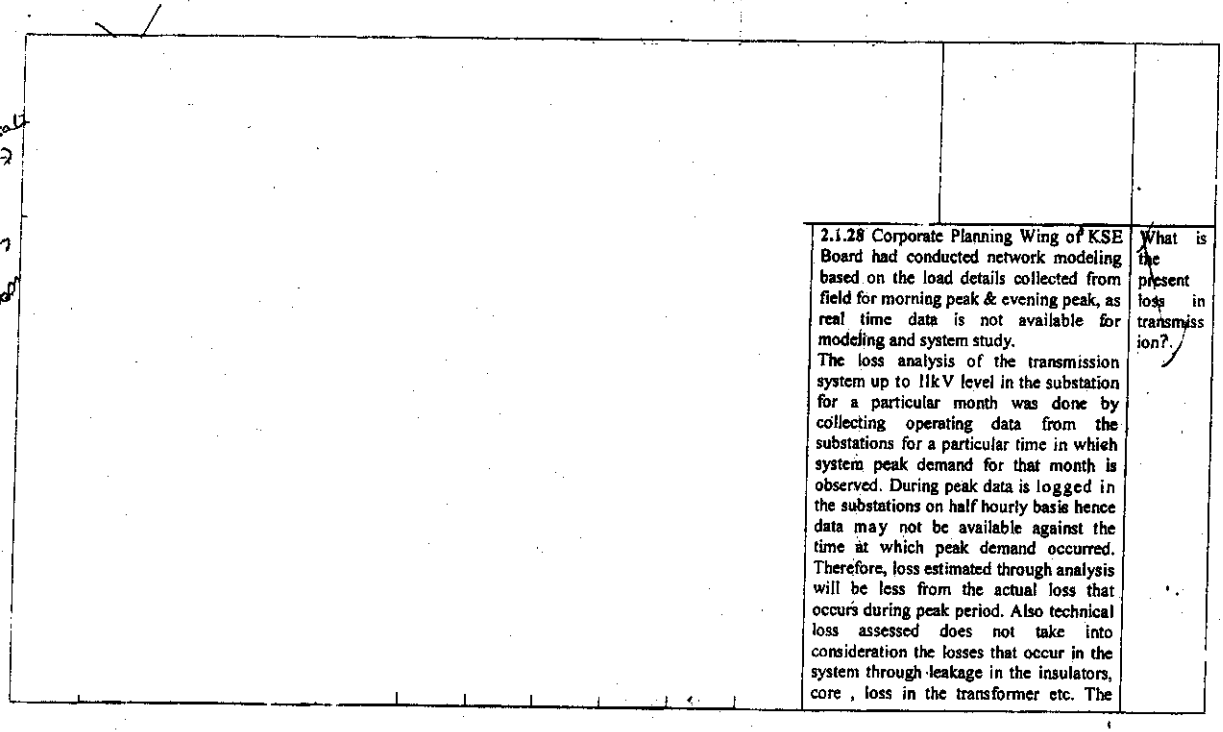
[40] Envisages attending to maintenance works without switching off.
[41] Three units (Kannur, Madakkathara and Edappon) tested only power transformers in SSs till 2009-10s
[42] Fault locators are used to detect the exact location of the fault in long distance feeders.

	of the CE (SCM) and the CE (Tr. &SO). Formations of more testing units (PET) are under the active consideration of Board. Sophisticated and costly equipments are to be procured for the PET wing, which require more time for tendering and procurement. Major criteria affecting the replacement and maintenance of equipment is the unavailability of funds. Board has constituted a Hot line maintenance unit at Kalamassery and action taken for procurement of necessary tools with the help of NPTI Bangalore. We already trained sufficient number of crews for carrying out the Hot line maintenance work. Further the procurement more sophisticated tool	

43 Dew point meter at GIS, Marine drive and Moisture measuring kit at Kalamassery

	and plant is under the active consideration of the Board. Direction already issued to the field maintenance units for the jungle clearance and touching removal in regular intervals and the same is fully monitored now. Instances of delay in repairs: Many of the Protective relays now in service at various Substations are procured 10 to 15 years back.Hence once the relays are faulty there are only two options either repairing the same with original manufacture or replace the same with new relays. In certain cases repairing of old relays are difficult due to lack of sufficient spares or technology advancement.Consideri ng this retrofitting was done in several stations and procurement of	

	relays for replacement have already initiated from the office of CE(Tr. &SO).Also based on _the problem we are facing now the procurement policy has been changed and with each lot of Protection panel one or two set of spare relays are also insisted. Earnest efforts are being taken to overcome the practical difficulties by the Board to carryout timely maintenance in Transmission wing.. Moreover, As stated above major factor affecting the replacement and maintenance of equipment is the financial crunch. The inclusion of spare parts in the purchase order has already been incorporated in the present purchases from SCM	



2.1.28 Corporate Planning Wing of KSE Board had conducted network modeling based on the load details collected from field for morning peak & evening peak, as real time data is not available for modeling and system study. The loss analysis of the transmission system up to 11kV level in the substation for a particular month was done by collecting operating data from the substations for a particular time in which system peak demand for that month is observed. During peak data is logged in the substations on half hourly basis hence data may not be available against the time at which peak demand occurred. Therefore, loss estimated through analysis will be less from the actual loss that occurs during peak period. Also technical loss assessed does not take into consideration the losses that occur in the system through leakage in the insulators, core , loss in the transformer etc. The		What is the present loss in transmission?

	system loss calculated / estimated is highly dependent on the point of injection / generation availability in the system. Non availability of internal generation coupled with the fact that almost 40% to 50% of the demand is met through import of power due to difficulties in setting up new power projects in State has also resulted in increased losses when compared with CEA norms. The system study shall be done correctly based on real time data under various load conditions as well as season. Real time data will be available after completion of up gradation of ULDC. And RAPDRP scheme. The new system will have the facility to import real time data and there by loss calculation can be done more accurately. At present AT&C losses are being calculated based on billing & collection efficiency of the utility, which cannot be considered as a scientific step.	

[#] Valued at average realisation per unit
[*] 2010-11 rate

	2.1.29 Up-gradation *of* SCADA system is *progressing in war* footing *basis* and installation works will be started by *August/Sept.* 2013. The work is *scheduled to* complete by March 2014. UI cannot be eliminated on real time Grid Management. Kerala Grid is being operated as per the existing rules and in some exigencies, overdrawal might have happened. SRPC had organized a meeting on 9th. Jan. 2013 to explain about FGMO/RGMO issues of SR constituents. SRPC	

[46] absence of back up for the data, absence of a metering interface, limited coverage, use of old transducers for transmitting data etc.

			appreciated correct operation of Generators at Idukki,Lower Periyar etc.

47over-drawl more than 50 MW or 10*per cent* of schedule whichever is less

48over-drawl between 50 and 200 MWs for more than ten minutes or 200 MW for more than five minutes

49 issued 15 minutes after the issue of message B when over drawl is more than 100 MW or ten *per cent* of the schedule whichever is less

i access up to one month at one time
ii access for 3 months to 3 years
iii access for 12 years to 25 years

Disaster Management **2.1.30** 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	**2.1.30** Inadequate facilities for Disaster Management: Black start and Mock drills are part of the Disaster Management, which is being carried out as per the existing regulations. KSEB has developed plans and procedures for restoration of the system from blackout for 13 generating stations.	

	At the same time, presently available facilities in 9 generating stations are more than sufficient Safety cell and Safety officer has been nominated in all Power Stations as a part of the DM programme. In addition, 3 Islanding scheme operation of Kerala Grid has been studied and submitted to SRPC. Technical , requirement for Islanding operation has been studied and proposal submitted for implementation. Also Board had taken several steps for setting up of a separate Safety Wing headed by a Chief Engineer, and assigned safety officers in each station for carrying out the day to day activities. More over the State Government had constituted district level Disaster management Cell which includes the Engineers from KSEB for meeting the contingency situation in the utility too. In addition to above ISO 9001-2008 certification has already been awarded to the three major Power Houses of KSE Board, viz, Idukki Gen. Station, L.P. Gen. Station & Sabarigiri Gen. Station. Steps are being taken to obtain ISO certification in all other Gen. Stations. **2.1.31** Black start and Mock drills are part of the Disaster Management, which is being carried out as per the existing regulations. KSEB has developed plans and procedures for restoration of the system from blackout for 13. generating stations. At the same time, presently available facilities in 9 generating stations are more than sufficient Safety cell and Safety officer has been nominated in all Power Stations as a part of the DM programme. j In addition, 3 Islanding scheme operation of, Kerala Grid has been studied and submitted to SRPC. Technical requirement for Islanding operation has been studied and proposal submitted for implementation.	

[33] procedure necessary to recover from partial to a total black out

	2.1.32 For the Regional Energy accounting, energy meter reading of SEM .meters (Interface Meters) installed by the CTU (PGCIL) is being used. All the SEM meters are of 0.2 class of accuracy. Hence, there is no deficiency in metering system on power import & export. Presently KSEB has not segregated precisely the transmission loss due to number of problem/ deficiencies. The AT&C losses are being computed manually with available E/M readings. The E/M installed in the 11 kV Feeders and Boarder meters are changed with TOD meter of accuracy class 0.5.' Majority of the E/M commissioned in the EHT feeders are of Electromechanical/ static with accuracy class 1. More over the Accuracy class of the CT/ PT units .provided is also of class 1 or 0.5. Action taken to replace the EHT feeder meters with better accuracy class of 0.5S/ 0.2S. For the total replacement of instrument transformers and Energy meters cost involvement is very high and" also time consuming. This work can be carryout only in phased manner. After the completion of total modification the Transmission losses can be computed more precisely.	

[1] Trivandrum, Kannur, Pallivasal

2.1.33 It is true that one of the objectives of the National Electricity Policy is financial turnaround and commercial viability of the Electricity sector. However, the Policy does not envisage unbundling as a measure to achieve this objective. The Government is taking steps for corporatization of the KSEB by converting it into a fully owned Government company under the Companies Act, 1956. The policy of the State Government is to retain KSEB as a single entity even after corporatization, and the Government does not intend to unbundle it into separate companies. However, it is proposed to create separate Strategic Business Units (SBUs) for Generation, Transmission and Distribution within the company to promote functional and financial independence for the three sectors.

2.1.34 The percentage of increase in per unit cost compared to previous year is as follows:

	2008-09	2009-10	2010-11	2011-12
Fixed cost	8.33%		15.38%	
Variable cost	-	5%	-	

Total cost	7.14%	6.66%	12.5%	

It may be noted that the major part of unit cost is fixed cost which consists of Employee cost, Administrative and General Expenses, Depreciation and Interest and finance charges. These expenditures will increase on account of inflation and other factors such as DA increase,; increase in schedule of rates etc on which the. Board had no control. The percentage of D.A increase which is linked to the inflation, during the above said period are as follows:

Year	D.A increase
2008-09	7%
2009-10	15%
2010-11	18%
2011-12	15% \

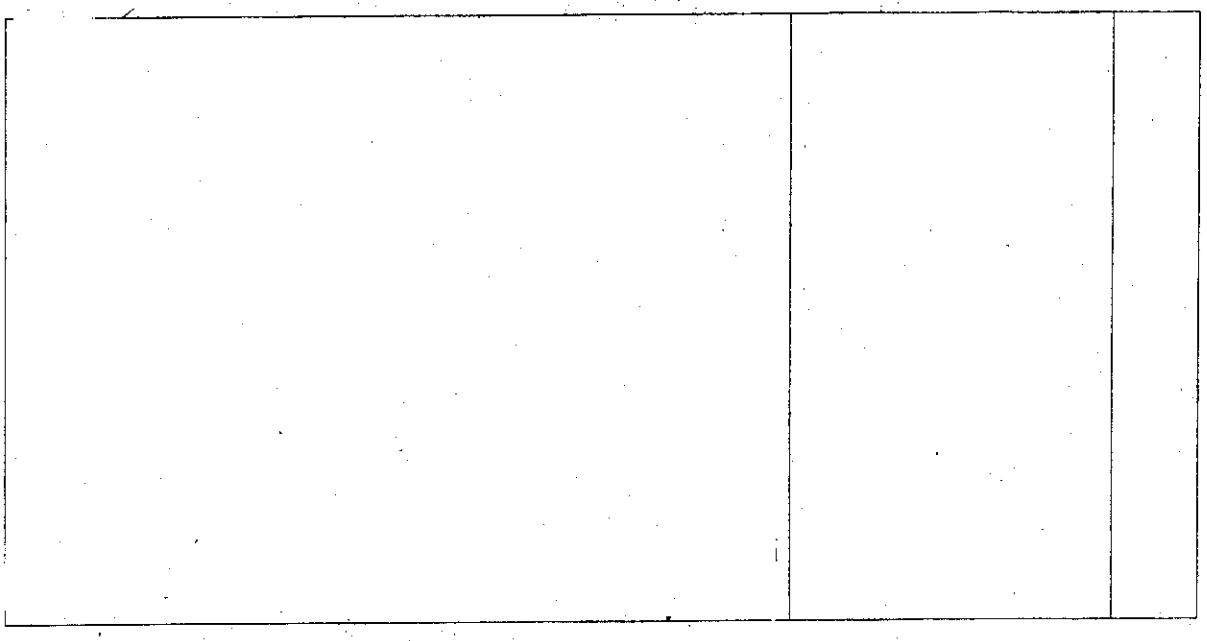
Similarly average increase in PWD Schedule of Rate for labour engaged in contract works are also linked to inflation. The average rate of inflation during the above said period is as follows:

Year	Average inflation
2008-09	12.32
2009-10	10.53
2010-11	8.42

		2011-12 9.90 Even In the above scenario KSEB was able to achieve reduction in per unit cost through efficiency in operation. **2.1.35** Compensation for unavailed power - Rs. 0.41 crore About 135 MW of ER power was allocated to TNEB for pooling with RGCCPP Power. However from September 2011, TNEB decided not to avail RGCCPP power as well as ER power. So the ministry of power allocated the ER power to Kerala for pooling with RGCCPP power as Kerala was the only beneficiary of RGCCPP power. The communication regarding this was received at SLDC on 14.09.11. As scheduling of ER power involved huge financial implication, a Board level decision was required. In practice this required some time, but SRLDC required an immediate reply for day ahead scheduling of 15 09 2011, hence after telephonic discussions with all higher officers a message was conveyed to SRLDC by the SLDC operator that KSEB at present had decided not to schedule ER power, as there were good rains at that time and power position was very good. It was a temporary decision. A final	

ies is

	decision needed evaluation of many parameters. Later as Kerala was not scheduling the power, MOP reallocated this power to Andhra Pradesh from 21.09.2011 as that state was facing acute power shortage but Kerala had to pay the transmission charges for the unavailed ER power for 6 days.	



[55] ₹ 1275943.24 (subsequent price quoted) — ₹1179135.90 (original price quoted by Cable Corporation of India, Chennai) x 31 km

The transmission charges are computed by SRPC based on allocation of power by MoP and not on scheduled quantum of power. Hence KSEB had represented to SRPC and PGCIL, the financial loss of Rs.41,23,505/- on account of this, whereby instructions were received to represent the matter to the Ministry of power. The matter was addressed to the director, MoP, Government of India from the office of the CE (Comml. &Tariff) twice, i.e. in the month of November 2011 and may 2012 respectively, but till date no reply was received in this regard. So it can be concluded that

1. It was not practically possible to out rightly deny the allocation, as the matter required a Board level decision and this naturally involved some time.
2. The communication given from SLDC to SRLDC is regarding day ahead scheduling only and it is not a rejection of allocation of ER power.

Share in capitalization of idle infrastructure - Rs. 13.28 Crore

It may be noted that whenever a new generating station in the Central sector is planned, it is the responsibility of the Central Transmission Utility (currently PGCIL) to develop the transmission system for evacuating power from such central Generating Stations based on certain approved procedures. The Transmission tariff of such assets is being determined by Central Electricity Regulatory Commission (CERC) and it has to be shared by beneficiaries of that asset. Usually the commissioning of generating stations gets delayed due to various reasons beyond their control. But the Transmission system associated for evacuation from these stations gets commissioned within the time schedule. CERC usually allows declaration of Commissioning (CoD) of such transmission systems even though the generating stations for which it was made are yet to be commissioned. Once the declaration of the generating stations for which it was made are yet to be commissioned. Once the declaration of CoD of the transmission system is made, beneficiaries have paid the transmission charges that date onwards.

In this case Koodamkulam evacuation scheme was approved in the standing committee meetings and SRPC meetings. As far as Kerala is concerned, there are two paths for getting Koodankulam power. They are Koodamkulam Tirunelveli - Pallikara Madakkathara and, Koodamkulam- Thirunelveli - Udumaipet- Madakkathara - Pallikara. Due to right of way problems PGCIL has not been able to complete the Edamon - Pallikkara portion. They have completed all the other portions. After investing huge amounts in transmission sector, it is natural that PGCIL has to get sufficient, returns., Non completion of downstream lines by KSEB is not a reason for denying the legitimate claim of PGCIL. Surrendering the right of way of Idukki Madakkathara line is a policy decision of KSEB. In Kerala getting Right of way is a serious issue. KSEB made the decision to surrender the Right of way in the hope that 400kV line from Thirunelveli to Madakkathara and 400kV line from Mysore to Areacode will be of great advantage in transmitting power all over Kerala. But unfortunately both the works are held up due to unexpected issues.

Kindly note that the third ICT at Pothencode is not a spare transformer. As a part of Koodamkulam evacuation scheme, proposals for a third transformer at Pothencode, Udumalpet and associated lines were approved for the Southern region after deliberations in various committees and forums. After this PGCIL obtained investment approval and subsequently they executed the works. Once the works are completed, PGICL will approach CERC for finalisation of tariff and based on CERC order bills will be raised by PGCIL.

Due to various reasons, the demand growth may not tally with the assumptions made at the time of planning but this cannot be used as a yardstick to classify the third ICT at Pallaippuram as a spare transformer.

An amount of Rs. 7,18,00,045/- has been paid to M/s PGCIL towards the Transmission tariff for 315 MVA 400/220 kV ICT-III at Trivandrum sub station with associated bays and equipments (DOCO:01/07/2009) for the period from July 09 to June 11 vide debit note dated 01.08.2011. As per CERC order dtd. 20.07.2011, the Annual Fixed Cost for this particular asset for the FY 2009-2010, 2010-2011,2011-2012 are Rs. 2,49,78,000/-, Rs. 3,48,30,000/- and Rs. 3,55,77,30/- respectively. More over, variation in Transmission charges, FERV, MAT and interest claims have also been claimed for all assets through PoC bills. However as per CERC sharing regulations, the point of connection (PoC) regime became effective from 01.07.2011. Under this methodology .of sharing of Transmission charges and losses, the transmission charges of the assets are being included under Point of Connection charges and are billed accordingly from July 2011 onwards. Computation of PoC charges for generation and demand zone has been fixed by CERC based on the implementing agency study on the basis of network data and assumptions and load flow studies which are not within the scope of the Designated ISTS Customers (DIC). Hence the monthly PoC charges pertaining to a particular asset within the region cannot be determined from July 2011.

PGCIL had made a proposal in the SRPC meetings for having sufficient spare ICT's for the Southern regions. KSEB and TNEB insisted that one spare transformer is enough for the entire region. But Karnataka and AP favored for having one transformer each for all states. So SRPC forum decided to have only one spare transformer for the southern region.

KSEB dues not collected

BPCL-KR was an EHT consumer availing 20MVA power at 66kV level. As per the request of the firm Board accorded sanction for allocation of 40MVA power to them at 220kV level and for construction of 220kV substation in their premises directly by the firm, on behalf of KSEB in the land offered by them as per Board's requirement. Accordingly MoU was executed with the firm on 01.02.2010. .

The 220kV substation at BPCL -KR was commissioned during May 2012. Agreement between KSEB and BPCL-KR for availing 40MVA power was executed on 02.05.2012. A draft O&M agreement to be executed between KSEB and BPCL-KR has been sent to the firm for scrutinizing and incorporating suggestions if any. The same is being verified by their legal wing. Even though the O&M agreement is not yet executed, the firm has remitted an amount of Rs.2,35,81,710/- towards the O&M expenditure .in 2012-13 vide receipt No. 179/1318 .dtd.25.06.2013 at Transmission circle office, Kalamassery as per Board's request.

M/s Airport Authority of India (AAI) has constructed one 66 kV Substation at International Airport, Thiruvananthapuram which was executed by KSEB on deposit work basis for availing energy from KSEB at EHT Tariff. The substation was, commissioned on 6-5-2010. Sanction was accorded vide Board Order B.O (FM) No. 855/2010(TPC2/IV/144/06) dated 30.03.2010 for the draft agreement to be executed between M/s AAI and KSEB for claiming the operation and Maintenance (O&M) charges of the 6£ kV Airport Substation from AAI based on the CERC norms.

Later conceding to AAI's request, the clause regarding advance payment was amended vide Board order B.O.(FM) No.1492/2010 (TPC2/IV/144/06) dated 08.06.2010. But M/s AAI had not turned up to execute the agreement and further demanded amendments in certain other clauses also. Based on the discussion held on 26.08.2011, the revised draft agreement incorporating modifications in clauses as requested by them has been submitted and requested concurrence for the same.

The operation and Maintenance agreement (O&M)executed during 2011 for a period of two years ie, from 06.05.2010 (the date of commencement of commercial operation of the newly constructed . 66 kV Substation, Airport) to 05.05.2012, there after the agreement is to be

renewed on mutual consensus. Lump sum amount of 2.36 crores paid during April 2012 and July 2012. Thereafter the O&M charges are being paid to KSE Board by M/s. Airport Authority regularly.

O&M agreement for the period 06.05.2012 to 05.05.2013 has been executed and an invoice amounting to Rs. 1, 40, 30,864/- has been issued against which they have remitted Rs.1,20,57,399/- (ie, amount up to March 2013, 02/2013- Rs.98,30,943/- and 04/2013- Rs.22, 26,456/-). Being a deposit work, statement of accounts for final settlement has not been finalized till now. Both being a Government department, levying of interest on O & M charges is not justifiable. The present O&M agreement has been expired on 5th May -13 Now the Airport Authority is preparing to execute new Agreement for the next year. Also please note that the O& M charges up to March -13 has been remitted to KSEB and the balance payment remittance under progress.

2.1.36

a. Excess procurement resulting in idling of costly equipment

At present, a Purchase Plan is prepared based on the requirement from field. For preparing the Purchase Plan, total material requirement is calculated as per planned work. • Material available at Stores and material under pipeline is deducted to arrive at the actual requirement. The purchases are limited to the quantity as per purchase plan. Strict direction has been given to all officers to avoid idling of spares.

For costly items like power transformers, the purchase is arranged only for the specific requirement from the concerned Board Member/Chief Engineer.

b.Disposal of obsolete inventory

For speedy disposal of obsolete inventory, Board had implemented E-Auction vide Board order dated 14.10.2011. The following items were included in the E- auction is simpler and more transparent and now being carried out from this office on a war footing.- Aluminum conductors, copper, scrap copper power cables, scrap distribution transformers with copper winding scrap distribution transformers with aluminum winding, copper winding scrap, Aluminum winding scrap and scrap power transformers. Direction has been given to all concerned to achieve the objective of zero scrap in KSE Board.

An approximate amount of Rs 19.9 Crore was realized through E-Auction till date.

c.Delay in finalisation of purchases resulting in lapse of offer

Utmost care is taken to avoid instances of delay in finalization of purchases resulting in lapse of offer and to issue the purchase order with in the validity period. However, in some cases time extension is required for finalizing the tender, since clarifications are required. E- tendering is also started.

2.1.37 Earlier Power transformers were procured based on the request collected from the field and based on the progress of the project. In certain cases the manufacturers supplied the transformer ahead of the time schedule and within the time. Hence transformers reached the site earlier occurred. More over even if the transformers were commissioned, the line work may get delayed due to litigations which also affects final energization. Now the procurement procedure has been modified by the implementation of SCM software. The materials delivery at site is affected only at the right time. More over the Guarantee period of the power transformer has been increased to 36 month from 18 month after supply.

The Board had accorded sanction to procure 4 Nos. of 66.67 MVA 220/110 kV transformers from M/s.TELK in connection with the construction of 220 kV Substation, Kundara. Accordingly Purchase Order No. TCM/24/2007-08/645 dated 17.05.2007 of the Chief Engineer (TCM) was placed with M/s.TELK for supply of 4 Nos. 66.67 MVA, 220/ 110 kV Transformer. Subsequently Board had directed to divert the transformers infended for Kundara Substation to 220 kV Substation, Pothencode in view of the requirement of strengthening the EHT network of Thiruvananthapuram city. The transformers were supplied by M/s.TELK from October 2007 to February 2008.

Board had sanctioned the estimate for capacity addition at Pothencode Substation by the end of December 2007 and foundation works were awarded to the contractor during the month of March 2009 after PQ evaluation. The site leveling work started during January 2008 and retaining wall was completed during August 2008. Thereafter cable trench work, equipment erection work etc. was tendered and awarded. Execution of the above works had taken more time due to various site problems and climatic conditions viz. heavy rain, soil condition at Substation (very silt), lack of availability of river sand, quarry strikes, shortage of certain' materials especially 220 kV disc insulator etc. Due to the above problems, commissioning of 66.67MVA Power Transformers at Pothencode substation could be materialized on 27th November 2010 only.

The Board had accorded sanction to enhance the quantity in previous order dated 17.05.2007 from four to seven numbers for capacity enhancement at3 kV Substation, Kundara. Accordingly Purchase Order No.TCM/56/07-08/1494 dated 28.06.2008 of Chief Engineer (TCM) was placed with M/s.TELK for supply of 3 nos. 66.67 MVA, 220/110 kV transformer. The transformer reached the site of 220 kV Substation, Kundara by the end of January 2009. The erection work of transformer was tendered and work order issued in April 2009. The transformers were erected in position after dismantling and shifting the existing 3x66.67 MVA transformer from the plinth. The erection work of 3x66.67 MVA transformer and accessories and oil filtering etc. were completed during July 2009 except secondary side CT erection, testing and terminal connection. Secondary side CT (1200 A, 110 kV) was faulty and the same was replaced. After CT replacement, the transformer was put ready for commissioning by the end of January 2010. The transformer erection work was completed with in a span of 6 months from the date of receipt at site. The commissioning is delayed for want of replacement of faulty current transformer.
After rectifying the defects, the transformer was commissioned during February 2010 ie., within the guarantee period. Hence the transformer was not kept idling at Kundara Substation and delay occurred is only accidental and there was no lapse of any kind.
The transformers were purchased as per the Purchase Plan approved by the Board. Normally the procurement process of transformer takes a long time around 8 to 10 months. The manufacturing companies will start manufacturing only after getting specification and purchase order from the buyer. Hence the power transformers are procured in a lot according to our target fixed and since it has to be available at site. More over the power transformers are not readily available in the market as such. One of the pre-requisite for commissioning of power transformers is drawal of electric lines which involve different hurdles like solving litigation and civil suits which are beyond our control. This is one of the major reasons for undue delay in commissioning of transformers.
The minimum expected life of a transformer is 25years. Therefore while maintaining purchase of such items, greater importance is given to

proven records. Board is expecting very long trouble free life span for the power transformers. Most of the firms attended the complaints even after expiry of the guarantee period free of cost or with a small service charge. They have also replaced faulty accessories free of cost. Hence, loss of benefit of the warranty period does not arise.

Now, utmost care is taken in purchasing the costly items like power transformers by coordinating with the transmission wing and periodical review meetings are held td ascertain the progress of work.

2.1.38 Numbers of procedures are involved in the finalization of tender. Communication delay and circulation in various offices for comments is creating very much delay in all procurement activities. All the above delay happened due to strict complains of the Government procedures and may be treated as administrative delays. Revision of Delegation of Powers and streamlining the procurements activities are under the active consideration of the Board and Government.

2.1.39 A committee with six Engineers was constituted on full time basis to standardize, classify and codify the materials procured by the KSE Board. The committee was divided into two groups for carrying out the work in distribution and transmission. The functional group has completed the following tasks and submitted the reports.

° Naming, grouping and coding of equipment materials

° Standardizing Transmission and Distribution works

The Supply Chain Management software was rolled out in the Distribution wing from 1.4.2011.

As the tasks are completed only partially in the Transmission wing, a supporting team of three field engineers from transmission wing were constituted vide B.O. (M (T&GO)) No.2284/2011 CE (SCM)/XM/ SCM-Consultancy/08-09 dtd 23.09.2011 for the completion of Transmission Master Data for the Supply Chain Management Software, resolving implementation issues such as addition or modification and fine tuning of tasks, materials, coding, classification etc. The Master Data finalized by this supporting team has been forwarded to RITU, Kochi for further necessary action and the same is being verified by the IT team for incorporating the same in the SCM software.

It is decided to implement the SCM software fully in transmission wing after rectifying the teething problems encountered in the Distribution wing;

	The technical audit team is conducting auditing of substations in addition to the normal functions and duties so It is not possible to conduct the auditing of all stations yearly. The recommendations of the team for replacement of equipments or other modification , can be implemented timely, based on the financial situation However office of CE (SO) is monitoring the adherence to audit team suggestions by Transmission wing. .To improve the accuracy of load flow study Board have acquired a real time software as a part of SCADA upgradation scheme and a group has started functioning in the office of CE (Tr.SO). Also the Board had award contract for the total computerization of all the activities and it is in progress. Once the same is completed all the system information can be made available through Dash Board and MIS. The monthly analysis of the Monthly Operating Review(MOR) received from the substations are carried out by the System Study wing for assessing the under loaded / under utilized/over loaded transmission elements and recommendations / reports are generated for rectifying the same. Further system wise voltage profile analysis are also being carried out for identifying low/high voltage pockets and status of capacitor banks in the substations. Actions are also initiated for identifying the faulty capacitor banks and new requirements / rearrangements of capacitor bank installation through the analysis. Monthly Operating review of substations are also used for identifying the status of energy meters and attempts are being made for assessing the loss through energy accounting. As per the audit	

[56] Maintenance activities carried out, urgent maintenance pending, programme of maintenance activities, the dates of major maintenance activities etc
[57] On Load Tap Changer
[58] Vennakkara, Veli, Neyattinkara, Vizhinjam, Kollandy , Perinthalmanna and Paika.

	findings/recommendations action is also being taken for modifying the MOR format for collecting data on the performance of the substation batteries, relays, important maintenance activities/breakdowns etc .Efforts are already underway for creating a web based system for collecting MOR from substations and creating a database for analysis purpose. Removing of Capacitor bank from Mundayad S/S and installation at to Kaniyampetta S/S is under progress. The Capacitor bank is already delivered in Kaniyampetta S/S for installation works. Pothencode S/S & Attingal S/S: The deficiency at Pothencode and Attingal substation has been rectified. Now two numbers of 110 kV Feeders available from Pothencode to Attingal after the capacity enhance work completed on 11/2010 **2.1.41** Action is being taken to rearrange the shift timing as follows with effect from 1st April 2013: 1st Shift : 7Hrs-13.30Hrs, 2nd Shift : 13.30Hrs - 20.30Hrs. & 3rd Shift :20.30Hrs.- 7.00Hrs.considering availability of transportation facility. However, CEs are authorized to change the shift timings if required in specific incidents with concurrence from Member (T & GO). **2.1.42** The standards adopted by CTUs cannot be adopted as such by STUs because of several factors. For PGCIL the funds availability is not a constraint. The decision making procedures related to tendering and construction is very much simplified. RoW issues are not severe as in Kerala due geographical advantage. Within Kerala even PGCIL could not complete	

[3] which provides a spare breaker and related bay equipment for sharing among the buses .

work in time due to RoW related issues. Construction of Evacuation lines from 400kV Pallikkara -Edmon S/S is a typical example. Also the bay wise expenditure of PGCIL is several times more than that of KSEB. PGCIL is replacing power equipment at the slightest deviation from standard value. This involves huge investment.

Certain schemes like one and a half breaker scheme is essential for 756kV &400kV system, it is not relevant to. KSEB, since our stations are of lesser voltage level. .

Always compelled to go for lowest tenderer is detrimental to quality work execution in several instances.

Even if KSEB is eager to adopt the best practices in Transmission but the huge amount required for this is a hurdle.

2.1.43 As mentioned in the audit report, one of the objectives of the various legislations and policies including the Electricity Act, 2003 promulgated by the union government is the financial turnaround and commercial viability of the electricity sector in the country., However, the Electricity Act does not mandate unbundling as a measure to achieve this objective.

Government of Kerala is taking steps for corporatization of the KSEB by converting it into a fully owned Government company under the Companies Act, 1956. The "policy of the State Government is to retain KSEB as a single entity even after corporatization, and the Government does not intend to unbundle it into separate companies. However, it is proposed separate Strategic Business Units (SBUs) for Generation, Transmission and Distribution within the company to promote functional and financial independence for the three sectors. ; As part of the restructuring of KSEB,

[96] Kalamassery, Brahmapuram, Nallalam, Pothencode (facility available at 220 kV side only at Pothencode)

	the' assets and liabilities of KSEB had been vested with the State Government as per notification dated:. 25.09.2008. These assets and liabilities are to be re-vested in a company incorporated under the Companies Act, 1956. A company namely, Kerala State Electricity Board Limited, was incorporated on 14-01.2011 for this purpose. The transfer scheme for re-vesting prepared by the consultant is under consideration of the Government and will be notified once the modalities are completed. The audit report mentions that the restructuring and creation of separate utilities would have enhanced the efficiency/performance of KSEB. In this context, it is to be noted that even as a composite entity, KSEB is performing much better than most of the unbundled utilities in other states, which is evident from the performance reports published regularly by the Ministry of Power and other agencies. As such, the essentiality of unbundling is a debatable question as far as performance improvement is concerned.	
	2.1.44 Audit comments in this regard are duly noted and steps have already been taken to streamline and strengthen the internal audit department to cover all major functions and activities of the KSE Board. A qualified and experienced professional (Chartered Accountant) has been recently appointed to the position of Chief Internal Auditor.	

Sl No.	Para No.	Paragraph	Statement
1	4.10		The Board had entered into a contract with M/s. Arun Manufacturing Company Limited for the purchase of various sizes of control cables and purchase order was placed with them on 14-2-06 with a total contract value of Rs.1,46,04,131/- on firm price basis. The delivery schedule as per the purchase order was to commence within two months from the date of purchase order and complete it within six months thereafter. M/s. Arun Manufacturing Company Ltd. had offered 20 km of control cable ready for inspection vide letter dated 25-3-06. But the inspection was offered before executing the contract agreement. So inspection was not arranged. As per purchase order condition Annexure II clause 5 &6 Agreement is security Deposit, the contract agreement along with Bank Guarantee towards security deposit should be executed within 15 days from the date of purchase order ie before 29-2-06. But the firm furnished the contract agreement on 27-4-06 which was executed on 29-4-06 and the copy of agreement was forwarded to the firm on 04-05-06. The Board could arrange for inspection only after the execution of contract agreement. It was the responsibility of the firm who had committed delay in submitting the draft agreement. Even after offering the material for inspection on 25-3-06, the firm had asked for amendment to the technical specification of the cables vide their letter dated 27-3-06. If the firm had manufactured the control cables before 27-3-06, they would not have asked for amendment to the technical specification.

		The Board extended (4 August 2006) the delivery schedule upto 14 February 2007 without imposition of penalty. AMC, however, did not supply the material. Consequently, the Board terminated (November 2006) the purchase order placed with AMC and arranged (March – May 2007) purchase of 151 kms of control cables through two other suppliers at an additional expenditure of Rs.1.39 crore at the risk and cost of AMC, which was not accepted (27 July 2007) by AMC. Thus, the undue delay on the part of Board in conducting inspection of materials provided by AMC and subsequent termination of the purchase order resulted in procurement of material from alternate source at an additional cost of Rs.1.32 crore. The Management stated (April 2008) that delay in inspection was due to delay in execution of agreement by AMC and steps were in progress for recovery of Rs.1.32 crore from AMC. The reply is not relevant to the point as the execution of agreement was a pre-condition for payment and not for conducting inspection of material. The delivery was to begin within two months from the date of purchase order and AMC had intimated readiness of materials in time	Even though the firm had intimated readiness of materials for inspection on 25-3-2006, it is understood that the materials were actually not ready since the firm was seeking technical clarifications vide letter dated 27-3-2006. Besides, the firm had not executed the agreement as stipulated in the purchase order at the time of offer for inspection. The Board could count the inspection offer from the date of execution of contract agreement only. The firm could furnish the agreement only on 27-4-06 and the same was executed on 29-4-06. The inspection of materials was conducted by Board's representative at the firm's works on 22-5-06 ie after 24 days from the execution of the contract agreement. As per clause 12 of the purchase order, advance information of less than 20 days had to be given by the firm regarding readiness of materials for inspection. The store purchase manual also insists execution of the agreement. The store purchase manual insists that the consignment need be sent by the firm only after execution of the agreement. Moreover, if any firm despatches the material before execution of the agreement, they should be held for the demurrage charges, if any. Hence, there was no delay on the part of the Board in inspecting the materials. Thus, the purchase order placed with M/s. Arun Manufacturing Company was cancelled at their risk and cost and fresh tender was invited. Subsequently purchase order was issued to M/s. Traco cable company, Kochi and M/s. SBEEE Cables, Bangalore. The additional financial commitment to the Board in this regard is Rs.1,38,95,963/-. So Bank guarantee for an amount of Rs.7,30,250/- in lieu of Security Deposit furnished by M/s. Arun Manufacturing Company Limitesd was encashed and credited to the Board's amount. Vide letter dated 24-8-07 it

		for inspection. The Board also had the option of withholding payment in the event of non-execution of agreement.	was intimated to the firm to remit the balance amount of Rs.1,31,65,713/- on or before 21-8-07 failing which the Board will be constrained to take legal action to realize the said amount. Since the firm failed to remit the amount, Revenue Recovery action was initiated through the District Colletor, Thiruvananthapuram. But the Disgtrict Collector, Thiruvananthapuram had intimated that since the firm is situated in Delhi, the RR action shall be initiated through District Collector concerned. Hence it was intimated to the District collector, Seemapuri, Delhi on 22-8-08 to initiate RR action proceedings against M/S. AMC for realizing the amount of Rs.1,31,65,713/- plus interest @12% per annum till the date of realization from the firm. Reminder letters dated 16-12-08, 19-10-09 were also sent. The Resident Engineer, Liaison Office, Kerala State Electricity Board Travancore House, Delhi was also intimated for follow up action and report. The matter is again pursued and reply awaited. Considering the fact that there was no undue delay on the part of the Board for the inspection of materials and the Board is taking all out effort to realize the amount from the firm, the audit may consider dropping the para.

Sl. No.	Para No.	Paragraph	Statement
	3.9		Most of the observations in the audit report relate to the time and cost overrun of various transmission system improvement schemes implemented by K.S.E.Board. Though these observations by the audit are true to some extent, there are various reasons that caused the delay in completion of schemes. The Board prepares the five-year plans and annual plans taking into consideration the anticipated demand growth in different regions based on projections and power surveys as well as to reduce losses and to improve the quality of power supply. While preparing the plans, it is normally expected that the proposed schemes can be implemented without much difficulty, though some margin for contingencies are taken into

	3.11	of the schemes (works taken up were financed by Rural Electrification Corporation Audit analysis revealed as under:	account as is the case with any infrastructure project. In majority of cases, the projects could be implemented and put to use within schedules while some schemes get delayed due to various reasons such as delay in getting various clearances, difficulty in land acquisition, litigations, contract failures, right of way problems etc. The construction and commissioning of a transmission scheme depend on many factors such as availability of land at desired locations, obtaining route approval, timely availability of materials, absence of litigations, efficiency of contractors etc. In a State like Kerala, where the population density is very high, it is very difficult to obtain lands at ideal locations especially in towns and cities, where the load centers are situated. People are normally not willing to part with the land in their possession even if they are offered market rates. Even if we

			resort to forced acquisition through revenue authorities, this may result in litigation and is time consuming. Further, transmission line construction being the most tedious process in view of the fact that it affects large number of people who own and occupy land in the right of way, also result in delays. There may be hundreds of court cases relating to disputes over land acquisition, tree cutting compensation, property crossing etc. in a transmission scheme. The delay in implementation of some transmission projects may be viewed in the above background. The audit has observed that no effective corrective actions were taken by the Board to address the problems/ bottlenecks in implementation of plan schemes with a view to facilitating timely completion of the projects. This observation by audit may be due to oversight and is contradictory to facts. The

	3.12	Additional revenue due to reduction in transmission and distribution loss stable other locations substation works were held up for want of	implementation of each and every plan project is closely monitored by the Board at various levels and appropriate corrective action is taken for removing the bottlenecks. Periodic review meetings are conducted by higher officers of the Board at the site offices as well as at headquarters (Division/Circle/ Region). In addition to this, monthly progress reports are sent to the Board, which is reviewed in the Planning and Monitoring Wing and submitted to the Board Members for their information and intervention, if needed. The Board Members concerned also convene regular review meetings with the field officers at site as well as in head quarters to review the progress and suggesting corrective actions. To monitor the progress of works more effectively, the Board has now implemented a computer based spreadsheet application at the field offices

	3.13		and in various head quarters. This application has improved the effectiveness of data collection and transmission to various offices and helped in close monitoring of minute level activities. To overcome the difficulty in arranging materials required for different projects at various locations and to streamline the material planning and procurement system, the Board has decided to develop and implement a modern state-of-the art Supply Chain Management System. A consultant has been appointed to develop the system and they have already started the work. From the above facts, it can be seen that K.S.E.Board, is very much concerned about the timely implementation of plan projects so as to improve the system and to pass on the benefits accruing to the consumers, by overcoming hindrances and bottlenecks in

			project implementation.
	3.10		The Tenth five year plan (2002-07) targeted an amount of Rs.1300 Crores for ongoing transmission schemes (including spill overs from Ninth Plan) and new schemes. The actual expenditure was Rs.1097 Crores. The budget and revised estimates are prepared each year based on the details (requirements) forwarded by the concerned ARUs. Although steps are taken to complete the schemes, shortfalls do occur due to non-availability of land, opposition and resistance from public and other technical reasons. There was unprecedented drought during the initial years and Board was put to untold hardship. Later on, however Board made good the earlier shortfall and the overall achievement was 85.09% for the

			five years which is to be considered as very satisfactory.

Sl. No.	Para No.	Paragraph	Statement
1	3.14		The construction work of substations/transformer bays, feeder lines and beneficiary substations could not be constructed simultaneously in most of the projects due to the reasons furnished below. The commissioning of a substation or line depends on many factors like easy availability of ideal and cheap land, obtaining route approval, availability of materials in time, absence of litigations, disputes etc. For the construction of substations, there may be delay in obtaining ideal land, which is cheaper, and with lesser developmental cost. Some times, land acquisition by negotiated purchase fails and the Board have to go in for forced acquisition, which is time consuming. in the case of Government lands, there may be delay in getting the land transferred from revenue authorities. The construction of connected line can be started only after getting the land registered in favour of KSEB. Sometimes, the feeding substation may have to be changed from the original proposal if it is found more advantageous to the Board consequent on power system network changes in KSEB. Once the construction of line has started, there may be disputes in the line routes, delay in getting FTCC approval etc. In some cases, the works which were originally proposed to be carried out on turnkey basis may have to be done departmentally later, as the turnkey contractor fails to carry out the work. Hence, even though it is true that some of the works get delayed due to a certain extent from the targeted date of completion, there was no deliberate delay on the part of KSEB in any of the projects mentioned in annexure 17, 18 & 19 of the audit para. The delays were caused mainly due to

the right of way problems, court cases, litigations, objections from the landowners etc. The details of works mentioned in annexure 17, 18 & 19 are furnished below.

The procurement time for power transformers is longer since they have to be designed according to our requirement. Hence, the procurement of each power transformer cannot be done as and when it is needed, since the manufacturer of the transformer may take more than 1.5 years for the design and manufacture after getting a firm order. Moreover, it may be noted that power transformers are not readily available in the market as such. Hence, the power transformers are procured in a lot according to target fixed and have to be available at site. The delay in commissioning mainly occurs due to reasons cited above which are beyond K.S.E.Board's control. If transformers are ordered after the completion of all other connected works as pointed out in audit para, this may entail another inordinate and avoidable delay in commissioning the substation. Also considering the hike in the cost of power transformers, (cost of 110/11kV 12.5 MVA transformers being Rs.46 lakhs during 2004 and Rs.83 lakhs during 2007 i.e an appreciable hike of nearly 82% within a period of 3 years). So, the transformers already procured and installed is rather advantageous to Board.

Annexure 17

33 kV line from Kilimanoor to Kadakkal

The 33 kV Kilimanoor- Kadakkal line construction was delayed as the first contractor Sri. Sobhana Devan did not complete the work and the contract was terminated. Later, the estimate was revised and the work was arranged with another contractor Sri. S. Babu, however, the line work was completed and Substation test charged on 15/12/2004. The Audit finding of

non-completion of 33 kV line from Kilimanoor to Kadakkal up to April 2005 is not correct, since the Substation test charged on 15-12-04.

Annexure 18

110 kV Substation North Parur

In 110 kV Substation North Parur, 2 nos. 110/33kV, 16MVA transformers were commissioned in 8/05 for feeding 33 kV substations at Vadakkekkara, Varapuzha and Alangad.

33 kV substation,Vadakkekara

The work of 33 kV substations, Vadakkekkara is entrusted with the turnkey contractor M/s TELK. 33kV substation Vadakkekara was commissioned on 2/06.

33 kV substation, Varapuzha

The work of 33 kV substation, Varapuzha is entrusted with the turnkey contractor M/s TELK. The work of Varapuzha Substation is over but the delay in commissioning is due to a pending case regarding drawal of line at one location.

Any how the Substation was energized on 23-01-08 after settling the issue.

33kV substation Alangad

The construction work of 33kV substation Alangad and connected line is in progress and 90% completed. The Substation is targeted for commissioning by 03/09.

110 kV Substation Moovattupuzha

			In 110 kV Substation Moovattupuzha, 1 no. 16 MVA, 110/33kV was charged on 12/04 and the installation of 2nd transformer is in progress. The beneficiary substations are 33 kV Substation Mazhavannur and Kallurkkad. **33kV substation, Mazhuvannur** 33kV substation, Mazhuvannur was commissioned on 12/04. **33 kV Substation Pothanikkad** The proposed, 33 kV Substation Pothanicadu was changed to 110 kV level and the land for the Substation registered on 27-12-07. The work of the Substation is in progress. **33 kV Substation Kallurkkad** In 33 kV Substation Kallurkkad, the work is fast progressing and 55% completed. The Substation is targeted for commissioning in 3/09. **110 kV Substation Perumbavoor** In 110 kV Substation Perumbavoor, the proposed 110/33kV 16 MVA transformer for feeding Kuruppampady & Vengola has been commissioned during 6/05. **33 kV Substation Kuruppampady & Vengola** 33 kV Substation Kuruppumpady was commissioned on 8/03 and 33 kV Substation Vengola has also been charged in 5/07. **110 kV Substation, Kurumassery** In 110 kV Substation Kurumassery, 2 nos. 110/33kV, 16MVA transformers were commissioned on 12/00 & 4/02 respectively. The beneficiary Substations are 33kV substation Puthenvelikkara, 33 kV S/s

Kurumassery and 33 kV substation, Annamanada.

33kV Substation Puthenvelikkara

33kV substation Puthenvelikkara has been commissioned on 5-10-06.

110 kV Substation Malayattoor

In 110 kV Substation Malayattoor 2 Nos. 16 MVA, 110/33 kV transformers were commissioned on 12/04 & 5/05 respectively. The beneficiary substations are 33 kV substation Kalady & 33kV substation Koovappady.

33 kV substation Kalady

33 kV substation Kalady was commissioned on 12/04.

33kv substation Koovappady

The construction of 33kv substation Koovappady and connected line is in progress and 85% completed. The Substation is targeted for 3/09.

110 kV Substation Udumpanoor

In 110 kV Substation Udumpanoor, 2 nos 110/33kV transformers were commissioned on 1/06. The beneficiary substations are 33kV substation Udumbanoor, Vannapuram & 33 kV S/s Muttom. The 33 kV S/s at Udumbanoor commissioned along with 110 kV S/s.

33kV substation,Vannapuram

For the proposed 33kV substation Vannapuram, land acquisition is in progress.

33 kV Substation Muttom

The proposal of 33 kV S/s Muttom, has been changed to 110 k' substation, Muttom. Board order has been obtained for the same. The lan acquisition is in progress.

110 kV Substation Pala

In 110 kV S/s Pala , the installation work of 1 No.110 /33 kV, 16 MV/ transformer is in progress and 60% completed. The beneficiary substation are 33kV S/s Paika, 33 kV Substation Ramapuram and 33 kV substation Kidangoor

33kV Substation Paika,

The work of 33kV S/s Paika and connected line is in progress.

33 kV Substation Ramapuram

The work of 33 kV Substation Ramapuram and connected line is in progress and 90% completed. The Substation is targeted for 3/09.

33 kV substation , Kidangoor

The land for the 33 kV substations for Kidangoor was registered on 24-6-05. The construction of substation is nearing completion.

110kV substation, Pathanamthitta

Regarding the installation work of 110/33kV, 16 MVA transformer in Pathanamthitta, the work was entrusted with M/s Reliance Energy Limited on turnkey basis. The beneficiary 33 kV S/s, Konni was commissioned on 5/08. The work of beneficiary 33 kV Substation Ranny Perinad was entrusted with M/s ICOMM on turnkey basis. Eventhough M/s Reliance completed the work at Pathanamthitta, M/s ICOMM didn't complete the work in the stipulated time. Hence the contract with M/s. ICOMM is terminated on 1-8-

07 and work of 33 kV S/s Ranni-Perinad & Kumbanad is now progressing departmentally.

33 kV substations at Ranni - Perunad

The land for 33 kV Substation Ranni- Perunad was taken in to possession during 11/2000. The construction of Substation and associated lines were entrusted to M/s ICOMM, Hyderabad on Turnkey basis. Only about 25% of the work was completed up to 31.3.2005. As the firm could not complete the work, the contract with the firm was terminated on 1-8-07. Now the work is being carried out departmentally and is in progress.

33 kV Substation, Konni

Land was taken in to possession during 12/2002. The layout necessitated changes due to the presence of a well in the yard. Public objections were high for the line work and the Collector ordered deviations, which caused revision of estimate including special type of towers. However, the Substation and connected line work is completed and energized on 15-5-08.

110 kV substation, Edappon

Regarding installation of 110/33kV, 16 MVA transformer in Edappon , the work was entrusted with M/s Reliance Energy Limited on turnkey basis and was completed in 12/03. The beneficiary S/s are Pandalam and Kattanam.

33 kV substation , Pandalam

A.S. was obtained for the substation on 14.12.99. Various sites were identified and proposed, but could not be finalised because of various reasons. At last, Pandalam Grama Panchayat agreed to transfer 36 Ares of

			land in Survey No. 96/2. Block 2 of Kurumbala Village. Transfer of this land is under process by the Revenue department **33kV Substation Kattanam** The land was taken into possession during 4/02. The work was proposed to be carried out on turnkey basis, but it did not materialize due to receipt of a single offer. Later, it was decided to carry out the work departmentally. Due to a dispute in the submission of EMD, the work was awarded to the second lowest. It was questioned by first lowest tenderer and he filed an OP with H'ble High Court of Kerala and the work was awarded to him in 1/05. The contractor to whom site leveling and compound wall construction were awarded delayed the work by carrying out the work intermittently, which in turn, affected the progress of the Substation construction. Now the work is terminated and retendered and is in progress. The contractor to whom line construction was awarded showed the very same attitude as was in the case of substation construction. Hence, the line work was also terminated and re-tendered. Now the work is in progress. **110 kV substation, Punnapra** Regarding installation of 110/33kV, 16 MVA transformer in Punnapra , this work was entrusted with M/s Reliance Energy Limited on turnkey basis and the work was completed in 12/03. **33 kV Substation Thakazhy** The bay extension work at Punnapra for feeding Thakazhy S/s, which was awarded to M/s Reliance Ltd, under turnkey, was completed in 12/03.

The land identified for the construction of 33 kV Substation Thakazhy includes 10.8 ares of Government land and 26.5 ares of Private land. The government land was handed over to KSEB during 3/01. Since the acquisition of Private land did not materialize due to procedural delay in forced acquisition, to avoid further delay, the construction of Substation was started in the available land after revising the lay out.

The work of Substation is completed and energized on 22/10/2008.

110 kV substation, Mallappally

Regarding installation of 110/33kV, 16 MVA transformers in Mallappally, the work was entrusted to M/s Reliance Energy Limited on turnkey basis and was completed in 12/03.

33 kV substation, Kumbanad

The land for 33 kV Substation Kumbanad was taken in to possession during 11/2000. The construction of Substation and associated lines were entrusted to M/s ICOMM, Hyderabad on Turnkey basis. Only about 25% of the work was completed up to 31.3.2005. The firm could not complete the work till date and the contract with the firm was terminated on 1-8-07. Now the work is being carried out departmentally and is in progress.

110 kV Substation, Thycattussery

The upgradation of 66 kv Substation to 110 kV and installation of 2 nos. 110/33kV, 16 MVA transformers in Thycattussery was entrusted with M/s Reliance Energy Limited on turnkey basis and the work was completed in 03/04.

33 kV Substation Kuthiathode

Bay extension work at 110 kV S/s, Thycattussery was completed

during 3/04 by M/s Reliance Energy on turnkey basis. The first land proposed was rejected due to high cost and alternate land was acquired during 10/04. The line passes through prawn farming area, which caused delay in the construction of the line as scheduled. The work of Substation and connected line completed and energized on 9-5-08.

110 kV Substation, Edathua

After remitting the land value at Treasury, Smt. Saramma Chacko, land owner raised objection and dispute in the site leveling etc. delayed the progress of construction work. 110/33 kV transformers are meant for feeding 33 kV substations, Kidangara and Kadapra. The work of Substation completed and energized on 12-6-08.

33 kV substation, Kidangara

The land proposed for 33 kV Substation Kidangara was owned by M/s. Pope John XX III Rehabilitations Center. The compulsory acquisition was stayed on 08/01. Enquiry for a suitable land in this waterlogged area is still being made.

33 kV Substation , Kadapra

The attempt to Purchase the land from M/s Travancore sugars, Valanjavattom failed as the company is a sick unit. The sanction order for purchasing the land owned by Sri. Girish kumar was received on 11.7.2006. Land value assessment is being processed at Collectorate Pathanamthitta.

110 kV substation, Ambalappuram

The 2 Nos. 110 /11 kV, 12.5 MVA transformers were commissioned within one and a half years, but the 110/33 kV 16 MVA transformer meant for Chengamanad, Ezhukone, Pooyappally and Puthur could not be utilized

since site for these substations were not ready at that time. But 33 kV S/s Chengamanad energized during 1/06 and 33 kV S/s Ezhukone energized on 24-3-08.

33 kV Substation, Chengamanad

Chengamanad Substation was commissioned in January 2006.

33 kV Substation, Ezhukone

The work of 33 kV substation Ezhukone is completed and energized on 24.03.08.

33 kV Substation, Pooyappally

The land registered on 10-7-07 and construction of Substation is progressing.

33 kV Substation, Puthur

The land registered on 11-1-08 and the work of Substation is progressing.

110 kV Substation, Kilimanoor

Eventhough the 110/33, 16 MVA transformer at Kilimanoor S/s was commissioned during 3/01, the Kilimanoor -Kadakkal line work was delayed.

The 33 kV Kilimanoor- Kadakkal line construction was delayed as the first contractor Sri. Sobhana Devan did not complete the work and the contract was terminated. Later, the estimate was revised and the work was arranged with another contractor Sri. S. Babu. However, the line work was completed and Substation test charged on 15/12/2004.

33 KV Substation, Kadakkal

As explained in the above para, 33 kV S/s, Kadakkal could not commissioned due to the delay in construction of 33 kV Kilimano Kadakkal line as the first contractor Sri Sobhana Devan did not complete t work and the contract was terminated. Later, the estimate was revised a the work was arranged with another contractor Sri. S. Babu. However, t line work was completed and Substation test charged on 15/12/2004.

110 KV Substation, Punalur

The proposal was to feed Pathanapuram and Anchal 33 Kv substatio from 110 KV substation, Punalur after installing 2 X 16 MVA 110/33 l transformer. But the proposal of 33 KV substations at Pathanapuram a Anchal were revised to 66 kV level due to increase in demand. As per B (FM) No. 1411/2005(TPC3/KPFC/1/2004) dated 05/05/2005, the installati of 2 x 16 MVA 110/33kV transformers at Punalur substation were delet and a revised scheme was ordered.

33 KV substation, Pathanapuram

Proposal was revised to 66 kV level due to increased demand and t Substation commissioned on 10-2-04. The work of upgrading this Substatic to 110 kV is progressing.

33 KV Substation, Anchal

Proposal was revised to 66 kV level due to increased demand. Th land registered on 5-10-06 and construction of Substation is in progress.

110 kV Substation, Attingal

110 kV S/s Attingal energized on 22/02/07.

			33 kV Substation Kadakkavoor Land for the Substation registered on 25-2-08 and the work of the Substation is in progress. **33 kV Substation Venjarammood** The work of Substation is in progress and 50% completed. **110 kV Substation, Thirumala** The installation of 1 no.-110/33 kV, 16 MVA transformer is in progress for feeding 33 kV S/s, Karamana. The 110/33 kV 16 MVA transformer for feeding 33 kV Substation Peyad and 33 kV Substation Balaramapuram reallocated. **33 kV Substation, Balaramapuram** Sanction was obtained for constructing a 66 kV S/s in 110 kV parameters under the existing line. The land acquisition is in progress. **33 kV Substation, Peyad** Alternate land for the Substation is being identified. **110 kV Substation, Parassala** The work of installing 2nd 110/33 kV transformer is in progress. The 1st 110/33 kV transformer has already been installed for feeding 33 kV S/s, Poovar. **33 kV Substation, Poovar** The construction of Substation completed and energized from 11 kV side. The Parassala-Poovar line work was delayed due to litigation. Any how the Substation commissioned on 06.08.08

66 kV substation, Peerumedu

One No. 66/33 kV, 16 MVA transformers is installed at Peerum and connected works are in progress. The beneficiary substations Uputhara and Vagamon.

33 kV substation, Upputhara

The land for 33 kV substation, Upputhara was ready during 12/03 a construction of substation and Peerumedu- Upputhara line is in progr 75% completed.

33 kV substation, Vagamon

The land for 33 kV substation, Vagamon was ready during 12/03 a construction of substation and Peerumedu- Vagamon line is in progress.

66 kV substation, Nedumkandom

The 66/33 kV, 16 MVA transformer installed at Nedumkandom meant for 33 kV substations, Senapathy and Murikkassery. The installation this transformer is in progress.

33 kV Substation, Senapathy

The land available with revenue department for the substation is y to be transferred to KSEB. Constant follow up action is being taken up wi Revenue authorities.

33 kV Substation, Murukassery

The land for 33 kV S/S Murukassery received only on 12.10.2006. Tl lay out approved and the work is in progress.

Annexure 19

33 kV Substation, Kidangoor

Land for the 33 kV S/S, Kidangoor was registered on 24.06 05. The construction of the S/s is 80% completed.

33 kV Substation, Upputhara.

The land for 33 kV substations, Upputhara was ready during 12/03 and construction of substation and Peerumedu- Upputhara line is in progress and 75% completed.

33 kV substation, Vagamon

The land for 33 kV substations, Vagamon was ready during 12/03 and construction of substation and Peerumedu- Vagamon line is in progress.

33 kV Substation, Ramapuram

The land for 33 kV Sub-Station Ramapuram was registered on 31.3.2005. The 33 kV Pala-Ramapuram line and work of S/s is fast progressing. The S/s is targeted for 3/09.

33 kV Substation, Kadakkal

The 33 kV Kilimanoor- Kadakkal line construction was delayed as the first contractor Sri. Sobhana Devan did not complete the work and the contract was terminated. Later, the estimate was revised and the work was arranged with another contractor Sri.S.Babu. However, the line work was completed and Substation test charged on 15/12/2004.

33 kV Substation, Pathanapuram

Proposal was revised to 66 kV level due to increased demand and the 66 kV

S/s commissioned on 10-2-04.

110 kV Substation, Mavelikkara

The original lay out was revised for more feasible entries of EHT feed Hence the original design changed and new proposal formulated

110 kV Substation, Edathua

Due to objection from Smt. Saramma Chacko, land owner after remitting t land value at treasury, dispute in the site leveling etc. delayed the progress construction work. 110 /33 kV transformers are meant for feeding 33 k substations, Kidangara, Kadapra and Thakazhy. The land for 33 k substations Kidangara and Kadapra has not yet been received. The 33 k substations, Thakazhy energized durirg 10/2008 by constructing Punnapr Thakazhi line. The 110 kV S/s Edathua energized on 12-6-08.

110 kV Substation, Ambalappuram

The 2 Nos. 110 /11 kV, 12.5 MVA transformers were commissione within one and a half years. The 110/33 kV 16 MVA transformers are mear for Chengamanad, Ezhukone, Pooyappally and Puthur. However 33 k substations, Chengamanad was over and charged during 1/2006. The wor of 33 kV Substation Ezhukone is completed and energized on 24-3-08. Th land for the 33 kV S/s Pooyappally and Puthur obtained and the work of S/ and connected line is progressing.

110 kV Substation, Kozhencherry

A.S for the above work was accorded by the Board vide B.O.No 1453/01 TC1/S1/KPFC/2000 -01 dated 2.7.2001 As per the original proposal,

(1) 110 kV DC line from Pathanamthitta Substation to Kozhencherry

Substation was constructed.

(2) 2 No. of 110 kV bays were constructed at Pathanamthitta

(3) Yard structure of 8 Nos. of 110 kV bays were completed on 28/3/03

(4) 2 No.s of 110 kV/11kV 12.5 MVA Transformer were installed and commissioned on 13/5/03.

As mentioned earlier, yard structure of 8 Nos. of 110 kV bays were completed on 28/3/03. With the available materials, 66 kV Substation, Kozhencherry was upgraded to 110 kV Substation with one incoming bay and 2 transformer bays on 13/5/03. The original proposal also included 2 No. of 110 kV feeders from Edappon Substation. But the existing 66 kV Edappon- Kozhencherry DC line is not yet upgraded to 110 kV because of the under mentioned technical reason. For the upgradation of Edappon 110 kV to 220 kV Substation, additional 220 kV bays were to be constructed at Edappon. This and the construction of additional foundation for capacitor Bank restricted the construction of 2 x 110 kV Bays meant for Kozhencherry. Out of 8 Nos of 110 kV bays, 2 x110 kV feeder bays were meant for accommodating DC line from Edappon Substation. The yard structures of these bays were already completed on 28/3/03. Since the proposal is pending, erections of equipments were not done.

In the original proposal, PTA- Ranny No. 2 110 kV feeder was designed to enter Kozhencherry Substation (LILO Arrangements) and the 110 kV DC line to Ranny has to be fed from Kozhencherry Substation This includes 3 number of 110 kV feeder bays at Kozhencherry Substation, As the upgradation work of Ranny Substation was completed on 1.3.2002, and as Government have targeted to commission the Substation on March 2002 the authorities were

			forced to do temporary arrangements for energizing Ranny Substation without entering Kozhencherry Substation as was designed in the original proposal. There was also a proposal to connect the upgraded Ranny Substation to Mallappally/Erumeli Substation for availing alternate supply from 220 kV Substation Pallom . Later, due to massive opposition from the public, the proposal was dropped by Board. The temporary feeding arrangement in Kozhencherry continued for avoiding interruption, since there is only one bus arrangement at Kozhencherry Substation and if any shutdown occurs at Kozhencherry, both Kozhencherry and Ranny Substation will black out. After getting A.S & T.S for the above work, the following works were done. 1. Site leveling — Work completed in 2000 2. Earthmat — Work completed in 2001 3. Yard structure foundation — Work completed in 2001 4 Yard structure & Equipment erection and completed on 28.3.03 — Work started on 20.7.01 The transformers were commissioned during 05/2003.

Sl. No.	Para No.	Paragraph	Statement
	3.15		Originally 220 kV Substation, Kalamassery was equipped with 2 Nos. of 100 MVA transformers and 2 Nos.of 120 MVA transformers. (ie 440 MVA) The work of enhancement of the capacity of 220 kV Substation, Kalamassery from 440 MVA to 800 MVA, was to facilitate receipt of power evacuated from BDPP and BSES and the anticipated load demand. The proposal was to change the lower capacity transformers with higher capacity transformers ie replacing the (2 x 100 + 2 x 120) MVA transformers with (4 x 200) MVA transformer. But the capacity was enhanced using only 3 Nos of 200 MVA transformers. (9 units of 66.67 MVA transformers). The 4th transformer could be utilized in Kalamassery substation as spare. But as it was found that it would be more advantageous to KSEB to utilize them at 220 kV Substation Kundara,, the 4th transformer was taken to Kundara Substation. Now the Kundara Substation is upgraded to 220 kV and commissioned on 05.01.06. In this context, it may be noted that the rate of 66.67 MVA transformer during 2/2000 was around 55-70 lakhs where as the

			present rate of 66.67 MVA transformer is about 3 crore. Considering the huge hike in the cost of power transformers, the purchase of equipments at the start of the project is justifiable and cannot be considered as causing loss to Board. The transformer purchased and kept for redundancy can only be treated as idle investment Moreover, the following points may be noted regarding proposal for enhancement of capacity. Usually, we plan for the enhancement of power system, depending on the Electric power survey/ power scenario available at the time of formulation of the project. Particularly, for high voltage power system, we have to keep a buffer of 50% to ensure redundancy and the span of planning will usually be 5 to 10 years. In the case of enhancement in capacity of 220 kV Substation at Kalamassery, the planning was done in anticipation of a load growth for the next 10 years. The drastic reduction in the demand of some of the existing EHT consumers like Indal, PACT etc. resulted in reduction in the anticipated demand.
1	3.17		(1) M/s AYG is a Government of India company and the contract was entered into in 2000, well before it became a sick company in 2004. Hence the audit objection that the work

			was arranged with M/s Andrew Yule without ensuring financial credibility is not correct. (2) The delay in handling over sites is attributed to the unexpected delays in taking over sites from the public through normal requisition proceedings. (3) Delay in handing over line routes, payment to the contractor etc. has not affected the work.
7	3.18		Under the para only four substations are coming: They are 33 KV Substations at Ananthapuram, Belur, Peria and Badiadka.

			The works of these substations were awarded to M/s ICOMM (ARM) Limited, Hyderabad on turnkey basis. Out of this the works of 33KV substation, Ananthapuram and Belur were completed and commissioned on 23/03/08 and 27/05/08 respectively. The works of 33 KV Substation Peria and Badiadka are in progress. Parappukkara:- One 11 KV was Utilized for evacuating power for the time being and later remaining portion had also been completed. Pazhayannur:- There was no need of land acquisition for the construction of 110/33 KV bays at Pazhayannur Substation. But M/s ARM had not started work on time. Chelakkara-Mullurkkara Substation:- As per the TK contract M/s ICOMM (ARM) was to make available the land for substation also. The delay in finalizing the land cannot be attributed to Board as the contractor themselves delayed the identification of suitable land for the station. The equipment was laying idle due to the delay in identification of land

	3.21		As already mentioned earlier, it was proposed to conduct a LILO line from PGCIL's Edamon-Kayamkulam using Double Moose Conductor. The technical parameter of the line was to conform to that of PGCIL's line. KSEB had constructed 220 kV lines using P Q Rs. S towers only and this is the first time, KSEB is using Double Moose Conductor in our transmission network. In order to avoid delay in starting the work, estimate prepared with available details and invited tender on Turnkey basis. The length of the line to be constructed was 23 km and no. of towers were 75, out of which, 30 numbers are angle towers. It is to be noted that nature of soil condition along the line is heterogeneous and even a random soil testing will not provide 100% accurate estimation because the alignment of transmission line will vary during the actual execution. The work was awarded inclusive of design of towers, preparation of detailed specification and construction of the transmission line. Even though sufficient provision was given in the estimate for pile foundation and

			shallow foundation based on the previous completed projects/construction of transmission line using kundah conductor, actual design of foundation based on the design of towers and soil testing these provisions were found insufficient and necessitated to revise the actually required levels. Construction of the tower foundation using pile will take much time, work had been completed in all respects and substation and line were commissioned during January 2006 itself. Regarding construction of LILO line to Edappon substation from PGCIL's Kayamkulam-Edamon line, work was re-tendered as per B.O. dated 11-01-06, and work awarded to M/s New Modern Technomech Private Limited, Orissa is in progress. The work consists of construction of 8.561 kms of DC line including supply erection and commissioning. Out of the 35 nos of towers 20 towers are already erected, 25/35 nos of stub setting completed, pile cap 30/35 nos completed and stringing from location 34 to 11 started. Major portion of work is completed and project can be commissioned as soon as possible if climatic condition in Alappuzha District favour. Most of locations are in water logged area and paddy fields.

	ACTION TAKEN BY GOVERNMENT
	Construction of Substation and Lines - **Turnkey basis as well as Departmental execution** The construction and commissioning of sub-station and lines depend upon many factors such as availability of ideal and cheap land, obtaining route approval, availability of equipments and materials in time, absence of disputes and litigations etc. Delay in completion of Turnkey works/ Departmentally executed works were due to the following reasons: **Delay in purchase/handing over of site** For the construction of substations, obtaining ideal land which is cheaper as well as having lesser development cost is essential. Usually, the turnkey works were awarded before acquiring land and only after the work was awarded, land acquisition procedures were started. The acquisition of the land was done either by compulsory acquisition or by negotiated purchase method. Earlier the land acquisition was done mainly through compulsory acquisition, which took much time for complying with the lot of Government procedures and also due to litigations. Though later, KSE Board opted for negotiated purchase, which took lesser time than compulsory acquisition, a reasonable time was unavoidable as it required the involvement of Negotiation Committee consisting of District Collector, Deputy Chief Engineer and Deputy Collector (Land Acquisition), and this Committee had to meet a minimum of five times to finalize the land negotiation. After finalization, Government Order as well as Board Orders had to be issued. These procedures were unavoidable as per Government rules. Hence acquisition of land consumed a minimum of one to two years which was further extended in cases where there were litigations. **Delay in getting permission from other Departments** Most of the projects were delayed due to the delay in getting permission

from NH Authorities, PWD, BSNL etc., and also from Railway authorities where crossing of the railway lines was required. Obtaining PTCC approval from BSNL also took a considerable time. All these were beyond the control of KSE Board.

At present, in order to avoid such delays, co-ordination meeting are conducted with various Government Authorities at frequent intervals for the smooth and timely implementation of projects.

Delay in material supply

In case of turnkey works, material supply was within the scope of turnkey contractor. In case of departmentally executed works purchase of materials had to be arranged through open tender. Since many procedural formalities were to be complied with before finalization and award of a purchase order, that also contributed for delay to some extent.

Right of Way Clearance (ROW)

During the construction of lines, objections were raised by public regarding the line route and cases were filed before ADM's Court and Honourable High Court and as such the work could not be carried out until the disposal of those cases. In some cases, even though after substation works were completed, the substation could not be charged due to litigation along the line work.

Delay in payment

Delay in payment occurred mainly due to improper preparation of bills and delay in submission of the same by the contractors. In addition, normal procedures of processing and verification of the bills at Asst. Engineer level to Deputy Chief Engineer level took time for processing. Board had given priority over other bills in fund assignment for purchases and work bills of new projects.

It may kindly be noted that the procurement time for power transformers was longer since they had to be designed according to Board's requirement. Hence the procurement of each power transformer could not be done as and when it was needed, since the manufacturers of the transformer would take up to 6 months time for the design and manufacture after getting a firm order. The power transformers were not readily available in the market as such. Hence it had to be procured in a lot according to target fixed by

Board. If the transformers were ordered after the completion of all other connected works. that would have entailed inordinate delay in commissioning of substations.

Turnkey contract with SPIC SMO Ltd, Chennai was for the construction of 110/33/11KV Substation Melattur and construction of Ramapuram-Melattur 110 KV SC line. The Substation works were completed in the year 2000 itself, but a portion of 110 KV SC line constructions was under Right of Way (RoW) dispute.

Board approached High court to obtain permission to draw the line through the original route mainly because of the following reasons:

- The deviated route suggested passes through the 'B' class property of Indian Railways and hence the approval for construction and sanction for energizing from the Railway department would have been denied or delayed.
- The route suggested was not technically feasible as the proximity of the 110 KV line would have affected the Railway communication net work.
- Railway also had approached Hon'ble High court against the decision of ADM on the deviated route.
- The deviated route suggested by ADM passes through thickly populated areas where many residential constructions were obstructed and objections were raised. Against this order the affected parties had filed a case in the Hon'ble High court.

It is not correct that the appeal against the decision of the ADM was rejected by the Hon'ble High court. In fact Hon'ble High court directed District Collector to personally inspect the route and to settle the issue. After joint inspection, District Collector ordered to draw the line through the original route with only slight deviation.

The intention of the Board was to complete the line work as early as possible without causing inconvenience to the public. The Board had to adhere to the standards of line clearance and technical feasibility while drawing the line.

From the above, it is clear that Board had taken all efforts to construct the line at minimum cost and at minimum time.

The major causes of delay in execution of sub-station and lines

	departmentally are already elaborated above in reply to Para 3.16.

As per the APDRP programme implemented in Board, (progress as on 31-03-2009) R&M works (sub-transmission 66 KV and below) have been completed in 114 substations under 3 circles/7 towns/26 town scheme. 9 nos. of 33/11 KV substations and 10 kms of 66 KV re-conductoring works were also completed. As targeted in the Annual Plan from 2002-03 to 2006-07, 156 substations were completed during the said period and almost all the other substation works targeted have also been completed. In this regard it is to be duly noted that the main hurdles in the establishment of the substations were obtaining suitable land for the construction of the substations and addressing public protest against drawal of lines and subsequent litigations which were beyond the control of K.S.E.Board.

However Board could bring down the T&D loss for 2012-13 to 15.30% and for 2013-14 it is expected to be around 15%.

In this regard, the following facts may kindly be considered by Audit:-

1. Transmission and Distribution (T&D) loss in a power system is the difference between the 'total energy input to the system' and 'total energy sold'.
2. In the case of KSEB system, the input energy is the sum of:
   (a) Total internal generation excluding the auxiliary consumption; and
   (b) Total power purchase at KSEB periphery.
3. It may be noted that, there is no confusion in accounting the internal generation. However, for accounting the power purchase at KSEB periphery, the following points may kindly be noted.
   (i) Power purchase mainly includes purchase of power from the Generating Stations situated outside the State, including the energy scheduled from 'Central Generating Stations', power purchased through traders etc.
   (ii) The Central Generating Stations (CGS) except NTPC's RGCCPP Kayamkulam plant is located out side the State of Kerala. i.e., Talcher-II power plant is located in the State of Orissa, Ramagundam plant is located in Andhra Pradesh, Neyveli and Kalpakkam plants are located in Tamilnadu and Kaiga plant is located in Karnataka.
   (iii) The allocation from the CGS is being decided by the Central Government from time to time.
   (iv) KSEB and other beneficiaries have to pay fixed charges to the CGS for the percentage of capacity allocation, based on the total annual fixed charges approved by Central Electricity Regulatory Commission (CERC) for each CGS. The energy charges being paid for the actual energy scheduled by each beneficiary including KSEB from each CGS.
   (v) It may be noted that, KSEB and other beneficiaries have to pay energy charges for the exbus energy at the generator bus, i.e., for the energy schedule metered at the generator bus, i.e., at the generator switch yard. In other words, KSEB has to pay the energy charges for the Talcher-II stations at the energy scheduled and metered at the plant in ORISSA, for Ramagundam plant for the energy scheduled and metered in Andhra Pradesh, for Neyveli plant at the exbus energy at their plant in Tamilnadu respectively.
   (vi) The energy generated from the CGS is being transmitted using the

Inter State Transmission lines developed and maintained by Power Grid Corporation of India. Transmission charges for transmitting power through PGCIL line is being paid by respective beneficiaries at the tariff approved by the CERC.

(vii) Transmission loss is also incurred while transmitting power from CGS upto the respective State boundary through PGCIL lines. Accordingly, the energy received at KSEB periphery (at Madakkathara/ Kayathar/ Udumalpetta etc) from the CGS will be lesser by the transmission losses incurred in the PGCIL lines up to State boundary.

(viii) KSEB and other beneficiaries have no control on the inter-state transmission losses incurred by PGCIL while transmitting power from Generator exbus (switchyard) to the respective state boundary. Further, PGCIL line losses are not associated with distributing the electricity within the State as these losses happened outside the State. Hence, the PGCIL line losses associated with transmission of power from ex-bus of CGS up to State periphery is not considered while assessing the T&D losses of State power system.

(ix) The interstate transmission losses incurred by PGCIL for transmitting power from the generator bus of CGS upto Kerala periphery for the years 2004-05, 2005-06 and 2006-07 is detailed below:

Energy Schedule at Generator bus, energy at KSEB periphery and PGCIL line losses of CGS

Sl No	Source	2004-05			2005-06			2006-07		
		Schedule of KSEB at Generator end	Energy received at Kerala periphery	PGCIL line losses	Schedule of KSEB at Generator end	Energy received at Kerala periphery	PGCIL line losses	Schedule of KSEB at Generator end	Energy received at Kerala periphery	PGCIL line losses
		(MU)	(MU)	(MU)	(MU)	(MU)	(MU)	(MU)	(MU)	(MU)
1	NTPC-RSTPS	2346.94	2260.92	86.02	2675.40	2574.38	101.03	2710.54	2586.90	123.64
2	Eastern Region	214.14	206.29	7.86	280.57	262.36	18.21	0.00	0.00	0.00

3	Talcher Stage-II	1437.29	1384.49	52.80	2561.18	2463.56	97.62	3556.46	3393.94	162.52
4	NLC-Stage-1	406.92	392.03	14.89	402.77	387.92	14.85	327.46	312.74	14.72
5	NLC-Stage-II	587.90	566.42	21.49	573.23	551.78	21.44	596.17	569.25	26.92
6	NLC Expansion	455.03	438.36	16.67	490.79	472.39	18.40	509.83	486.63	23.21
7	MAPS	76.11	73.31	2.79	97.65	93.93	3.72	138.25	131.92	6.33
8	KAIGA	340.47	328.05	12.42	333.28	320.83	12.45	279.10	266.33	12.77
	Total	5864.80	5649.87	214.93	7414.86	7127.14	287.73	8117.81	7747.71	370.10

(x) As detailed above, the transmission losses in transmitting power from ex-bus of CGS to KSEB periphery for the year 2004-05 is 214.93MU, 287.73MU for the year 2005-06 and 370.10 MU for the year 2006-07

4. Due to the reasons cited under para 3(vii) and 3(viii) above, all the regulators in the country are not accounting the inter-state transmission losses while approving the T&D losses of the State owned system. Similarly KSERC also, is not accounting the inter-state transmission losses incurred by PGCIL , while approving the T&D losses of the Kerala system,
5. It may be noted that, for the year 2005-06. KSEB has scheduled 7414.86 MU from the CGS, however at Kerala periphery KSEB could receive only 7127.14 MU due to PGCIL line losses.
6. As stated under paragraph-2 above, the total energy input into the KSEB system is the sum of (a) the total internal generation excluding auxiliary consumption and (b) the total power purchase at KSEB periphery. The total purchase at KSEB periphery is the net energy from the CGS excluding the PGCIL line losses.
7. It may kindly be noted that the figure shown in Annexure 20 of the Audit Para do not match with either the power purchase approved by KSERC or the actual power purchase shown in annual accounts of the year 2005-06.

Energy account statement for the year 2005-06 is as follows:

Sl No.	Items	Energy in MU
1	Energy generated by KSEB	7554.36
2.(a)	Total Energy purchased by KSEB from CGS and other generators located outside the State (at Generator Bus)	7414.87
2(b)	Energy transaction through Unscheduled Interchage	-759.10
2(c)	PGCIL line losses	287.74
2(d)	Net Power Purchase at KSEB periphery(2(a)+2(b)-2(c))	6368.03
2(e)	Power purchase from IPPs inside the State	44.73
2(f)	Energy sales outside the state	635.90
3	Total energy generated and power purchased to the KSEB system PGCIL losses and sales outside the State	13331.22
4	Energy sales within the State	10269.80
5	Transmission and Distribution loss in the KSEB system(=4-3)	3061.42

8. As discussed above, the audit has considered the total exbus energy purchased from CGS instead of the net energy received from CGS after accounting the PGCIL line losses for computing the T&D losses. This conceptual error committed by the audit may be appraised to them and accordingly request them to drop the audit observation.

Sl. No.	Para No.	Paragraph	Statement
	3.22		Previous reply furnished by K.S.E.Board is in line with actual field difficulties experienced in execution of the 220 KV Substation project at Shornur. Equipments and line materials are centrally procured by the K.S.E.Board. The transmission line has to be constructed through Public property. All the bottlenecks cannot be anticipated in advance while fixing target date for commissioning. Small delays in execution are quite normal. Moreover the approvals from PTCC, approval from the Chief Electrical Inspector were needed for the commissioning of the above project. The loss sustained cannot be worked out on the basis of the amount spent for the various capital works in the Substation. Each work is inter related. Normally, a big project is subdivided into small works to facilitate easy and speedier execution of work. The K.S.E.Board is not following the practice of awarding turnkey contracts widely. Even the prior experience of arranging works on turnkey basis has not been satisfactory from the point of view of speedy execution and lower costs, Major materials are usually centrally procured by Board so as to avail benefits of lower cost of bulk order and standardization.

			Only labour portion is locally arranged on contract basis. There is a generally accepted and time proven procedure for identifying/ purchase of land for substations and finalization of line route prevalent in the Board. However certain unforeseeable problem came up during execution, which cannot be avoided in total. The recommendation of the audit that the line route must be finalized before arranging finance and awarding the work of substation is acceptable. It may also be pointed out that the present system being followed in the Board has its own inherent advantages of lower cost, reliability and accountability, which is often not perceived properly and viewed in right perspective while auditing.
	3.23		The construction of substation was started in July 1996. The contractor Sri.K.P.Rajendran stopped the work in October 1997 and Board initiated steps to terminate the contract. Subsequently termination notice was issued on 5.8.99. On receiving the termination notice, the contractor filed an OP No.25092/99 before the Hon'ble High court of Kerala for obtaining stay against the termination of work. But, during 12/99, the contractor informed his willingness to resume the work with certain conditions including rate revision. The contractor was informed on 1/2000 that since the case is under consideration of Hon'ble High Court of Kerala, future decision could be taken only with the consent of legal cell of KSEB.

			It was the contractor who approached the Honorable High Court of Kerala against the termination notice issued by KSEB and the case finally disposed of only during 11/04.That only due to the diligent efforts from the part of KSEB. Once the case was disposed of, the substation was commissioned within the shortest possible time of 6 months. Incidentally the line had been commissioned on October' 2002 .In the mean while, every effort was taken by KSEB to safeguard the interest of Sabarimala pilgrims by maintaining electric supply in Sabarimala through 11kv lines. Though the Travancore Devasom Board had remitted 35 lakhs during 1995, K.S.E.Board could not complete the Substation due to problems with the Contractor. In view of this long delay in setting up of Substation, K.S.E.Board was not in a position to ask for the balance of the 25% payable by the Travancore Devaswom Board. The work has been completed in 2005 and commissioned on 2/11/2005. Follow up action will be taken to collect the balance amount of 25% from Travancore Devaswom Board on finalizing the Project cost. The delay in starting the construction of line to Thriveni Substation was due to delay in obtaining clearance from Ministry of Environment. After that due to adverse climatic condition and difficult terrain the work couldn't be completed as schedule. The 25% of amount is to be collected from Travancore Devaswam Board in connection with the construction of 66 KV Substation, Thriveni. The request made

			in this regard by the Secretary, Kerala State Electricity Board vide letter No.TC1/SS/144/93 dated 8.10.2009 is under consideration in Revenue (Devaswoms) Department in Government.
8	3.24		As per B.O No. 1074/2000 (TC1/S1/REC/99-2000/AS) dated 5-5-2000, One No. 66/33 kV, 16 MVA transformer has to be installed in addition to the already sanctioned scheme, at 66 kV Substation Nedumkandam. Eventhough the site was identified in August 99, due to the exorbitant development cost involved; the possibility of obtaining alternate suitable land with lesser development cost was explored. This was the main reason for the delay and not due to lack of co-ordination between civil and electrical wing. Eventhough the site plan was approved from the office of the Chief Engineer (Transmission South), vide letter dated 5-8-2000, the layout of the 66 kV substations, Nedumkandom was revised for accommodating one more 66/33 kV transformer. The retaining wall proposed was also redesigned for the above modification. The delay occurred was due to the above

			modifications. The work of construction of yard and equipment structure foundation of 66kV substation Nedumkandam was awarded to Sri. P.C.Punnoose, vide agreement dated 27-10-03, with time of completion of 3months. Time extension was granted upto 17-4-06. The estimate was prepared based on the already approved drawing of K.S.E.Board, which was incidentally used in the construction of Punnapra Substation also. It is the accepted practice to adopt already approved drawings for fresh construction, as there is not much difference in substations. As the work was of poor quality, rectification had been done by the contractor at his own cost. Disciplinary actions were initiated against the concerned Officers. Sri. A.G.Chandran, Assistant Executive Engineer was punished by barring two increments without cumulative effect for a period of two years. Sri. G. Sivadas, Assistant Engineer was not found quilty of charges and he was exonerated from the charges, moreover he had already retired from Board service. As mentioned earlier, line construction could not be completed in the scheduled time due to the objection from land owners, and non patta land owners. Dispute relating to the payment of tree cutting compensation to land owners having non patta land was settled and payment affected during 2004 itself, KSEB had taken all efforts to complete the

		Rs.31 lakh.	line work and delay occurred is beyond the control of KSEB. Delay in construction of transmission lines are mainly due to objection from land owners, filing cases before ADM, Hon'ble High Court of Kerala etc. Settlement of the cases will take considerable time and is quite natural constructing transmission line of 11 km through the terrain nature of Nedumkandom is hazardous. During the settlement of cases in the construction of line, substation work is also nearing in a stage of completion. However constructions of substation and line work are completed almost in same period. Hence due to non settlement of tree cutting compensation in Board sustained loss cannot be agreeable.
	3.25		The amount already expended for the 33 kV project at Pathanapuram could be fully utilized for construction of a temporary 66 kV Substation at Pathanapuram as well as for the proposed 110 kV Substation at Pathanapuram itself. When the system voltage is increased to 66 kV from 33kV, the loss will be reduced considerably (ie, for transmitting same power, the loss will be reduced by one fourth, when the transmission voltage is doubled). The audit observation that the use of the existing 66 kV transformer, after overhauling has shown an increase in transmission loss of 0.03% is not correct. On the contrary, the life of the transformer will be extended considerably after overhauling. After the A.S was received for the construction of 66 kV Substation at Anchal & Pathanapuram, some preliminary

			works like site leveling and foundation were started. Meanwhile, in the meeting convened by the Hon'ble Minister for electricity and the Hon'ble Minister for Transport with K.S.E.Board officials on 22/11/2001, it was decided to construct a 66 kV Substation at Pathanapuram instead of a 33kV Substation. At that time, works at 110 kV Substation Punalur were lagging since 110/33kV 16 MVA transformer and associated equipments are to be installed at Punalur Substation only for feeding Anchal substation. Also, it was proposed to construct a 66 kV Substation at Anchal also. As per B.O (FM) No. 1411/2005(TPC3/KPFC/1/2004) dated 05/05/2005, the installation of 2 x 16 MVA 110/33kV transformers at Punalur substation were deleted and a revised scheme was ordered. As the originally proposed 33 kV transformers to be installed at Pathanapuram and Anchal were used elsewhere, and there is no wastage of investment. Regarding 110 kV S/s, Pathanapuram construction work was completed on 16.09.2004 and 66KV substation was completed on 10.02.2004. Regarding 66 kV S/s Anchal, the land was registered on 5.10.2006 and the work was completed on 28.302.2011.
6	3.26		While proceeding with the land acquisition, M/s Kerala Feeds Ltd, a state Public Sector Undertaking offered 1 acre land on

			lease. The Board accorded sanction on 28/12/2002. A Board order for taking over one acre of land owned by M/s Kerala Feeds Ltd. on lease basis (@ Rs.1/-only) for 90 years was received (dated 15/02/03). The construction of substation started in May 2003 departmentally and commissioned in November 2005. There were delays in providing materials. But on commissioning as the substation is near the load center, loss to a greater extent could be reduced. Lengthy 11 KV lines could be avoided and interruption to a great extent could also be avoided.
4	3.27		Estimate for construction of transmission lines are usually prepared by taking a survey along the line route 2 or 3

			prepared by taking a survey along the line route 2 or 3 surveys are carried out on alternate routes before finalizing a feasible route. From the 3 possible routes, one which is most economical, involves a less populated area and less compensation given is selected as the feasible route. After fixing the route, location of the tower to be fixed is finalized. Even though required provisions are given in the estimate for pile foundation, design of the tower foundation may vary depending upon the soil condition. The final route fixed may or may not vary slightly from the route due to various reasons viz disputes, if such things happened. According to this, original estimate is to be revised. Soil conditions in different tower location are different. For example, to construct a 220 kV tower foundation, base width is more compared to 66 kV tower. Tower legs are to be situated in a wide area. So nature of the soil condition is different in different locations where each leg of the tower situated. Hence realistic assessment cannot be possible without excavation in most of the cases. Kumbalangi-Chellanam 110 kV DC line is constructed very near the sea and is a water logged area. During execution of line work, special type bund was necessary instead of earthen bund. Soil condition necessitated additional pile driving chimney size, had to be increased to avoid corrosion, as the tower location are fully submerged in saline water especially during period of prawn cultivation and high tides. Thus during actual execution, considerable change occurred in the estimate. Hence, Board sanction was necessitated for

			the revised estimate. In order to issue a sanction by the Board for the variation in the items/quantity several clarifications were required, so delay occurred in issuing Board sanction to the revised estimate. The line was finally energized on 03/07. As mentioned in the Audit para, loss due to defective design is not correct. Because the above, said reason are quite natural, common and unavoidable.
	3.28		The cost of the land first identified (34 lakhs) for the construction of above substation was higher than the normal rate prevailing in that locality. Hence, the Board explored the possibility for cheaper land with the same advantages for construction. Subsequently, a cheaper land was acquired with a saving of Rs 16 lakhs. Major portion of the land acquisition process is done by the revenue authorities. The normal acquisition process will take its own time for the procedural activities. Even if the earlier costly land was selected, it would have taken more or less the same time or more for completing these procedures. Moreover, the cost of drawing 110 kV line to the first proposed site is much more than in the case of second site selected, not to mention the possible objections, litigations etc. In the case of the selected land, the line from which tapping is to be effected to the proposed Substation at Thrikkodithanam passes very near to the selected land (ie, by 200 meters) there by considerably reducing the cost of construction of 110 kV line and avoidance of possible litigations that are usually

	3.29		encountered in Kerala during drawal of line. The work was started by 12/2005 and the Sub-Station commissioned on 15.05.2008.Considering the above facts, it can be seen that there is only savings in the part of KSE Board rather than the loss as pointed out by the audit, not to mention, the additional saving to K.S.E.Board of Rs.30.58 lakhs. Moreover the cost of drawing 110 kV line to the first site selected is much more than in the case of the second site selected, not to mention, the possible objection, litigations etc. The main reasons for the dealy in substation construction were some works were not started as scheduled, was due to the delay in purchasing land. Major portion of the land acquisition process is done by the revenue authorities. The normal acquisition process will also take its own time for the procedural activities. The line works were delayed due to court cases at different locations. In some cases line route was changed due to these cases, which was lead to revision of original estimate. Some works were delayed due tot he delay in getting clearance from various statutory bodies such as PWD, Irrigation Department, NH authorities, Forest departments etc.

	3.30		The original layout was revised for more feasible entries of EHT feeders. Hence the design has to be changed and fresh proposals formulated. The revised layout resulted in reduced area for earth mat. Since 32 mm earth rods were found most suitable, the earth mat design was revised accordingly. The changing of earth rod from 25 mm to 32 mm have in no way effected or delayed the project since other works were being done simultaneously. This is in no way an adverse change since it ensured more technical feasibility and safety in the substation operation. The lowest rate quoted during tendering (with 25 mm dia M.S. Rod) was 159%. But during the re-tendering with 32 mm M.S. Rod the lowest rate quoted was 149%, thereby benefiting K.S.E.Board. KSEB decided to upgrade 66 kV Substation, Mavelikkara to 110 kV and to construct 4.66 kms of 110 kV DC line. The work of substation construction and line work were started simultaneously. But the line work delayed due to court cases filed at different locations. These cases were disposed only by 7/04. Line route was slightly changed due to these cases and it necessitated the revision of original estimate.

		~~funds amounted to Rs. 1.06 Crore.~~	Now, work of construction of Vathikulam-Mavelikkara (4.66 km) line is in progress and is almost completed except tower erection in 3 locations. Contractor of the said work stopped the work by demanding rate escalation. Subsequently, the work is terminated at the risk and cost of the contractor. Balance work of errection of towers in 3 locations and 1.29 km of stringing is retendered and the work will be completed soon. 110KV Mavellikkara Substation commissioned on 1.02.2010.

Sl. No.	Para No.	Paragraph	Statement
1	3.31		The delay in commissioning of GIS substations at Thiruvananthapuram & Kochi and the associated cable laying works was mainly due to the delay in getting clearance from various statutory bodies such as PWD, Irrigation Department, NH authorities etc. The under ground cabling works involving EHV cables through Highway roads require statutory clearance from many state and National authorities. All these requires fulfillment of many statutory obligations. The GIS substation at Thiruvananthapuram (LA Complex & Power House) was commissioned during June 2005. The GIS substation at Fort Kochi was commissioned during May ,2007 and GIS Marine Drive commissioned on 10/2007. The reasons for delay are detailed below. 1. <u>Cable laying work at Ernakulam</u> <u>(a) 66 kV Cable laying from Perumanoor to Marine drive (Route Length 4.2 Km)</u> <u>The work was entrusted to M/s CCI</u> Even though the work order was issued in 4/2000, it was possible to remit the road restoration charges only during

			10/2000. The firm commenced the work on 8-1-2001 with trial pits and road crossings. The cable laying started on 26-3-2001. Up to 8.6.2001, 1.5 km cable laying was completed. The work could not be continued due to PWD ban on road cutting during monsoon. Hence, no further progress could be made during the year 2001. In the 5th section of the route (from Kasavukada to Park Avenue), the feeder had to cross five big oil pipelines of M/s HPCL, BPCL and CRL. From the beginning of the project itself, the matter was discussed with these oil companies. Several meetings were conducted for the clearance to be maintained. Initially a clearance of, 1.5 m was insisted by the companies, which was not at all practical in this water logged area. The matter was taken up with M/s. Oil Industries Safety Directorate, Delhi, and 30 cm clearance was confirmed by them. This confirmation took some month's time. The work at 5th section was re- started on 31-12-2001 and finished on 08.01.2002. The firm finished two more sections starting from 25.02.2002 to 15.05.2002. After that, the firm did not carry out any work during that year. In the 6th section (along Park Avenue road), there is a culvert crossing in front of Yathri Nivas. And also in the 8th section there is a market canal crossing. Both these crossings involved additional civil works as demanded by the PWD. The firm demanded additional amount for this additional work. The estimate for the additional work was sanctioned

			from the office of the Chief Engineer Transmission South 16-9-2003 and the work was arranged departmentally during 12/2003. No progress was achieved in cable lying during 2003, as the firm did not turn up to carry out the work in the fair months of 2003 in spite of repeated directions. The 6th section work commenced on 24-04-2004 and completed on 05.05.2004. Then due to heavy rain, the work was stopped. PWD permitted to resume the work only after the rainy season. The Balance work of 1.2 Km commenced on 03-11-2004 and was completed on 23-11-2004. Thus, the cable laying work was completed. In spite of repeated instructions, the firm did not turn up to do the balance work of construction of jointing chambers and jointing works till March 2005. The construction of cable jointing chamber commenced on 04-03-2005 and completed by 15-04-2005. The jointing work completed on 31-5-2005 except the indoor end termination in GIS Substation. <u>(b) 66 kV feeder from Kaloor to Marine Drive (Route Length – 3.8 km)</u> <u>The work was entrusted to M/s FGI</u> Here also, the road restoration charges were remitted on 30-1-2002 and work was started on 07-03-2002. The work was stopped in November 2002 due to the visit of the Hon'ble President of India at Cochin. Again, due to the visit of Hon'ble Prime Minister of

			India in January 2003, work could not be preceded further. Thus, one fair month's time was lost. Then, the work restarted and the Rail crossing was done under North Over Bridge, which was time consuming. Much progress could not be obtained as the laying was through the busiest roads in Kochi. Traffic blockage was also a major hurdle in achieving good progress along this route. The PWD officials objected further open trenching of the road and the works had to be stopped. Various alternatives were looked in to ie; Horizontal directional drilling method and laying through the drain etc. were considered and subsequently found not practical. In 2004, the PWD gave road-cutting sanction for open trenching only in April. The next section of 500 m was started on 30-4-2004 and completed on 12-5-2005. Due to heavy rain and early onset of monsoon, the work had to be stopped. After the monsoon season, the road cutting permission was again obtained from PWD on 1-11-2004. The final section of cable laying (800m) was commenced from 7-11-2004 and was completed on 20-11-2004. The constructions of all the 7 jointing bays were completed in December 2004 itself. The jointing work was completed in May 2005 except indoor end termination at GIS Substation. (c) 66 kV feeder Double circuit feeder from Mattancherry to Fort Kochi (Route length 4.2 km) The work was entrusted to M/s RPG

			The work by M/s RPG started on 9-11-2000 with trial pits, and completed on 20-1-2001. After taking trial pits, it became necessary to deviate the route due to public protest in cutting the freshly tarred road. The cable laying work started on 22-1-2001 and completed 1.5 km on 10-5-2001. The work was stopped due to the onset of monsoon. In the next season from 24-11-2001 to 28-1-2002, 1 km of cable laying was completed After 1/2002, the work was stopped due to shortage of Cable. 1 km cable laying was completed by 7-02-2003. The firm did not turn up until 11/2003 wasting several fair months. 500 meter cable laying was done in 11/2003 One drum of cable stored at site by the firm of damaged in 3/2001. The cable was tested and brought back by the firm only on 25-4-2004. This cable was utilized in the last 200 m stretch of the feeder. The laying was completed in 11/2004. There was a dispute regarding the size of the jointing chambers to be constructed. The size in the drawing was of double circuit, while in the schedule, the specified size was of single circuit. The dispute was resolved on 25-2-05. The jointing was carried out in temporary chambers as in the case of 110 kV cable at Willington Island Substation and the jointing work was completed in 28-4-2005. The heavy rains; non- receipt of sanction from the District Administration and the inability of the contractors to mobilize work at the appropriate time had delayed the work. Stoppage of work due to VVIP visit had also hampered the

			progress of work. The work of cable laying including joints along all the routes were completed by 31st May 2005. Substation Building at Fort Kochi The Building work was originally awarded to M/s. Target Engineering Corporation on 8-2-1995. The ground floor roof height was designed as 6m. To provide 4m statutory clearance of 66 kV live part to ground, the GIS room floor level was raised by 0.5 m and transformer room floor lowered by 0.5 m. Then the height of the building up to Ground floor was fixed as 7 m and haunch for the crane was fixed at 4.5 m. In order to have sufficient head room clearance and for easy maneuvering of cables, the height of the building up to Ground Floor slab was again increased to 8 m after a discussion with Chief Engineer (WBP'S) in the conference held on 04.01.95. The increase in height necessitated strengthening of columns, which were already designed for 6 m high roof. In the meanwhile, the contractor stopped work due to labour problems and dispute due to increase in height of the building on 4-12-1995. The work awarded to M/s. Target Engineering Corporation was terminated on 14-07-1997. During 7/1997, M/s Holec clarified that 3 m clearance is sufficient from 66 kV bushings to ground. The ground floor roof height was further reduced to 6m and the work awarded to Mr. K.M. Mathew by the Deputy Chief Engineer on 26.02.98. The problem of lack of clearance for the head room of crane again popped up. There was only 23 Cm clearance

			between the top of the haunch and ground floor roof. The building height was finally fixed as 6.5 m on 01.09.1998. The contractor requested escalation of rate and stopped the work in 07/1998. The contract was terminated on 06.02.99. New contract was awarded to Mr. N.V Baby on 25-11-1999, and agreement executed on 07.02.2000. In the mean while, Mr. Mathew had filed a civil suit and hence the site could not be handed over to the present contractor, in time. Mr. N.V.Baby also filed a suit and he did not start the work. Hence, the work awarded to Sri.N.V. Baby was terminated. Again, the work was re- tendered and awarded to Mr. V.Mathew, Perickamathil, Nechoor P.O, on 03-11-2003. The work of the building was completed in all respects on 20-6-2005. <u>Substation Building at Marine Drive</u> The work of casting pile foundation was awarded to M/s G.S Jain & Associates Pvt Ltd and the agreement executed on 28-11-1997. 1st test pile was cast on 21.05.98. The Research Organization, Pallom had not approved the mix design. So the 1st test pile was cancelled. Sanction for revised mix design was obtained on 09-08-98 and the 2nd test pile cast on 12-09-98. Load test of the test pile was done on 25-12-98 and the test failed. Soil test was again carried out on 15.07.99 and report received on 07.09.99. Revised estimate was prepared incorporating new drawings and design and was submitted for sanction from Board. The sanction obtained in 06.09.2000

			and supplementary agreement executed on 20.12.2000. The test pile cast on 11.12.2000. The load test conducted and approval received on 25.03.2001. Casting of working piles started on 20.04.2001 and completed by 10.04.2002. The work of pile cap started on 30.07.2002 and completed by 04/2003 the building work was awarded to Sri. A.S Kunchan on 28.02.2002 and agreement executed on 08.04.2002. He started grade beam work construction in 08/03. M/s G.S.Jain & Associates Pvt Ltd failed to carryout the balance work of transformer plinth and GIS plinth. So the work was terminated at his risk and cost on 12.01.2004. After inviting quotations, the balance of pile caping work was awarded to Sri.A.S.Kunchan. The delay caused after the finalization of pile on 25.03.2001 was due to the lapse of the piling contractor, M/s G.S.Jain & Associates Pvt Ltd. Now the building works are completed. 2. Delay in Cable laying at Thiruvananthapuram The order for laying 66 kV UG cable was placed on 31/5/2000. The work was awarded to 3 different contractors which is detailed below (1) Paruthippara to LA Complex (M/s CCI) Total length - 4.35 Kms No of jointing Chambers - 8 Straight joints - 8 x 3 nos. Terminal joints - 2 x 3 nos.

			(2) LA Complex to Power House (M/s RPG) Total length - 3.48 Kms No of jointing chambers - 6 Straight joints - 6 x 3 nos Terminal joints - 2 x 3 nos. (3) Power House to Thirumala (M/s FG1) Toal length - 6.8 kms No of jointing Chambers - 13 Straight joints - 13 x 3 Nos. Terminal joints - 2 x 3 nos. <u>The delay occurred in cable laying works are mainly due to the following reasons.</u> (1) The cable laying route in Thiruvananthapuram city is passing through the busiest area of the city including culverts, road crossings, and bridges etc. which belong to different agencies like PWD - NH, PWD - City Road, City Corporation, Railways KSRTC etc. The liaison for getting way leave clearances from various agencies started as early as 10/98 and the clearances were obtained as noted below. PWD sanction - obtained on 31/10/2000 (Thirumala to Power House route) PWD sanction - obtained on 7/12/2000 (LA Complex to Power House route)

			NH sanction without cross cutting of roads received on - 02/03/01 (Paruthippara - LA Complex) Railways - during 10/2000 Corporation - 02/11/2000 (2) Jagathy bridge - Cable laying along Jagathy Bridge (8th stretch) could be started only after the completion of the bridge on 16/1/02 even though the cable laying work had started on January 01. The work of 7th sketch was already over on 20/4/01. Thus, the work at Jagathy could be started only on 9/9/02 and completed on 27/9/02 due to delay in obtaining PWD sanction afresh for the laying. (3) The Permission was not obtained in time from the NH authorities to cut open the BM & AC for the road crossing at various locations on the ground that cutting will be allowed only after 5years once the surface is made. Thus, permission was denied on 18/5/00 in NH crossing and all the 3 cable routes were adversely affected. So, Board resorted to lateral Thrust Boring, which was not a time proven technique (a new technique of inserting 300 mm dia pipe at a considerable depth without cutting road surface), the work order of which was issued on 5/9/01. Though the work of lateral Thrust Boring at Ponnara Park (23 m) started on 26/2/02, it stopped on 10/5/02 after 15 m due to underground obstruction along the route. The balance 8 m had to be done by cutting open the road. NH sanction for road cutting was obtained only on

			13/8/02. Thus, a delay of almost 2 years had occurred due to want of the above NH sanction in 5 locations. So, even if the other laying works were completed before this, it cannot be fully finished due to the above problem. (4) Construction of NH duct from Kesavadasapuram to Plamood: Cable laying work from Paruthippara to LA Complex was affected due to the construction of NH duct from Kesavadasapuram to Plamood for a distance of around 1.8 kms out of 4.35 kms. This construction of duct was completed during 9/01 only. Hence, laying could be done only after that. (5) Delay in KSRTC Compound: Sanction was obtained from KSRTC to lay cable in KSRTC compound on 31/3/02. But, when the cable laying work started, KSRTC objected the laying on 8/10/02 and hence revised sanction had to be obtained which was received only on 28/11/02. (6) Damages were observed in the cable laid by M/s RPG on 24/5/05 between Palayam and Panchapura junction during the construction of underpass. The fault in UG Cable has been rectified, (7) Moreover, while the work of cable laying by M/s CCI was in progress. The Executive Engineer, NH Division, Thiruvananthapuram had granted permission to M/ Kerala Communication Network (P) Ltd to lay optical fiber cable

			ducts from PMG to Plamood junction through the trenches below the Board' cable. This matter was not brought to the notice of higher authorities of K.S.E.Board, even though the laying of optical fiber cable was not in anyway connected with the Board's underground cable works. However, allegation was framed against Board officers, which caused undue delay in cable laying in that stretch. (8) Damages caused to cable during reconstruction of Amayizhanchan Thodu Bridge, Thampanoor- During the work of reconstruction of Amayizhanchan Thodu Bridge, the 66 kV cable already laid by M/s FGI through GI Pipe crossing over the bridge had collapsed during 4/03. One pivot adjacent to the Indian coffee House had broken to 2 pieces and the GI Pipe had slanted to ground level. The alignment of the cable had also deviated. This had caused delay as the cables had to be checked and re-laid in coordination with construction work of NH authorities. (9) The work order for the supervision of erection, testing and commissioning of GIS at LA Complex and Power House was awarded to M/s VA Tech Elin Holec High Voltage BV, Netherlands on17/09/04. Accordingly, the experts from M/s VA Tech had arrived on 12/04. The end indoor terminations of the cable laying contractors could be done only after the erection of GIS equipment.

			These reasons mentioned above have caused the delay in cable laying and affected the commissioning of GI Substations necessitating renewal of contract for erection as well as replacement of the damaged bushings. The details of Commissioning of GIS Substations under my jurisdiction are as follows: 66 kV S/s, GIS Fort Kochi - 14-12-06 LA Complex - 16-02-06 Power House - 02-03-06 Marine Drive - 06-10-07 The 66 KV cable laying to Puthiyara Substation was delayed due to the delay in getting permission from other departments. The main bottleneck was the construction of cable over bridge through Canoli Canal. This canal was included in the National "Inland Navigation Scheme of Government of India. Hence permission for laying cable over the canal from Government was a difficult task. This work was done after obtaining government order. The 11 KV cables laid for feeding power from this Substation were energized initially and utilized for power transmission in the city by interconnecting to the existing network. Only a short length, very near to the substation was kept idle.

			The commissioning works of Substation can only be done after laying, jointing of cables. The straight joints/ end termination can be done only in fair weather condition. After completion of cable laying work, without any delay, the substation commissioning works were started.
20	3.32		The 110/33 KV Substation at Thiruvambady was originally proposed for evacuating around 110 MW of power form various SHIPS around Thiruvambady. Later on Board decided to construct only 2 pilot projects i.e. Urumi, Chembukadavu initially. So the power from these SHEPS (Urumi & Chembukadavu) can be evacuated through 33 KV lines. The route selected for drawing 33 KV line was most feasible and shortest. Due to the objections from public and to avoid the delay in construction of line, an alternate route was surveyed. But as this route was not feasible it was decided to draw the line through the original route itself. The line route is mainly through thick vegetation and hilly terrain. Hence erection of poles and stringing of line was very difficult.

		...realization of Rs. 3.11 ... 2004.	
	3.33		The turnkey work for installation of 2 x 20 MVAR capacitor bank at Kunnamangalam Substation was awarded by Chief Engineer, Transmission (South). When the drawings were received for approval, discussions with field officers and representatives of the firm were conducted at site and directions were issued to start the work. So the delay in drawing approval has not affected the progress of work. Also site is in the possession of K.S.E.Board itself, hence handing over is not delayed in this case. The Capacitor bank is put in to service only when the LD station Kalamassery requested to do so. The requirement of capacitive power in the grid at a particular time will be intimated by LD station. Till date only one unit of capacitor bank is necessitated at a time. When one unit was on faulty condition, other can be put in service when it required. So failure of one unit did not

			affect the system and hence no loss. The Shunt Capacitors at Chalakkudy and Sasthamkotta were not working due to Technical problems. Anyhow, the company has rectified the defects and replaced the shunt capacitors.

Annexure 7

Statement showing Transmission Network of Kerala State Electricity Board and its growth

(Referred to in paragraph 2.1.10)

	Description	2007-08	2008-09	2009-10	2010-11	2011-12	Total
	A. Number of Sub-stations (Numbers)						
1	At the beginning of the year	270	285	302	330	340	270
2	Additions planned-spill from previous	0	23	62	76	101	
3	Additions planned for the year	38	56	42	35	54	225
4	Actual addition during the year	15	17	28	10	10	80
5	At the end of the year (1+4)	285	302	330	340	350	350
6	Shortfall in additions (2+3-4)	23	62	76	101	145	135
	B. Transformers capacity (MVA)						
1	At the beginning of the year	13576.3	14357	14680.7	15826.1	16105	13576
2	Additions planned-spill from previous	-	-287.2	1046.4	1234.4	1943	
3	Additions planned for the year	493.5	1657.1	1333.4	987.5	2516.5	6988.0
4	Actual addition during the year	780.7	323.7	1145.4	278.9	220.5	2749.2
5	At the end of the year (1+4)	14357	14680.7	15826.1	16105	16325.5	16325.5
6	Shortfall in additions (2+3-4)	(287.2)	1046.4	1234.4	1943	4239	4239
	C Transmission lines (CKM)						
1	At the beginning of the year	9652.21	9826.17	10013.24	10279.03	10376.85	9652.21
2	Additions planned-spill from previous		227.84	1158.65	1492.7	2079.88	
3	Additions planned for the year	401.80	1117.88	599.84	685	1095.52	3900.04
4	Actual addition during the year	173.96	183.07	265.79	97.82	81.76	806.4
5	At the end of the year (1+4)	9826.17	10013.24	10279.03	10376.85	10458.61	10458.61
6	Shortfall in additions (2+3-4)	227.84	1158.65	1492.7	2079.88	3093.64	3093.64

[16] Excludes 10 SSs which were upgraded during the review period

[17] 225+80+10SSs)

Annexure 8

Statement showing transformer failures in Kerala State Electricity Board
(Referred to in paragraph 2.1.24)

Year	No. of transformers at the end of the year (For all SS)	No. of transformers failed (127 SS)	No. of transformers failed within guarantee period (127 SS)	No. of transformers failed within normal working life (127 SS)	Expenditure on repair and maintenance (₹ *in crore*) (127 SS)
2007-08	721	3	1	2	0.03
2008-09	764	5	2	3	0.04
2009-10	798	6	1	5	0.59
2010-11	858	2	1	1	NA
2011-12	886	6	1	5	2.62

Annexure 9

Details of expenditure and cost per unit of transmission wing in Kerala State Electricity Board

(*Referred to in paragraph 2.1.34*)

(₹ in lakh)

Sl No	Description	2007-08	2008-09	2009-10	2010-11	2011-12
1	**Expenditure**					
	Fixed cost					
(i)	Employees cost	7233.58	8535.39	9636.63	13300.89	15902
(ii)	Administrative and General Expenses	1617.74	1443.51	1341.42	1779.99	179
(iii)	Depreciation	11231.47	12245.90	13640.92	14591.92	1507
(iv)	Interest and Finance charges	5.15	9.67	1.34	0.75	
	Total fixed cost	20087.94	22234.47	24620.31	29673.56	3276
	Less Expenditure capitalised	1473.87	1972.08	2493.37	2936.08	351
(a)	**Net Fixed Cost**	18614.07	20262.39	22126.94	26737.48	2924
(b)	**Variable cost - Repairs & Maintenance**	2746.20	3394.77	4218.40	4918.66	530
(c)	**Total cost (a) + (b)**	21360.27	23657.16	26345.34	31656.14	3455
	Power transmitted (MU)	15523.93	15451.35	17094.76	17469.02	1908
2	Fixed cost (₹ per unit)	0.12	0.13	0.13	0.15	
3	Variable cost (₹ per unit)	0.02	0.02	0.03	0.03	
4	Total cost (₹ per unit)	0.14	0.15	0.16	0.18	

Annexure 15

(Referred to in paragraph 3.8)

Statement showing transformer capacity, installed capacity for transmission, length of transmission lines, total power handled, supplied and transmission loss in Kerala State Electricity Board for the five years upto 2005-06

Sl. No	Particulars	2002-03	2003-04	2004-05	2005-06	2006-07 *
1	Transformer capacity-					
	400/220/110/66KV (MVA)	10915.00	11826.90	12432.00	12536.40	12564.00
	33KV (MVA)	190.00	260.00	380.00	465.00	510.00
2	Installed capacity 400/220/110/66KV (MW)	9823.50	10644.21	11188.80	11282.76	11307.60
	33KV (MW)	171.00	234.00	342.00	418.50	459.00
3	Transmission lines (CKMs)					
	220KV	2577.89	2582.15	2594.35	2653.00	2654.00
	110KV	3554.94	3730.64	3802.50	3816.00	3875.00
	66 KV	2933.08	2943.33	2948.37	2961.00	2986.00
	33 KV	252.85	358.92	530.69	647.00	715.00
4	Power handled (Million units(MU) available)	12544.96	12143.43	12313.34	13136.21	14798.06
5	Total units supplied for distribution (MU)	11854.16	11409.16	11731.24	12558.05	14098.06
6	Transmission loss (MU) (4-5)	690.80	734.27	582.10	578.16	700
7	Transmission loss (*per cent*) (6÷4) 100	5.50	6.04	4.72	4.40	4.70
8	**Transmission loss in excess of norm of 4 *per cent* (MU)**	**188.40**	**248.00**	**88.79**	**52.56**	**108.03**

* Provisional figures

Annexure 16
(Referred to in paragraph 3.9)

Statement showing physical targets and achievements of transmission system improvement works in Kerala State Electricity Board

Substation	Target			Achievement		
	No of sub station	Capacity in MVA	Line length in circuit Kms	No of substation *(per centage)*	Capacity in MVA *(per centage)*	Line length in circuit Kms *(per centage)*
New Substations (a)						
220 KV	3	665.00	2.00	0	0	0
110 KV	36	1249.00	575.74	13 *(36)*	288.00 *(23)*	234.77 *(41)*
66 KV	15	269.90	198.32	11 *(73)*	125.00 *(46)*	72.08 *(36)*
33 KV	143	1340.00	1771.96	45 *(31)*	355.00 *(27)*	512.26 *(29)*
Total	**197**	**3523.90**	**2548.02**	**69** *(35)*	**768.00** *(22)*	**319.11** *(32)*
Up gradation of Substations (b)						
220 KV	11	1837.50	249.94	3 *(27)*	277.50 *(15)*	39.71 *(16)*
110 KV	36	1466.00	389.52	11 *(31)*	379.00 *(26)*	284.00 *(73)*
66 KV	-	-	-	-	-	-
Total	**47**	**3303.50**	**639.4 6**	**14** *(30)*	**656.50** *(20)*	**323.71** *(51)*
Capacity enhancement (c)						
220 KV	6	1137.50	--	3 *(50)*	180.00 *(16)*	--
110 KV	52	1115.50	19.20	28 *(54)*	477.40 *(43)*	--
66 KV	7	594.00	8.30	0	0	--
Total	**65**	**2847.00**	**27.50**	**31 (48)**	**657.40 (23)**	
Overall Performance (a+b+c)						
220 KV	20	3640.00	251.94	6 *(30)*	457.50 *(13)*	39.71 *(16)*
110 KV	124	3830.50	984.46	52 *(42)*	1144.40 *(30)*	518.77 *(53)*
66 KV	22	863.90	206.62	11 *(50)*	125.00 *(14)*	72.08 *(35)*
33 KV	143	1340.00	1771.96	45 *(31)*	355.00 *(26)*	512.26 *(29)*
Total	**309**	**9674.40**	**3214.98**	**114** *(37)*	**2081.90** *(22)*	**1142.82** *(35)*

Annexure 17
(Referred to in paragraph 3.14)

Statement showing idle investment due to mis-match in construction of substation and line works in Kerala State Electricity Board

Sl No	Name of Substation / line	Period of idling (months)	Investment (Rs in crore)	Reasons for delay in commissioning
1	One 33 KV Athani-Kunnamkulam line (16 Km) completed in July 2003	10	3.52	Non completion of 33 KV Substation up to May 2004
2	Two lines 33 KV Pulamanthol-Koppam and Pulamanthol-Makkaraparamba completed in December 2000 and October 2001	48 & 38	0.61	Non completion of Pulamanthol and Makkaraparamba substations up to December 2004
	Total		4.13	
3	110/33/11 KV Agasthiamoozhy: 90 *per cent* completed in September 2003	10	1.98	Non completion of 8 Kms of Kunnamangalam-Agasthiamoozhy line up to July 2004
4	110/33 KV Kollangode, 33 KV Muthalamada, 33 KV Koduvayoor: 95 *per cent* completed in March 2002	21	2.83	Non completion of 33KV transmission lines up to December 2003
5	33 KV Kadakkal: 50 *per cent* completed in February 2003	26	1.51	Non completion of 33 KV line from Kilimanoor to Kadakkal up to April 2005
6	33 KV Thazhekode: Completed in January 2002	10	1.21	Non completion of 33 KV line up to November 2002
7	33 KV Chavakkad: Completed in Octoberl 2002	30	1.54	Non completion of 33 KV Guruvayoor-Chavakkad line up to April 2005
8	33 KV Pattikkad: Completed in April 2002	16	1.05	Non completion of 33 KV line from Ollur to Pattikkad up to August 2003
9	33 KV Puthur: Completed in April 2002	11	1.87	Non completion of 33 KV line from Ollur to Puthur up to March 2003
10	33 KV Kongad: 90 *per cent* completed in March 2003	33	2.02	Non completion of 33 KV line from Parali to Kongad up to December 2005
11	33 KV Kaipamangalam completed in May 2003	28	0.50	Non-completion of 33 KV line from Valappad to Kaipamangalam up to September 2005.
	Total		14.51	
	Grand total		18.64	

Annexure 18

(Referred to in paragraph 3.14)

Statement showing idle investment due to mis-match in construction of feeder substations and other substations in Kerala State Electricity Board

Sl No	Feeder substation (No. of transformers and capacity)	Invest-ment (Rs in crore)	Beneficiary substations (33 KV)	Status of commissioning of beneficiary substation	Delay in months up to March 2007
1	110/33 KV Ollur (2*16 MVA) completed in August 2001	3.57	Pattikkad	August 2003	24
			Palakkal	Ongoing	67
			Puthur	March 2003	19
2	110/33 KV Irinjalakuda (2*16 MVA) 96 *per cent* completed in May 2003	2.40	Parappukara	August 2003	3
			Vellangallur	March 2006	34
3	110/33 KV Valappad (2*16 MVA) 95 *per cent* completed in May 2003	2.80	Anthikkad	Ongoing	46
			Kaipamangalam	September 2005	28
			Anchangadi	September 2005	28
4	110/33 KV Chalakkudi (2*16 MVA) 90 *per cent* completed in May 2003	3.02	Kallettumkara	November 2005	30
			Pariyaram	Ongoing	46
			Vellikulangara	Ongoing	46
			Koratti	Ongoing	46
5	110/33 KV Viyyur (2*16 MVA) 80 *per cent* completed in May 2003	1.52	Poomala	November 2006	42
			Kundukad	Ongoing	46
			Parappur	Ongoing	46
6	110/33 KV Cherpu (1*16 MVA) completed in November 2001	1.71	Chirakkal	December 2005	49
7	110/33 KV Koottanad (1*16 MVA) completed in June 2002	1.78	Thrithala	December 2002	6
			Chaisseri	December 2002	6
8	110/33 KV Mannarkad (2*16 MVA) completed in September 2002	1.98	Agali	December 2002	3
			Alanellur	May 2004	20
9	110/33 KV Parali (2*16 MVA) 85 *per cent* completed in January 2003	1.54	Kongad	December 2005	35
			Sreekrishnapuram	December 2005	35
10	110/33 KV North Parur (2*16 MVA) 95 *per cent* completed in September 2002	3.25	Vadakkekkara	November 2005	38
			Varapuzha	Ongoing	54
			Alangad	Ongoing	54
11	110/33 KV Moovattupuzha (2*16 MVA) partially commissioned in December 2004	3.20	Pothanikkad	Ongoing	27
			Kallurkkad	Ongoing	27
			Mazhuvannur	December 2004	nil
12	110/33 KV Perumbavoor (1*16 MVA) 98 *per cent* completed in Septemmber 2002	2.05	Kuruppampadi	December 2003	15
			Vengola	Ongoing	54
13	110/33 KV Kurumasseri (2*16 MVA) completed in September 2002	3.30	Puthanvelikkara	May 2005	32
			Annamanada	Ongoing	54
14	110/33 KV Malayattoor (2*16 MVA) 90 *per cent* completed in Septemmber 2002	2.85	Kalady	December 2004	27
			Koovappady	Ongoing	54

15	110/33 KV Udumpannoor (2*16 MVA) completed in October 2005	1.45	Vannapuram	Ongoing	17
			Muttom	Ongoing	17
16	110/33 KV Pala (2*16 MVA) transformer received in October 2005	1.55	Paika	Ongoing	17
			Ramapuram	Ongoing	17
17	110/33 KV Pathanamthitta (2*16 MVA) completed in December 2003	3.20	Ranni-Perinad	Ongoing	39
			Konni	Ongoing	39
18	110/33 KV Edappon (1*16 MVA) completed in December 2003	2.50	Pandalam	Just started	39
			Kattanam	Just started	39
19	110/33 KV Punnapra (1*16 MVA) completed in December 2003	2.30	Thakazhy	Ongoing	39
20	110/33 KV Mallappally (1*16 MVA) completed in December 2003	2.30	Kumbanad	Ongoing	39
21	110/33 KV Thycattussery (2*16 MVA) completed in March 2004	3.52	Kuthiyathode	Ongoing	36
22	110/33 KV Edathuva (2*16 MVA) 45 *per cent* completed in February 2005	3.00	Kidangara	Land yet to be identified	25
			Kadapra	Land yet to be identified	25
23	110/33 KV Ambalappuram (2*16 MVA) completed in January 2003	2.37	Chengamanad	June 2006	41
			Ezhukone	On going	50
			Veliyam/ Pooyappally	Just started	50
			Puthur/Kollam	Just started	50
24	110/33 KV Kilimanoor (1*16 MVA) completed in March 2001	1.62	Kadakkal	April 2005	49
25	110/33 KV Punaloor (2*16 MVA) completed in January 2003	2.35	Pathanapuram	Kept in abeyance	50
			Anchal	Just started	50
26	110/33 KV Attingal (2*16 MVA) 40 *per cent* complete in March 2003	1.28	Kadakkavur	Ongoing	48
			Venjaramud		
27	110/33 KV Thirumala (1*16 MVA) 69 *per cent* complete in March 2005	0.90	Balaramapuram	Not started	24
			Peyad		
28	110/33 KV Parassala (1*16 MVA) 66 *per cent* complete in March 2005	1.00	Poovar	March 2007	24
29	66/33 KV Peerumedu (1*16 MVA) erected in March 2005	1.00	Upputhara	Ongoing	24
			Wagamon	Ongoing	24
30	66/33 KV Nedumkandam (1*16 MVA) transformer received in January 2006	1.02	Senapathy	Ongoing	14
			Murugassery	Ongoing	14
	Total	**66.33**			

Annexure 19
(Referred to in paragraph 3.14)

Statement showing idle investment in purchase of transformers and other equipments in Kerala State Electricity Board

Sl No	Substation / equipments	Date of supply/receipt	Cost (Rs in crore)	Period of idling	
				From-to	Months
1	33 KV Koratty- 33 KV transformer and other substation equipments	October 2004	0.82	October 2004- March 2007	29
2	33 KV Kidangoor, Upputhara, Vagamon and Ramapuram- four 33 KV transformers received but not erected	September 2006	1.05	September 2006- March 2007	6
3	33 KV Kadakkal- two 33 KV transformer received but not erected	August 2000	0.80	August 2000- February 2003	30
4	110/11 KV Edathuva- two 110/33 KV transformers received but not erected	October 2001	0.31	October 2001- May 2003	19
		November 2005	0.46	November 2005- March 2007	16
		August 2006	0.26	August 2006- March 2007	7
5	110/11 KV Ambalappuram- two 110/33 KV transformers and two 110/11 KV transformers received but not erected	March 2001	1.28	March 2001- January 2003	22
		March 2001	1.15	March 2001- June 2003	27
6	110/11 KV Kozhanchery- two 12.5 MVA, 110 KV transformers received but not erected	March 2000	0.62	March 2000- May 2006	74
	Total		**6.75**		

Annexure 20
(Referred to in paragraph 3.35)

Statement showing short accountal of power purchases in Kerala State Electricity Board during the year 2005-06

Sl No	Particulars	2005-06
1	Purchases accounted (MU)	7624.10
2	Aggregate quantity of power billed (MU)	7414.87
3	Difference (MU)	209.23
4	Less Auxiliary consumption (MU)	Nil
5	Transmission and distribution loss not accounted (MU)	209.23
6	Average sales realisation per (MU)	3.09
7	Revenue loss (Rupees in crore)	64.65

KERALA NIYAMASABHA PRINTING PRESS.