

PUNJAB STATE ELECTRICITY REGULATORY COMMISSION  
SCO 220-21, SECTOR – 34-A, CHANDIGARH

Petition No. 54 of 2014  
Date of Order: 04.12.2014

In the matter of: Technical audit of works executed by PSTCL and PSPCL for development of transmission/sub-transmission system from 01.04.2010 to 31.03.2013.

In the matter of: 1. Punjab State Transmission Corporation Limited  
2. Punjab State Power Corporation Limited

Present: Smt. Romila Dubey, Chairperson.  
Er. Virinder Singh, Member.  
Er. Gurinder Jit Singh, Member.

**ORDER:**

Central Power Research Institute (CPRI) Bangalore was appointed by the Commission vide No.PS/CON/120/49 dated 16.09.2013 as a consultant for undertaking the technical audit of works executed by Punjab State Power Corporation Limited (PSPCL) and Punjab State Transmission Corporation Limited (PSTCL) for the period from 01.04.2010 to 31.03.2013. The scope

of work and the responsibility of the consultant for carrying out the assignment involved the following:

- (i) Alignment of methodology adopted by the Transmission and Distribution Licensees (PSTCL and PSPCL) for development of a reliable Transmission/Sub-Transmission System for meeting with load demand and evacuation of power from the generating stations with the planning criteria as laid down in “Manual of Transmission Planning Criteria (MTPC)” issued by Central Electricity Authority.
- (ii) Implementation of provisions of Grid Code including Planning, Connection, Operation and Metering codes for efficient, economical and coordinated Technical Interface among other power utilities/both licensees PSTCL & PSPCL and development of a robust and reliable Transmission network.
- (iii) Implementation of various facets of planning and construction by PSTCL & PSPCL viz. Planning Criteria, Project Report Preparation, System Engineering, Procurement Procedures, Project Management & Monitoring, Quality Assurance, Construction Practices, Safety and Training in line with the report of the Committee constituted by the Ministry of Power/Gol recommending the “Best Practices in Transmission.”
- (iv) Validation of the technique/software used for Assessment of Demand, Load flow analysis, Contingency Analysis, Short Circuit Analysis and Dynamic Stability Analysis for Voltage wise Capacity Addition Plan by PSTCL/PSPCL.

- (v) Scrutiny of procedure for award of contracts by PSTCL/PSPCL with reference to principles of economy, efficiency, effectiveness and quality.
- (vi) Scrutiny of physical and financial progress reports for both PSTCL/PSPCL vis-a-vis records relating to project execution, procurement, receipt of funds and expenditure, scheduled date of Commissioning and budgeted expenditure.
- (vii) Whether the companies achieved the planned additions/augmentation/up-gradation of the transmission/sub-transmission system in respective years with respect to the planned works. Scrutiny of time overrun and cost overrun.
- (viii) Whether the companies took up various preparatory activities such as surveys, design and testing, processing for forest & other statutory clearances, tendering activities etc. parallel to Transmission system/sub-transmission system project appraisal and sanction/approval. Blockade of funds due to delay on this account.
- (ix) Whether benefits envisaged to the consumers actually achieved in terms of flow of reliable power by both of companies? Loss due to delay in up-gradation/Commissioning of transmission system in terms of flow of energy with respect to Available Transmission Capability (ATC) & Total Transmission Capability (TTC). Financial loss due to blockade of funds due to poor planning.
- (x) Unfruitful payment of transmission charges to PGCIL due to delay in development of linking system.

- (xi) Matching of construction of substations, related lines and downstream sub-transmission and distribution network. Assessment of losses due to underutilization of capacity of substations due to non-construction of downstream system by distribution licensee (PSPCL).
- (xii) Financial and Technical Loss on account of damage to equipments due to poor design, poor quality of construction (non compliance of requisite specifications/standards) or inadequate protection system.
- (xiii) Losses on account of mismatch between available generation capacity and development of transmission and sub-transmission facilities.
- (xiv) Whether adequate number of shunt capacitors provided for reactive compensations by PSTCL & PSPCL? Penalties paid on account of inadequate reactive compensation.
- (xv) Losses on account of poor planning for inventory management, material at site and purchase of spares.
- (xvi) Extent of overloading of the Transmission & Sub-transmission substations as compared to permissible maximum capacity as per manual on Transmission Planning Criteria (MTPC). Whether rating of various substation equipment matches with loading limits of Transmission/Sub-transmission Lines? Whether timely action for preparation of suitable plan for expansion/augmentation taken up or not?
- (xvii) Capital Expenditure incurred/planned to be incurred towards development of smart grid operations, SCADA & SLDC. The intended purpose achieved/to be achieved in terms of energy accounting, checking of overdrawal, outage detection and

well-coordinated outage recovery. Losses on account of delay in executing various schemes e.g. Procurement and integration of RTUs, Interstate and Intra-state ABT metering system etc.

- (xviii) Expenditure on safety measures and training as per CEA (Safety Requirements for construction, O&M of Electrical Plants and Electric Lines) Regulations, 2011 vis-a-vis loss due to accidents. Implementation of already approved 'PSEB Training Policy'.
- (xix) Cross checking the Transmission System Projects executed by PSTCL to ascertain their necessity in view of PSPCL's view that PSTCL has been executing some of the Transmission System Projects (Substations and Transmission Lines) which were otherwise the responsibility of PGCIL thereby burdening the distribution licensee (PSPCL) financially. Necessary System Studies and techno-economic analysis be carried out to establish the factual position.
- (xx) Laid down 'Future Road Map' for development of Transmission and Sub-transmission system aligned with tenets laid down under the "Manual of Transmission Planning Criteria (MTPC)" issued by Central Electricity Authority for efficient, economical and coordinated Technical Interface with other transmission and distribution licensees.

2. The Commission vide its various letters directed PSTCL and PSPCL to provide the relevant information to facilitate the conduct of the study. PSTCL and PSPCL vide their various letters and e-mails

submitted the information. The Commission officers conducted discussions with the Consultants along with the officers of PSTCL and PSPCL to discuss in detail the information required and the information submitted by PSTCL and PSPCL.

CPRI Bangalore submitted the preliminary report in respect of audit of PSTCL and PSPCL transmission/sub-transmission system to the Commission. Thereafter, the Commission held meetings with the Consultant on 18.03.2014 and 19.03.2014 to discuss various issues brought out in the report. Taking cognizance to various observations made by the Commission during the aforesaid discussions, the Consultant submitted the Audit Report in respect of PSTCL and PSPCL. PSTCL and PSPCL were asked to give comments on draft report vide Commission's letters dated 03.06.2014 and 11.06.2014 respectively. PSTCL and PSPCL submitted their comments vide their letters dated 17.06.2014 and 07.07.2014 respectively on the Audit Report. Consultant submitted its response on comments of PSTCL and PSPCL.

### **3. Initiation of Suo-Motu Petition**

For taking further action in the matter, a Suo-Motu petition (No. 54 of 2014) was initiated by the Commission and notices were issued to PSTCL and PSPCL. PSTCL was asked to give comments on the comments of PSPCL and PSPCL was asked to give comments on comments of PSTCL. PSTCL and PSPCL submitted their comments vide letters dated 23.09.2014 and 24.09.2014 respectively.

During hearing of the petition on 20.10.2014, PSTCL and PSPCL submitted that certain data/information could not be made available to the consultant earlier and stated that they want to give clarifications on the data supplied earlier. They requested to supply the additional

information on the scope of work as discussed during the hearing. After hearing the arguments of PSTCL, PSPCL and consultant; the Commission directed PSTCL and PSPCL to have a meeting with the consultant on 27/28<sup>th</sup> October, 2014 at Patiala to supply the requisite information/clarifications. Thereafter, the consultant was directed to submit the supplementary report to the Commission after incorporating the same, by 14.11.2014. The order was reserved. The Consultant submitted its supplementary reports after incorporating the additional information/clarifications supplied by PSTCL and PSPCL on 15.11.2014 and 17.11.2014 respectively.

**4. Analysis and decision of the Commission:**

The study carried out by the consultant, recommendations given in the reports, comments made by PSPCL and PSTCL on the reports, observations of the consultants on the comments of PSPCL and PSTCL, comments of PSTCL on the comments of PSPCL, comments of PSPCL on the comments of PSTCL and supplementary report from the consultant alongwith the view of the Commission on the key issues covered in the study are discussed in the following paragraphs:-

5. **Alignment of methodology adopted by the Transmission and Distribution Licensees (PSTCL & PSPCL) for development of a reliable Transmission/Sub-Transmission System for meeting with load demand and evacuation of power from the generating stations with the planning criteria as laid down in “Manual of Transmission Planning Criteria (MTPC)” issued by Central Electricity Authority.**

(i) The consultant pointed out that PSTCL and PSPCL have not adopted any methodology for development of reliable transmission/sub-transmission system for meeting with load demand and evacuation of power from the generating stations with the planning criteria as laid down in “Manual of Transmission Planning Criteria (MTPC)” issued by Central Electricity Authority and there is need to implement the same.

(ii) PSTCL in its comments submitted that first preference has been given to the load forecasting as per provisions/guidelines of State Grid Code. PSTCL further submitted that PSPCL has not provided data on the relevant performa/format sent to them. In the absence of data, PSTCL has to rely on CEA load projections as per EPS 17/18<sup>th</sup> reports.

(iii) PSPCL submitted that it is taking due care for development of reliable sub transmission system for meeting future load demand. Besides that, transmission system above 66kV is being planned by PSTCL, and the same is planned well in advance keeping in view the upcoming generating stations resulting into establishment of 400kV transmission ring main in Punjab. PSPCL at its own level plans and executes the related 66kV level sub-transmission system for which planning criteria as laid down in ‘Manual of Transmission Planning Criteria’ is kept in view. PSPCL has already issued planned list of works to improve sub- transmission system up to the year 2017. PSPCL has a practice to review these works based on actual site conditions.

(iv) PSPCL vide letter dated 24.09.2014 submitted on the comments of PSTCL that it has not received any request from PSTCL regarding furnishing of load forecasting data. PSTCL has not brought out such demand in various Coordination Committee meetings being held on regular basis. Planning Organization is planning the sub transmission system broadly as per planning criteria laid down in ‘Manual of

Transmission Planning Criteria'. The basis for planning is the data/projections of Central Electricity Authority which is based on information/figures/data supplied by PSPCL/PSTCL and all other relevant factors. Now, PSPCL has formed a Committee of three Chief Engineers to prepare demand forecasting upto the year 2024-25, which will be supplied to PSTCL after finalization.

(v) As per the order of the Commission dated 21.10.2014, PSTCL supplied additional information to the consultant and submitted that:-

So far as planning part is concerned, PSTCL is doing its planning for 400kV/220kV/132kV transmission works strictly as per the various provisions of Manual of Transmission Planning Criteria (MTPC). Guidelines /various provisions of State Grid Code are also being followed as:-

- (a) Data from various utilities like HVPNL, UPPCL, J&K, Rajasthan, Himachal, BBMB etc. is being taken on prescribed proforma as per the Planning Code.
- (b) Data is further processed/converted according to the suitability of Power System Analysis Software, and a data base is created for the system network.
- (c) Load projections for the State have been considered as per the EPS 18th report. Now, PSTCL has prepared its own data base for loads (Sub-Station wise) on the basis of last 11 year's figures and load projections for FY 2016-17 have been worked out on average growth rate for each individual grid station.
- (d) Different transmission alternatives are worked out, while deciding the evacuation system of a power plant or a 400kV/220kV grid, and these alternatives are further scrutinized on account of "Right

of Way" space constraints as well as economical aspects and finalized accordingly.

(e)A "Fault Study Report" is also prepared on Five Year Plan basis and is circulated to various organizations such as TS, P&M, and other offices of PSPCL. Findings of the report are useful in:-

- Designing Earth Mat of Sub-Stations.
- Deciding switchgear capacity of equipments at the sub-stations.
- For relay co-ordination in P&M.
- For deciding relay settings at generating stations.

(vi) In the supplementary report submitted in compliance to Commission's Order dated 21.10.2014, Consultant has further submitted that PSTCL need to adopt the other aspects of MTPC, Grid Code and various facets of Planning and Construction.

**The Commission agrees with the recommendations of the consultant regarding methodology for reliable transmission system development and directs PSTCL and PSPCL to consider, adopt and implement in toto the aspects/provisions of the planning criteria as laid down in "Manual of Transmission Planning Criteria" (MTPC) issued by CEA (Central Electricity Authority).**

**6. Implementation of provisions of Grid Code including Planning, Connection, Operation and Metering codes for efficient, economical and coordinated Technical Interface among other power utilities/both licensees (PSTCL & PSPCL) and development of a robust & reliable Transmission network.**

(i) The consultant has mentioned that PSTCL and PSPCL have not furnished any information specifically with regard to implementation of

various provisions of Grid Code. The Consultant has further mentioned that PSTCL and PSPCL are not implementing the Grid Code.

(ii) PSTCL in its comments has submitted that it has given first preference to the load forecasting as per provisions/guidelines of State Grid Code. PSTCL has further submitted that data has not been provided by PSPCL on the relevant proforma/format. In the absence of the data, PSTCL has to rely on CEA load projections as per EPS 17/18<sup>th</sup> reports.

(iii) PSPCL submitted in its comments that various provisions of State Grid Code as brought out below are being followed by it: -

Role of Distribution Licensee (PSPCL) :

- (a) Upgradation of the Distribution System is consistently being carried out on regular basis.
- (b) The provisions of Grid Code as well as non-discriminatory open access to the embedded consumers of PSPCL is being granted according to the provisions of Open Access Regulations – 2011.
- (c) PSPCL is operating its Power System from the SLDC Control Room Ablawal (Patiala).
- (d) The real time monitoring and control of load is also being carried out from SLDC Control Room, Ablawal (Patiala).

Role of Generating Companies:

The real time operation and control of the system and scheduling of generation is being carried out in co-ordination with SLDC.

PSPCL submitted in its comments on comments of PSTCL that primarily the onus of implementation of the Grid Code lies with the SLDC/PSTCL. However, PSPCL is coordinating with the SLDC/PSTCL

for the implementation of the State Grid Code fully. PSTCL has not pointed out any specific issue in this regard.

(iv) PSTCL commented upon the comments of PSPCL that PSPCL being a single generation cum distribution company in Punjab, is carrying out scheduling of generation of Central Sector Plants at its own level and thereafter, upload it on behalf of PSTCL/SLDC, contrary to PSPCL's reply that scheduling of generation is being carried out in co-ordination with SLDC. PSTCL has further submitted that scheduling of new IPPs i.e NPL & TSPL is also being carried out by PSPCL due to its 100% share in these IPPs. However, SLDC is issuing implemented Schedule, State Energy Accounts & UI Accounts.

(v) PSPCL in its comments on the comments of PSTCL has submitted that primarily the onus of implementation of the Grid Code lies with SLDC/PSTCL. However, PSTCL is co-ordinating with SLDC/PSTCL for the true implementation of the Grid Code.

(vi) In compliance to Commission Order dated 21.10.2014, PSTCL has submitted the same additional information to the consultant as brought out in para 5 above.

(vii) In the supplementary report, consultant has given the same view as given in para 5 above.

The Consultant has concluded that PSTCL & PSPCL are not implementing the State Grid Code fully, which has been specified in compliance with section 86 (1) (h) of the Electricity Act, 2003 by the Punjab State Electricity Regulatory Commission. State Grid Code is consistent with the Indian Electricity Grid Code specified by the Central Electricity Regulatory Commission under section 79 (1) (h) of the Act. The State Grid Code lays down the rules, guidelines and standards to be followed by all users of the State Grid and STU/SLDC to operate and

maintain an efficient and coordinated power system in the State in integration with the Northern Regional Grid as per the provisions of Indian Electricity Grid Code (IEGC). The State Grid Code further lays down what is technically optimal with respect to operation and defines standards and common terms to reduce ambiguity and avoid discrimination.

**The Commission directs PSTCL and PSPCL to follow in letter and spirit the relevant provisions of the Grid Code, for efficient, economical and coordinated Technical Interface between PSTCL & PSPCL and to develop a robust & reliable Transmission and Sub-transmission network.**

**7. Implementation of various facets of planning and construction by PSTCL & PSPCL viz. Planning Criteria, Project Report Preparation, System Engineering, Procurement Procedures, Project Management & Monitoring, Quality Assurance, Construction Practices, Safety and Training in line with the report of the Committee constituted by the Ministry of Power/Gol recommending the “Best Practices in Transmission”.**

(i) The consultant has mentioned that PSTCL and PSPCL are not following the report of the committee constituted by Ministry of Power, Govt. of India recommending the “Best Practices in Transmission for carrying out various facets of Planning and Construction.”

The Consultant has submitted that “Best Practices in Transmission” are required to be followed for evacuation of power from a Power Station, which is either newly constructed or where a new generation capacity is added, for grid strengthening, for intra-regional

exchange of power, for inter regional connection for exchange of power. Load flow, short-circuit, stability and over voltage studies are required keeping in view the long term power plans.

The data and time schedules for carrying out Planning Studies are to be collected from various organizations, such as CEA, Planning Commission, respective power utilities, Regional Load Despatch Centres (RLDC), Power Utility's own system and operational data. These are corresponding to different time frames including present scenario and comprise of:

- Generation Details
- Load (both Active and Reactive)
- Details of Transmission Network at different voltage levels
- Transformer Capacity
- Details of Reactive Compensation

Long term transmission plans are required to be evolved considering the long term power transfer requirement from generation resources to Load Centres.

Different Transmission alternatives are required to be evolved. While developing an alternative, following issues are to be considered:

- Minimization of Transmission Cost and Loss
- Right of Way (RoW) considerations
- Optimal utilization of energy resources
- Adoption of new technologies like FACTS (Flexible AC Transmission System) at suitable locations

Most optimal system is to be evolved by carrying out computer studies based on the input available from above.

System Engineering studies are carried out to decide various equipment rating and parameters, charging instructions.

The outputs of these studies are forwarded to various groups for carrying out system design.

(ii) PSTCL submitted that point has been noted for compliance in future while carrying out system studies for 13<sup>th</sup> five year plan.

(iii) PSPCL submitted that best practices in Transmission basically pertains to 132kV & above voltage level and are thus being taken care of by PSTCL. Whereas PSPCL deals with planning of sub transmission system of voltage levels 33kV & 66kV only, still due care is being taken while Planning Sub Transmission System by taking clues from 'Best Practices in Transmission' document & 'Manual of Transmission Planning Criteria' and has submitted as under:

(a) Minimization of Transmission Cost and Loss:

The work of constructing 66kV lines is in the scope of PSPCL. These works are planned by the office of Chief Engineer/Planning, PSPCL, Patiala. The vital input regarding the shortest possible route plan of a 66kV transmission line is provided by the TS organization field staff and is passed on to the planning organization for minimizing the transmission line length. This input helps in reducing the transmission line cost and also results in substantial reduction in the transmission losses.

(b) Right of Way (RoW) Considerations:

Right of Way is always critical for the construction as well as planning of a transmission line. This is particularly a cumbersome problem in the construction field of transmission lines. The Planning Organization often refers the proposal for new transmission line to the TS organization for vetting keeping in view

the Right of Way availability or the obstruction likely to be confronted. Even after planning and start of actual construction of a transmission line, the Right of Way problem crops up. Electricity Act, 2003 empowers the utility for placing towers of transmission line. Govt. of Punjab has conferred powers of telegraph authority to the PSPCL for smooth execution of transmission projects. Even the litigation arises because of the Right of Way problems. Completion of certain ongoing projects misses the target because of this problem. Full attention is given to the subject of following the practically shortest, feasible and most viable route for a transmission line so as to ensure minimum hindrance/ obstruction for the Right of Way.

(c) Optimal Utilization of Energy Sources

Generation capacity is being added in the State of Punjab at different locations. Down the line evacuation of power is being planned by PSPCL and PSTCL jointly. There is a co-ordination committee at the level of Chief Engineer for proper finalization of power evacuation projects. Generation capacity added so far is being evacuated efficiently through 400kV/220kV/ 132kV/66kV transmission system.

(d) Adoption of New Technology like FACTS (Flexible AC Transmission System) at suitable locations

Flexible AC transmission system is being followed by PSPCL. Most of the 66kV transmission lines being planned and constructed by PSPCL are radial type and having loading at the end. However, the subject of flexible AC transmission system falls mostly in the domain of PSTCL.

(iv) PSPCL vide letter dated 24.09.2014 submitted on comments of PSTCL that PSTCL has already agreed to comply with the directions, so PSPCL agrees with the same.

(v) PSTCL gave additional information to the consultant as given under para 5 above.

**The Commission directs PSTCL & PSPCL to follow meticulously the provisions of the report of the Committee constituted by the Ministry of Power/ GoI recommending the “Best Practices in Transmission”.**

**8. Validation of the technique/software used for Assessment of Demand, Load flow analysis, Contingency Analysis, Short Circuit Analysis and Dynamic Stability Analysis for Voltage-wise Capacity Addition Plan by PSTCL/PSPCL.**

(i) The consultant has mentioned that PSTCL & PSPCL are not using any technique/software for Assessment of Demand, Load flow analysis, Contingency Analysis, Short Circuit Analysis and Dynamic Stability Analysis for Voltage wise Capacity Addition Plan and therefore no validation could be done. PSTCL & PSPCL has not used any software for assessment of Demand forecast. PSPCL has assessed demand only on the basis of Power Survey carried out by CEA and the load growth projections in the power survey for Punjab State as a whole has been proportionately applied to all regions/load centres, though realistically the growth of a particular area varies from the other. During a meeting held on 05.09.2013 with PSTCL & PSPCL at Patiala, PSTCL agreed that they will obtain data from PSPCL to have realistic future load growth for each load centre rather than applying a thumb rule to forecast the growth on equal/proportion basis. However, PSTCL could not get the

information from PSPCL. For the future, PSPCL in coordination with PSTCL should forecast future growth based on actual growth for each load centre over the previous years. PSPCL & PSTCL to hold monthly meetings to exchange the information with standard formats for load growth, constraints faced both in existing system and Planning Studies.

PSTCL has not carried out a detailed load flow analysis which could be validated. The only document that PSTCL furnished to CPRI was an analysis based on a peak demand of 9074 MW and the date and time was identified for this peak demand as 5<sup>th</sup> July, 2012 at 18.30 hrs by SLDC, PSTCL. On analysis of the Load Flow Base Case file provided by PSTCL, following key observations were made by the consultant: -

- (a) The Planning studies carried out by PSTCL have not been evolved from the base case of the existing network and its real time data for a particular date and time.
- (b) The reactive power limits were deactivated in the studies carried out by PSTCL. This could result in unrealistic reactive power at the generators and interstate flows. On activation of reactive power limits in the file provided by PSTCL, non convergence was observed.

Consultant carried out Load Flow planning studies for a base case with actual data for date and time of Peak Load for 2012 and considered the base case for carrying out further scenarios, contingencies for future load growth and Power evacuation of additional generation of Talwandi Sabo, Rajpura and Goindwal Sahib. Consultant also carried out the studies for base case for Future Load (2017) along with various scenarios focusing on the Power evacuation of additional generation with different contingencies. The conclusions and recommendations of Load Flow report are given in the Audit Report.

(ii) PSTCL in its comments submitted that they had given first preference to the load forecasting as per provisions/guidelines of State Grid Code and has further submitted that PSPCL has not provided data on the relevant performa/format sent to them. In the absence of data, PSTCL has to rely on CEA load projections as per EPS 17/18<sup>th</sup> reports. PSTCL has given parawise reply to the Load Flow Studies carried out by the consultant.

(iii) PSPCL submitted its comments on the report as under:

- PSPCL is using data of last 4 years for assessment of demand forecast.
- PSPCL is acting in close co-ordination with PSTCL for planning Sub- Transmission System on the basis of forecasting future load growth and holding meetings with PSTCL to exchange information.
- The load flow study, contingency analysis, short circuit analysis and dynamic stability analysis of transmission system are carried out by PSTCL at its own level.
- At this juncture, there is no software with PSPCL to carry out the demand forecasting. Still, PSPCL is exploring the possibility of such software for future use. Beside this, PSPCL is searching for suitable software package, applicable to Sub Transmission System, having features like load flow study, contingency analysis, short circuit analysis and dynamic stability analysis.
- Presently, PSPCL takes into account historical data of sub-stations to assess futuristic load growth as well as upcoming generation.
- The point relating to assessment of load growth, centre/region-wise load has been noted for future compliance for which the required data is being collected from concerned quarters of

PSPCL for supplying the same to PSTCL for accurate forecasting of demand on Day-Ahead & Short term basis, using historical data with consideration of weather and other techno-economic parameters. M/s Marcados Ltd., Gurgaon has been engaged and work order has been placed on the firm.

(iv) PSTCL submitted on the comments of PSPCL that one number software lock of System Study Software (Mi-Power) was retained with PSPCL and this software has all the modules like load flow study, short circuit study as well as Transient Stability Study. Contingency analysis is a part of Load Flow Study. This software lock is still with PSPCL Planning, as such system studies, if required, by providing suitable data, can be carried out for 66kV system.

PSTCL has already requested for the load forecasting data from PSPCL along with the relevant proforma as per State Grid Code provisions. As the prescribed proforma is quite complicated and furnishing load forecasting data on the same may be quite difficult, PSTCL has suggested devising a simple proforma so that purpose of implementing the provisions of State Grid Code is fulfilled and at the same time, PSTCL may also get requisite load forecasting data from PSPCL.

(v) PSPCL submitted on the comments of PSTCL that it is taking the recommendations contained in CPRI report earnestly & sincerely and is holding regular meetings to exchange the information with PSTCL to plan transmission/sub-transmission system as per actual and ground position requirements. Like PSTCL, long term demand forecasting is also an area of concern for PSPCL, and so PSPCL has already formed a committee, to prepare Long Term Demand forecasting upto the year 2024-25, which will take all these things into account and give necessary

recommendations which need to be adopted to incorporate these recommendations in true spirit. However, for short term forecasting M/s Marcados India Ltd., Gurgaon have already been engaged as consultant by CE/PPR. The preliminary reports already stand received and the initial testing of modules on short term/day ahead demand forecasting is under way. After the successful testing of these modules, the system will be introduced for the estimation of demand in due course of time.

Also, for the implementation of the Automatic Demand Management Scheme, a meeting of the Punjab State Grid Code Review committee was held on 01.08.2014. As a follow up action to the decision taken up in the meeting, a draft agenda for the approval of WTDs of PSPCL is being prepared for formulation/implementation of the state of the art ADMS for effective monitoring and control of entire 11kV feeders in PSPCL distribution network.

So far as laid down future Road Map by PSPCL is concerned, the Planning Organization has already issued the Transmission Works lists for the years 2014-15, 2015-16 and 2016-17 after getting the same approved from competent authority.

The works enlisted by PSTCL under para 8 & 24 are a normal planning practice undertaken by PSTCL in which PSPCL is also associated through Transmission Planning Committee meetings. PSTCL has already noted the recommendations for compliance and PSPCL agrees with the same.

(vi) In the additional information supplied to consultant, PSTCL has stated that this study was carried out for July 2012 system conditions, and from 2012 to the year 2014, a lot of new 765kV/400kV system has been added and planned by CEA in Northern Region such as:-

400kV Amritsar-Panarsa (pooling point) LILO at 400kV S/Stn. Hamirpur

765kV Moga-Meerut LILO at 765kV S/Stn. Aligarh.

400kV Amritsar–Kurukshetra LILO at 400kV S/Stn. Malerkotla.

400kV Jalandhar-Samba line.

400kV Malerkotla-Dadri LILO at 400kV S/Stn. Kaithal.

400kV Patiala–Panchkula line.

System Stability Factor comes into picture when line lengths are quite long. In the case of PSTCL system, almost all the interstate lines have been cut short in length by making LILO at the adjacent grids. Therefore, in PSTCL's view point, the problem of System Stability may not come with this enhanced system network. However, if necessity arises, it will be taken up by them with CEA.

(vii) In the supplementary report, consultants have submitted that they have given their recommendations based upon data furnished by PSTCL. PSTCL should implement the same.

**The Commission directs PSPCL that it should coordinate with PSTCL for working out the realistic future load growth for each load centre/substation over the previous years. PSPCL and PSTCL should have regular meetings for exchange of information/data on this issue. PSTCL and PSPCL should use software for load assessment/demand forecast for each sub-station and do the load flow analysis, contingency analysis, short circuit analysis, dynamic analysis etc.**

**9. Scrutiny of procedure for award of contracts by PSTCL & PSPCL with reference to principles of economy, efficiency, effectiveness and quality.**

(i) The consultant submitted that to bring out economy, efficiencies, effectiveness and quality in the procedure for award of contracts, PSTCL and PSPCL should follow the procedures like qualifying requirements, quality assurance, system of vendor and sub-vendor, manufacturing quality plan and inspection.

(ii) PSTCL submitted in its comments that it already has provision of qualifying requirement in specifications for major items like Power Transformers, Tower material, Disc Insulators etc. The system of approval of sub vendors is also prevailing. Stage Inspection for Tower material and Transformers is being carried out. In addition to this, final inspection before dispatch of all items is also being carried out. However, guidance/advice as per report will be followed in future, with the approval of competent authority.

(iii) PSPCL submitted in its comments that they have made purchase regulations and works regulations and follow the same for award of contracts and keep on updating them as per the need based requirements. For technical aspects, such as vendor approval, QAP, inspection etc. centralized system of standardizing vendors for common material for generation and distribution is being followed. Standardization of vendors is done on the basis of prescribed criteria only. Inspections are carried out according to relevant standards and QAPs are also seen and approved by end user. PSPCL further submitted as under: -

(a) Financial turn over for the last 3 financial years is kept in view for supply/manufacture/construction of similar or higher capacity equipment. The financial healthiness is got certified by Chartered Accountant, Performance certificate to check the exact performance of material in the field already manufactured by the

firms is also obtained for at least 2 years of satisfactory performance. In case of new firms, Works Appraisal is got carried out by a SE level Officer to check the manufacturing quality, capability etc. of a firm. Qualifying requirement varies a little from item to item. The specification is a well documented manual approved by the competent authority for the procurement of different items and allotment of the works which contains the detailed qualifying requirement.

(b) Quality assurance system being followed by PSPCL is built around a philosophy of prevention rather than detection & cure. The suppliers are required to be BIS approved firms. Most of them are having ISO certificate. The stringent Type Test Certificates for different items which are carried out by Labs of Central Power Research Institute (CPRI) are obtained as part of the procurement process. Strict testing is also carried out in the NABL Accredited Labs.

The steps as laid down in the report for quality assurance are summarized by PSPCL as under: -

- Quality requirements are included in the purchase order/work contract.
- The suppliers/ vendors are the registered/approved vendors having high quality track record for supply/work execution.
- Manufacturing quality plan forms part of tender specifications and is asked for from the firm.
- Stage inspection is carried out for the procurement of major equipment like power transformers. Raw material is checked/tested for procurement of Tower material and Transformers etc. The Power Transformers involve 6-7 stage

inspections which alone forms 40% cost of the total procurement.

- In case of failure of equipment like Power Transformers etc., detailed investigation is carried out. A Committee of three SEs investigates in detail the reasons for failure which is circulated to all the officers for taking remedial measures/further improvement. However, efforts shall be made to implement quality assurance plan as per ISO 9001 with more attention. It is ensured that approved vendors also stick to quality plan as per PSPCL requirement.
- The manufacturing quality plan is obtained from the main supplier, like power transformers. Stage inspection of the raw material in process testing is carried out for all major items like Power Transformers and tower material etc. Final inspection as per technical specifications as per IS and IEC standards is carried out for all procurements. For the execution of works, final inspection is carried out by the Technical Audit wing of PSPCL also.
- Inspection is carried out at stages for heavy equipments like Power Transformers, tower material etc. Inspection is also done regularly for civil works, being got done through approved agencies. Final inspection for material as per specifications/IS/IEC is carried out by deputing one or two officers.

(iv) In the additional information submitted to the consultant, PSTCL submitted that:

- (a) Qualifying Requirement form a part of the specifications/tender documents for major items of transmission lines and substation.
  - (b) Qualifying management system in the form of quality plan, Quality Control Register etc. is being followed.
  - (c) The list of approved vendors exists in the specifications.
  - (d) The system of CIP, MICC etc. as followed by PGCIL is not required as the system evolved by them is for pan-India operation, where PSTCL has the centralised system being small utility as compared to PGCIL. However, a time tested and well established system of inspection suitable for a transmission licensee of PSTCL's size is being meticulously followed.
- (v) In the supplementary report, consultant has submitted that PSTCL has now enclosed "Manufacturing Quality Plan" formats being followed by them, and the observations in the Audit Report stand modified to that extent. Regarding procurement & inspection, no additional/new information has been furnished by PSTCL. The observations of CPRI stand modified to that extent as observations of CPRI are of suggestive nature. However, PSTCL need to implement other provisions as brought out in the Audit Report.

**The Commission directs PSTCL and PSPCL to follow the system/procedure for award of contracts as elaborated in the Audit Report to ensure more economy, efficiency, effectiveness and quality control in the system for award of contracts.**

**10. Scrutiny of physical and financial progress reports for PSTCL & PSPCL vis-a-vis records relating to project execution, procurement, receipt of funds and expenditure, scheduled data of commissioning and budgeted expenditure.**

(i) The consultant has brought out that PSTCL has not furnished any such records, as they are not maintaining physical and financial progress reports vis-a-vis records relating to project execution, procurement, receipt of funds and expenditure, scheduled data of commissioning and budgeted expenditure.

(ii) PSTCL submitted in its comments that this point has been noted by them.

(iii) PSPCL submitted in its comments that physical progress of each and every transmission work is reported every month to the concerned organization. Financial progress is also reported every month on the same lists. The receipt of funds and expenditure is taken care of on the basis of these lists. The works expenditure register is also maintained in the Account Units.

(iv) In the additional information provided to consultant, PSTCL has submitted that detailed physical & financial progress reports are being maintained and reviewed periodically to evaluate the status of progress of works.

(v) In the supplementary report, consultant has submitted that PSTCL has enclosed a progress report for the month of September 14, which is not relevant to the audit period.

**The Commission has taken serious view on this issue for not supplying the physical and financial progress reports of the works to the consultant. PSTCL and PSPCL are directed to maintain**

**proper physical and financial records of the works month wise and should submit the same on half yearly basis to the Commission.**

**11. Whether the company (PSTCL/PSPCL) achieved the planned additions/augmentation/up-gradation of the transmission/sub-transmission system in respective years with respect to the planned works. Scrutiny of time overrun and cost overrun.**

(i) The consultant has estimated/worked out period of delay and cost over run from FY 2010-11 to FY 2012-13 for transmission lines and sub-stations separately as per the information made available to them by PSTCL.

The total cost over-run worked out by the consultant is as under:

Year	Cost Over-run (₹ Lac)	
	Lines	Sub-stations
2010-11	4.6996	53.2207
2011-12	87.8257	354.9890
2012-13	423.3020	292.2123
	515.8273	700.4220

The consultant has submitted that in some of the cases, the scheduled date of commissioning has been mentioned by PSTCL as FY 2010-11, FY 2011-12 etc., which is not correct.

Further, as per the information furnished by PSPCL, for all the works in respect of lines as well as sub-stations, the scheduled date of commissioning has been mentioned as 30<sup>th</sup> March of the year in which the work was actually completed, which implies that all the works were completed ahead of schedule, therefore, losses could not be computed

by the consultant. It is obvious that true picture has not been brought by PSPCL & PSTCL.

(ii) PSTCL submitted in its comments that consultant has identified 25 nos. Lines & 33 Nos. sub-stations where work has been delayed. In many of the cases, the delay is within 3 months period which may not be considered in view of various site problems, such as site clearance, statutory clearances, weather hindrance, shifting of man power due to priority of work at some other location etc. The reasons for delay have been recorded against all these works.

(iii) PSPCL submitted in its comments that TS Organization is responsible for the execution of sub-stations and transmission works for which the planning list is issued. In this case, planning lists of the period 2011-14 were issued by the office of CE/Planning, PSPCL, Patiala. However, it was not possible to complete all the works of three years in one year, as such priority was obtained from all the CE/DS for the execution of works. Some works were carried out during FY 2011-12, others were carried out during FY 2012-13, and most of the remaining works were executed during FY 2013-14. However, certain works still remained incomplete and they form the spill over works for the planning list of year 2014-15 and so on. The target schedule for commissioning of works during the year 2011-12 was taken as March, 2012 and for year 2012-13 was taken as March, 2013 and so on. There was no intentional misreporting, manipulation of the target schedule for commissioning of these works. The actual progress of the works commissioned during three years period 2011-14 have been depicted and the remaining works of course remain incomplete or are in progress. There was no intention to manipulate or misreport the target dates for commissioning of these works.

(iv) In the additional information, PSTCL has submitted that delays mentioned may not be taken into consideration as the targets fixed by PSTCL were ambitious and delays were much less than the standard norms.

**The Commission agrees with the findings of the consultant that incomplete or vague information has been provided to the consultant by PSTCL and PSPCL. The justification regarding delay in executing the works of transmission lines and sub-stations given by PSTCL is general in nature, like various clearances, weather hindrance and shifting of manpower at other locations of priority. PSPCL has given manipulated scheduled date of commissioning. PSTCL and PSPCL have not supplied the correct information, due to which actual cost over-run could not be computed by the consultant. The Commission directs PSTCL and PSPCL to maintain proper record of scheduled date of commissioning and actual date of commissioning of all the works, in future. Reasons for delays, if any, should be recorded against each work.**

**12. Whether the company (PSTCL/PSPCL) took up various preparatory activities such as surveys, design and testing, processing for forest & other statutory clearances, tendering activities etc. parallel to Transmission System Project appraisal and sanctions/approval. Blockade of funds due to delay on this account.**

(i) The consultant mentioned in its Audit Report relating of PSTCL that the following works relating to transmission system addition, augmentation, upgradation etc. were delayed due some reasons which could either be delays with regard to surveys, design and testing or

owing to delays in processing for forest & other statutory clearances, tendering activities etc. or for other reasons such as delay in construction, non availability of material in time, non availability of adequate funds, Force Majeure, lack of monitoring, control etc.: -

<b>Financial Year</b>	<b>Number of works delayed (Lines)</b>	<b>Number of works delayed (Substations)</b>
2010-11	2	3
2011-12	8	20
2012-13	13	10

The consultant further submitted that the reply of PSTCL is evasive and not based upon facts.

Regarding PSPCL, the consultant has mentioned in its report that 12 No. works were delayed on account of Right of Way, forest clearance, railway clearance, court cases and public hindrances. But as per the data given by PSPCL to the consultant under para 11, works have been delayed during the years, 2010-11, 2011-12, 2012-13. The consultant could not calculate the losses, as true picture has not been provided by PSPCL in respect of delayed works.

(ii) PSTCL submitted in its comments that the details have already been supplied by them and observations are of informatory nature only.

(iii) PSPCL submitted in its comments that forest clearance and clearance of railway are the two important statutory clearances to be obtained for the construction of transmission lines. Many a times, these clearances do not match with the target of works. Some instances of skipping the target of 12 works have already been reported. However, efforts are being made to apply for these clearances well in time, pursue

them vigorously for obtaining the same. There was no intention at all in any manipulation of the target date.

(iv) In the additional information, PSTCL has given same reply as given in para 11.

**The Commission agrees with the findings of the consultant that incomplete or vague information has been provided to the consultant by PSTCL and PSPCL. The justification regarding delay in executing the works of transmission lines and sub-stations given by PSTCL is of general nature like various clearances, weather hindrance and shifting of manpower at other locations of priority. PSPCL has given manipulated scheduled date of commissioning. PSTCL and PSPCL have not supplied the correct & true information, due to which actual cost over-run could not be computed by the consultant. The Commission directs PSTCL and PSPCL to maintain proper record of scheduled date of commissioning and actual date of commissioning of all the works, in future. Reasons for delay, if any, should be clearly indicated for each work.**

**13. Whether benefits envisaged to the consumers actually achieved in terms of flow of reliable power by both the companies? Loss due to delay in up-gradation/Commissioning of transmission system in terms of flow of energy with respect to Available Transmission Capability (ATC) & Total Transmission Capability (TTC). Financial loss due to blockade of funds due to poor planning.**

(i) The Consultant in their Audit Report for PSTCL has mentioned that the impact of flow of power has been examined for such lines as have been identified as delayed works. The transmission lines which have

been delayed and loss in terms of Power Flow envisaged for these lines have been analyzed in the report. The Flow of Energy depends on the load curve after commissioning of the line under analysis. As the load curve was not available with PSTCL for the planned works, the Loss of Energy could not be directly estimated. However, on commissioning, the maximum demand on the line has been assumed to be the maximum possible Power Flow. Hence, the approximate loss in terms of flow of energy due to delay in up gradation/commissioning could be analysed based on the Maximum Demand Flow obtained after the delay period. The lines which were delayed year wise have been analyzed and the details of each delayed line have been brought out in the report by the consultant.

The consultant in their Audit Report of PSPCL has mentioned that as per the information furnished by PSPCL, for all the works, executed in all the three years in respect of lines as well as sub-stations, the scheduled date of commissioning has been mentioned as 30<sup>th</sup> March of the year in which the work was actually completed, which implies that all the works were completed ahead of schedule. It is obvious that true picture has not been brought by PSPCL. The total cost overrun for the three years therefore works out to be NIL, which is not the correct position. PSPCL has not given a true picture to the consultant and therefore, the actual losses could not be computed in spite of carrying out the entire exercise.

(ii) PSTCL submitted in its comments that consultant has identified 25 Nos. Lines & 33 Nos. Substations, where work has been delayed. In many of the cases, the delays is within 3 months period which may not be considered in view of various site problems such as site clearance, statutory clearances, weather hindrance, shifting of man power due to

priority of work at some other location etc. The works are identified by the planning wing depending upon the system studies to cater additional loads/system improvement etc. The construction is carried out and tentative targets are fixed to focus the attention of the construction staff. However, the constructional constraints are unavoidable. The system requirement is also considered for fixing the priorities and the works are completed to meet with the system requirements in stages. Hence, there is no point to say if there is any energy loss due to individual delay.

(iii) PSPCL submitted in its comments that efforts are being made by them to complete and commission the sub-stations and transmission line works well in time as per planning list. A lot of progress has been made for the sub-stations and transmission works as depicted by them in their reply.

**The Commission observes that the incomplete/vague information was provided by PSTCL and PSPCL due to which losses could not be computed correctly by the consultant and therefore the Commission directs PSPCL and PSTCL to maintain proper record of progress of works relating to sub-stations and transmission lines, in future, and submit to the Commission on quarterly basis, the lists of the works delayed for more than three months along with proper justification.**

**14. Unfruitful payment of transmission charges to PGCIL due to delay in development of linking system.**

(i) The consultant has mentioned that earlier nil information was given by PSTCL. However, at later stage, PSTCL intimated that PGCIL has not constructed 3 number 220kV Bays at 400kV PGCIL sub-station at Ludhiana.

(ii) PSTCL submitted in its comments that the construction of 3 no. Bays at 400kV Substation of PGCIL at Ludhiana, is in progress. Out of these, 1 no. Bay required for LILO of one Ckt. of Sahnewal – Lalton Kalan at 400kV S/S PGCIL, Ludhiana is likely to be commissioned by 30.06.2014, as per the confirmation given by PGCIL authorities.

(iii) PSPCL has not given any reply as this point did not relate to them.

(iv) In the additional information, PSTCL has submitted that information supplied by it earlier may be read as there is nothing on record of payment of unfruitful charges to PGCIL. However, regarding additional bays it has been mentioned that the same were additionally demanded by PSTCL as the original 6 no bays as per norms have already been utilized for evacuation of power by PSTCL.

**The Commission observes that proper information has not been given by PSTCL and in future they should be careful to prevent unfruitful payment of transmission charges to PGCIL.**

**15. Matching of construction of substations, related lines and downstream sub-transmission and distribution network. Assessment of losses due to under utilization of capacity of substations due to non-construction of downstream system by distribution licensee (PSPCL).**

(i) The consultant has mentioned that to identify the matching construction of substations, related lines and downstream sub-transmission works, the list of 220kV and 132kV sub-stations & lines as given by PSTCL for the years 2010-11, 2011-12 and 2012-13 were considered. The corresponding downstream connectivity for 220kV and 132kV sub-stations was identified from the connectivity map provided by

PSPCL wherein the 66kV lines commissioned/proposed by PSPCL for the years 2010-11, 2011-12 and 2012-13 have been given. The work-wise connectivity diagrams have been drawn from the comprehensive connectivity map furnished by PSPCL. Date of commissioning, delay in construction of matching works and the corresponding loss/cost overrun have been tabulated in the Report based on the detailed analysis of connectivity of all the substations. The losses pertain to only such substations/works for which the connectivity and data was made available and does not include the works for which losses could not be calculated in the absence of connectivity/data. Further, the losses have been calculated for blockade of funds for the delayed period/mismatch and the losses on account of non flow of envisaged power which could flow, had there been no mismatch and the connecting system was timely in place, could not be calculated.

A total of 29 number 220kV/132 kV substations have been identified and tabulated in the Report, wherein the connectivity details are not clear. It has been observed by the consultant that seven no. 220kV and 132kV substations do not have any downstream connectivity and PSPCL need to plan downstream substations for meeting the load demand. In case, there are no planned works downstream, then these substations have not been planned for proper utilization and are declared underutilized, based on the data provided by PSPCL for downstream connectivity. Consultant has given a list of 29 substations for which connectivity details are not clear/legible.

It has been computed by the consultant that there is a minimum loss of ₹111.85 Lakhs for the year 2010-11, ₹128.21 Lakhs for the year 2011-12 and ₹12.09 Lakhs for the year 2012-13.

This is not the total loss owing to mismatch but the loss will be much more if all the connectivity and data would have been made available. Further, there is huge loss which could not be calculated pertaining to non flow of useful power owing to mis- match.

(ii) PSTCL submitted in its comments that this point relates to PSPCL.

(iii) PSPCL submitted in its comments that there is no delay in planning relating to downstream 66kV works. May be the maps provided to consultant could be old/not computerized and therefore connectivity details were not clear to them on this account. It has further been submitted that

(a) There was no lack of downstream connectivity of 7 nos. 220kV sub-stations namely Malout, Pakhowal, Dasuya, Dhuri, Sarna, Phagwara and Kotli Surat Malhi. In case of 220kV sub-station Malout, there are 17 no. 66 kV sub-stations emanating from this particular 220kV substation. Keeping in view the loading of this sub-station, additional 100 MVA T/F was proposed by PSTCL.

(b) Downstream sub-stations in case of other 6 nos. 132kV/220kV sub-stations were duly planned and commissioned by PSPCL.

(c) Development of 33kV/66kV latest connectivity map on computer is under progress.

(d) There was no such loss to PSPCL due to incomplete data.

(iv) PSPCL submitted on comments of PSTCL that PSPCL is planning downstream matching evacuation system of 66kV sub-transmission works. An elaborate list of sub-transmission works has been planned for the period 2011-14 and the list was issued by Chief Engineer/Planning, PSPCL, Patiala. Major quantity of the works have been completed and commissioned by this time. Now, PSPCL has issued a detailed planning scheme for the years 2014-15, 2015-16 & 2016-17. The works for the

year 2014-15 shall be completed as per schedule. These works shall ensure proper evacuation from the 220kV works of PSTCL. Reply of the PSPCL as submitted earlier remains the same and there has been no loss to PSPCL due to lack of planning of sub-transmission system works. The 33kV/66kV connectivity already shown on map up-dated upto 03/2012 whose copy was provided to the audit team has not been depicted against various sub-stations discussed under para 15. The delay/cost overrun should not be calculated in the cases where downstream connectivity was already existing adequately and creation of more 66kV downlinks was not related directly to power evacuation from the relevant 220kV substations. The computerized transmission map of 33kV/66kV sub transmission system has been got updated upto 31.03.2014 and is being circulated to relevant offices. Out of 220kV substations discussed in the Audit Report, the factual position in respect of some of them has been brought by PSPCL in its reply.

(v) In the additional reply, PSPCL submitted the revised/updated connectivity sketches, zone wise for all the sub-stations alongwith clarifications in respect of individual sub-stations. In its concluding para, PSPCL has submitted that for all the sub-stations considered in the report, it can concluded that all the 220kV sub-stations have come up as upgradation from 66kV sub-stations. Hence, the 66kV lines connectivity already existed, with the upgradation to 220kV, the 100MVA T/F installed by PSTCL was automatically loaded upto 70% with existing 66kV transmission line system. Therefore, there was no scope for delay in evacuation of power. New link lines where ever planned were also executed timely. It has been mentioned that no 66kV line got overloaded or had limitation in evacuation of power over the years 2011-12, 2012-13, from the year when 66kV Transmission System got operative under PSPCL.

(vi) The Consultant in its supplementary report has submitted that the information furnished by CE/ARR & TR, PSPCL vide letter dated 12.11.2014 has been analysed by it. The consultant has brought out its observations, substation wise, in the supplementary report alongwith original connectivity sketches (as per earlier information supplied by PSPCL) and revised sketches (now furnished by PSPCL). The consultant has mentioned that its observations in the final Audit Report, stand modified as per supplementary report. Consultant has submitted, on conclusion, that the downstream connectivity for evacuating power already existed and it is mostly the upgradation work from 66kV substations to 220kV sub-stations. The upgradation of 66kV to 220kV if under PSTCL, then the list of planned works especially 66kV lines should be very minimal for the central zone and also the new 66 kV works shall be minimal and should match accordingly with the list of planned works for year 2010-11, year 2011-12 and year 2012-13.

**The Commission observes that PSPCL has supplied incomplete and illegible maps to the consultant earlier, due to which losses could not be calculated due to mis-match and non flow of useful power owing to mis-match. Now, PSPCL submitted information on 12.11.2014 to justify its mismatch downstream. As pointed out in the supplementary report by the consultant, in some cases, PSPCL has still not supplied relevant information due to which cost overrun and delay could not be worked by the consultant. The Commission directs, PSPCL that it should, in coordination with PSTCL, compile data and duly updated maps needs to be meticulously prepared for reference of all concerned. The maps should be developed on computer so that it could be regularly updated, as and when there are additions, up gradation & augmentation of the system.**

**16. Financial and Technical Loss on account of damage to equipments due to poor design, poor quality of construction (non compliance of requisite specifications/standards) or inadequate protection system.**

(i) The consultant mentioned in the report, the details of transformers and equipments damaged from the year 2010-11 to the year 2012-13 as per the information furnished by PSTCL. The dates of commissioning as well of damage in respect of 2 no. transformers damaged under Ludhiana Circle were not intimated. Since the reasons for damage were not made available for these transformers, the cause of damage could not be ascertained by the consultant.

**FY 2011-12**

A total of 4 no. power transformers were damaged during the year 2011-12 for all the five P&M circles. The date of commissioning for 2 no. transformers damaged under Patiala Circle, has not been intimated. Similarly, the date of commissioning as well as the date of damage in respect of transformer damaged under Ludhiana Circle has not been intimated. Further, since the reasons for damage are not available for all these transformers, the cause of damage could not be ascertained. The Bharat Bijlee Make, 100 MVA transformer, under Amritsar Circle was damaged within warranty period, but further information has not been provided by PSTCL.

**FY 2012-13**

A total of 9 power transformers were damaged during the year 2012-13 for all the five P& M circles. Out of these damaged transformers, date of commissioning for 6 number transformers damaged under Patiala, Ludhiana and Bhatinda Circles have not been

made available to the consultant. Therefore, the reasons for the cause of the damage could not be ascertained. Under Jalandhar circle, 2 nos. transformers have been damaged within 9 to 10 years of commissioning, out of which one transformer has been damaged due to internal fault and the second due to fault in OLTC. A life of 9-10 years for power transformer is too short. Details like investigation report and expenditure incurred need to be brought out to ascertain whether the damage was owing to poor quality of construction (non compliance of requisite specifications/standards) or inadequate protection system. As per the information furnished by P&M Jalandhar, the third transformer got damaged after 41 years of useful service, but the date of commissioning has been intimated as 18-1-2011 and date of damage as 10.07.2012, which means the transformer got damaged after 18 months in service.

#### Equipment other than Transformers

From the abstract of equipment damaged, consultant has mentioned that a total of 140 CTs were damaged during three years. Out of these 140 damaged CTs, 42 CTs were damaged in Amritsar Circle and 35 in Bhatinda Circle. A total of 66 LAs were damaged during three years, out of which, 42 LAs were damaged in Amritsar Circle alone. This large number of equipment damage in Amritsar Circle alone needs to be investigated.

The details of the damaged equipment for the years 2010-11 and 2011-12 in respect of Jalandhar Circle have not been furnished by PSTCL to the consultant.

Regarding PSPCL, consultant mentioned in its report that damage to 15 no. 132kV LA's in the year 2012-13 of Joginder Nagar Power Station needs to be examined. PSPCL has submitted that Shanan

Power House, Joginder Nagar is geographically located in high rain fall zone which is prone to frequent lightning and thunder storms throughout the year. Also, the circuits evacuating the power from this station pass through the same zone which is approximately 123 KM in length.

(ii) PSTCL in its comments has submitted the list of transformers damaged during financial year 2011-12 and 2012-13 along with their date of commissioning, date of damage and cause of damage.

(iii) PSPCL in its comments has submitted that Shanan Power House. Joginder Nagar is geographically located in rain fall zone which is prone to frequent lightning and thunderstorm throughout the year. Also the circuits evacuating the power from the power station goes through the same zone which is approximately 123 km in length.

**The Commission observes that PSTCL has not given any specific reason for damage of power transformers and has given a general cause of damage as internal fault and has not done proper investigation to ascertain the exact cause of damage.**

**The Commission directs PSTCL that in future proper investigation should be done to ascertain the actual cause of damage to transformers, and submit to the Commission at the end of each year, the list of power transformers damaged along with the cause, date of commissioning & date of damage.**

**PSPCL needs to examine and take remedial measures regarding damage of large number of Lightning Arrestors in the year 2012-13 at Joginder Nagar generating station.**

**17. Losses on account of mismatch between available generation capacity and development of transmission and sub-transmission facilities.**

(i) The consultant has mentioned that a total of 11 no. evacuation lines were overloaded beyond the permissible thermal loading limit as per CEA Planning Criteria. Though the maximum conductor temperature has been assumed as 75 deg. C, but there could be some old lines with maximum conductor temperature less than 75 deg. C. In such cases, the permissible maximum temperature will be lower and the extent of overloading will be more. These lines need to be identified and underloaded by augmenting these lines. PSTCL/PSPCL should, however, undertake a load flow study (contingency studies) in respect of these overloaded lines to plan additional lines or up-gradation of these lines to cater to an eventuality which may cause a restriction in the flow of generated power.

(ii) PSTCL submitted in its comments that this point is being considered in routine planning exercise.

(iii) PSPCL submitted in its comments that:

(a) Point is being considered in routine planning exercise. It will be further explored for improvement, wherever applicable.

(b) PSPCL is taking care to add new lines and to augment/replace overloaded lines/old conductor, so as to avoid any restriction in flow of power in case of an eventuality/contingency.

(c) The required 400kV/220kV lines for evacuation of power from upcoming generation capacity are planned and executed by PSTCL whereas the required 66kV sub-

transmission system are timely planned and there is no mismatch on this account.

**PSTCL and PSPCL should undertake load flow studies so as to plan the system to bring the loading of overloaded lines within permissible limits.**

**18. Whether adequate number of shunt capacitors provided for reactive compensation by PSTCL/PSPCL? Penalties paid on account of inadequate reactive compensation.**

(i) The consultant has mentioned in its Audit Report of PSTCL that the total capacity of shunt capacitors installed as on 31.03.2010 was 5856.72 MVar.

For capacity planned to be installed (including previous year backlog), PSTCL needs to verify the details of the substation wise reactive compensation based on NRPC target. Actual capacity installed was as under:

Year	2010-11	2011-12	2012-13
Target MVar	1266.00	1241.00	1092.00
Actual MVar	145.347	59.772	613.604
Shortfall MVar	1120.653	1181.228	478.396

Only 11.48%, 4.8% and 56.1% reactive compensation has been added for the years 2010-11, 2011-12 & 2012-13 respectively which is well below the target. This will impact the voltage profile and the reactive loss in the network. Reactive power and the voltage profile need to be monitored for planning of adequate sub-station wise reactive power compensation.

For PSPCL, consultant submitted that as per information supplied by PSPCL, it has been observed that the basis, criteria & load flow studies carried out for determining reactive power requirement for planned addition of capacitor banks for FYs 2010-11, 2011-12 and 2012-13 have not been given. Though it has been mentioned that there is no shortfall, but as can be seen from the information furnished, there is a huge short fall as against planned capacity addition of 1266 MVAR, 1241 MVAR and 1092 MVAR for the years 2010-11, 2011-12 and 2012-13, actual capacity addition is only 36.747 MVAR, 20.415 MVAR and 61.245 MVAR respectively. Reasons for these shortfalls need to be furnished by PSPCL.

There is a huge shortfall in the planned capacity addition, but there is no such difference in the budgeted and the actual cost. PSPCL need to clarify the discrepancy. PSPCL also need to explain as to why the Reactive Power Charges paid by PSPCL to ISTS/BBMB are negative in the years 2010-11 & 2011-12, and then suddenly it became positive in the year 2012-13, with a huge margin compared to the earlier two years.

(ii) PSTCL submitted in its comments that Installation of capacitor banks is a system requirement, and hence a collective effort by both PSTCL & PSPCL is to be taken into consideration. Operation Coordination Committee (OCC) of Northern Regional Power Committee (NRPC) in the agenda circulated for its 87<sup>th</sup> meeting held on 16-17<sup>th</sup> May 2013 under item- 9. "Installation of Shunt Capacitors" has updated the progress of installation of new capacitors in the Northern Region during the period 01.04.2012 to 31.03.2013. The installed capacity of capacitors includes manually operated shunt capacitors (11kV) installed by APDRP wing of PSPCL also. The total capacitor installation required during year 2012-13 i.e. 1092 MVAR (including previous backlog) has

already been achieved in Punjab. Punjab has installed additional 26.95 MVAR of capacitors in the system after achieving target of year 2012-13 and overhauling the previous deficit/backlog up to year 2012-13. In the additional information submitted to consultant on 27.10.2014, PSTCL has submitted that the percentage related to the achievement of reactive compensation need to be corrected in line with actual NRPC data. The perusal of data ending March, 2013 indicates that there is no overall shortfall in providing reactive compensation.

(iii) PSPCL submitted in its comments that:

- (a) After planning of a 66 kV substation by Planning Organization, its matching MVAR capacity is decided by CE/TS on the basis of which capacitor banks are provided on the substations.
- (b) Regarding budget/actual cost incurred, Planning Organization allocates budget to major heads in totally with one head being 'transmission system'. Further utilization of funds under different sub heads is taken care of by CE/TS.
- (c) The shunt capacitors are being installed against new as well as additional Power Transformers.
- (d) Most of the amount payable as reactive energy charges is for the period between May to September for each of the years 2010-11, 2011-12 and 2012-13. The reactive energy drawl is maximum during the months of paddy season. The rise in load specially the high inductive load of Agricultural Pumping sets during fully loaded system amounts to the rise in reactive energy drawl and the reactive energy charges. In the year 2012-13, the average energy consumption during the months of June, July, August and September recorded was 1834 LUs/day, 2114 LUs/day, 1902 Lus/day and 1575 LUs/day respectively, against average energy

consumption of 1477 LUs/ day, 1857 LUs/day, 1746 LUs/day and 1456 LUs/day during the year 2011-12.

(e)The progress of installing and commissioning of 11kV capacitor banks given by PSPCL is given below:

2011-12	2012-13	2013-14
20.415 MVar	61.245 MVar	438.242 MVar

This work was given full priority, but the progress achieved during year 2013-14 was quite high. The reason for less progress in this field during years 2011-12 and 2012-13 was because TS organization being newly carved out of the established system of PSTCL. Electrical material was under procurement as well as civil works were also taken up by new organization. By overcoming all these starting problems, the work of installing & commissioning of 11kV capacitor banks has been done with appreciable results. The same pattern shall be followed by PSPCL in the present year. PSPCL vide letter dated 24.09.2014 submitted, on the comments of PSTCL, that the total capacity of shunt capacitor added by PSTCL has been noticed. A capacity of 26.95 MVar over & above the required MVar capacity has been added in the State of Punjab during the year 2012-13. PSPCL is also commissioning the 11kV capacitor Banks on sub-transmission system of the State in a big way. Capacity of 438.242 MVar 11kV capacitor banks during the year 2013-14 has been added. The work is also continuing with the same momentum during year 2014-15. 253.146 MVAR 11kV capacitor banks have been added upto 08/2014.

(iv) In the additional submissions, PSPCL submitted that the percentage relating to the achievement of reactive compensation need to be corrected in line with actual NRPC data enclosed by them. Ending March, 2013 indicates there is no shortfall for reactive compensation.

(v) In the supplementary report, consultant has submitted that as per the revised figures furnished by PSTCL, HT shunt capacitors installed up to 31.03.2012 are of 8467 MVAR capacity and upto 31.03.2013 are of 9585.95 MVAR capacity. There is a very wide variation in the figures earlier furnished and now furnished by PSTCL. If the figures now provided are correct, then there is no shortfall.

**The Commission notes that PSTCL has supplied wrong information earlier to the consultant regarding planned addition of Shunt Capacitor for reactive compensation for year 2010-11 to year 2012-13. Accordingly, consultant calculated the reactive power loss in the transmission system. Later on, PSTCL submitted that up to FY 2012-13, they have added 26.95 MVAR more of capacitors in the system after achieving the target of FY 2012-13, covering the previous deficit up to FY 2012-13.**

**The Commission agrees with the explanation given by PSPCL regarding power reactive compensation provided in the years 2010-11 and 2011-12.**

**The Commission directs both PSPCL and PSTCL to be more careful in future in providing reactive power compensation in the transmission system and submit at the end of each year, the details of the reactive compensation provided along with deficit, if any.**

**19. Losses on account of poor planning for inventory management, material at site and purchase of spares.**

(i) The consultant mentioned in their report that the stock inventory of PSTCL is in the range of ₹11 crore, excluding civil works organization, for each year, though on ground it will be much more as complete

information has not been made available in respect of all the three years. In the absence of complete information, the loss on account of lack of inventory management could not be ascertained by the consultant. If complete information had been made available, the inventory could go up to ₹20 crore, which can be reduced appreciably by proper inventory management. From the information furnished by PSTCL and PSPCL, it has been observed by the consultant that PSPCL/PSTCL is not adopting any inventory management and merely procuring material on adhoc basis. Consultant has mentioned that Power Grid has developed its own unique spare and component level codification system. Components that are interchangeable or are from same manufacturer and identical are given a unique number. The required data of the spares is computerized and the information is accessible to all in the Power Grid through its own intranet. This helps not only in reducing the spares inventory but also make the spares available to the needy group expeditiously. Power Grid has, on the basis of experience and consumption rate of the spares, developed the norms for procurement and storage of spares. The spares are procured and stored at line/substation level and regional level.

(ii) PSTCL submitted in its comments that the stock inventory in the range of ₹11 crore also includes the material of 66kV Transmission System to be transferred to PSPCL amounting to approx. ₹6 crore, as works of 66kV stand transferred to PSPCL.

PSTCL has already developed on-line Inventory Management System. The system has link on PSTCL web site and is assessable to all concerned. The procurement of material is done in accordance with planned works on annual basis. The delivery period is spread over in

accordance with the requirement keeping in view the progress of works. It regulates the inflow of material/inventory.

(iii) PSPCL submitted in its comments that Inventory of all the 3 Nos. S&T Stores i.e. Mandi Gobindgarh, Verpal and Bathinda is being continuously monitored by the Transmission Line Design Section and is supervised by Addl. SE/TD-2 at Patiala. Efforts are always made to keep the inventory at minimum required level. Computerized list of items available in the different stores, rate of items and total cost of these items are prepared every month. To meet with any exigency of the State Transmission System, like damage of power transformer or uprooting of 66kV transmission line due to heavy storm etc., a minimum level of inventory has been maintained. Full care is taken not to pile up the material in the Stores. Old damaged power transformers are being surveyed off and put to e-auction. The scrap like GI scrap, MS scrap, copper scrap are put to e-disposal on month to month basis. Also, the inventory control in the various Thermal Plants of PSPCL is being carried out through computerised software ENERGISE developed by TCS and is connecting all the Thermal Plants and Thermal Design wing of PSPCL. Modern Inventory Management system adopted by PGCIL will be studied for further improvement.

(iv) PSPCL submitted, on comments of PSTCL, that the Inventory Management System of PSTCL is in place. Some 220kV/132kV material is lying with 2 nos. S&T stores of PSPCL. Matter has been taken up with PSTCL for taking over this material for its optimum utilization.

(v) In the additional information submitted to consultant, PSTCL submitted that the system of procurement and execution of works in case of PGCIL are totally different from that of PSTCL and cannot be adopted as such. The process of codification of material/items in the

PSTCL store has been started and implementation of ERP has been taken up.

(vi) In the supplementary report, consultant submitted that adoption of system developed by PGCIL was of suggestive nature. However, PSTCL need to implement suggestions as brought out in the Audit Report. PSTCL/PSPCL may adopt the procedure for better management of the store within their organizational setup.

**The Commission observes that PSTCL and PSPCL have not adopted any scientific inventory management system and is procuring the material in an adhoc manner. The Commission directs PSPCL and PSTCL to develop a scientific inventory management system in their organizations, may not be entirely on the lines of PGCIL, though it should be studied and aspects beneficial to PSTCL and PSPCL be adopted.**

**20. Extent of overloading of the sub-transmission substations as compared to permissible maximum capacity as per Manual on Transmission Planning Criteria (MTPC). Whether rating of various substation equipment matches with loading limits of sub-transmission lines? Whether timely action for preparation of suitable plan for expansion/augmentation taken up or not?**

(i) The consultant has mentioned in the Report of PSTCL that for determining extent of overloading based on CEA Transmission Planning Criteria, the thermal loading limits of various sizes of ACSR conductors have been considered in the report. The maximum Ambient Temperature has been considered as 45 Deg. C. Maximum conductor design temperature for 132kV lines has been considered as 65 deg. C. For all 220kV lines, the maximum conductor design temperature has

been considered as 75 deg. C. During the meeting of consultant with PSTCL on 16.12.2013, PSTCL had agreed to identify 220kV lines erected before and after 1985, but did not identify such lines. Length of 220kV and 132kV lines, size of conductor, maximum demand for the years 2010-11, 2011-12 & 2012-13 have been given in the report by the consultant.

The percentage loading with respect to the permissible loading limit has been brought out in the report based on the above criteria. It has been concluded by consultant that there are total of 106 number of transformers loaded above 90% during the year 2010-11, 118 numbers of transformers loaded above 90% during year 2011-12 and 102 numbers of transformers loaded above 90% during year 2012-13. Total percentage of transformers loaded above 90% during the year 2010-11 is 25.3%, during the year 2011-12 is 27% and during the year 2012-13 is 20.7%. It has been further observed by consultant that under Amritsar Circle, 100 MVA transformer at Majitha is loaded upto a maximum of only 32.38% during the three years 2010-11, 2011-12 & 2012-13. PSTCL to analyse if the load growth envisaged on this transformer for next five years could reach upto a reasonable loading. Other such under loaded transformers in all the circles also needs to be analyzed by PSTCL. The over loading needs to be analysed for additions/ augmentations also. Consultant has also mentioned that Dhuri-Nabha 220 kV line shall get loaded only up to around 20 MW.

#### Matching of rating of various substation equipment with loading limits of transmission lines

From the list of overloaded lines, all the lines have been identified by the consultant having worst overloading during April 2010 to March 2013. The permissible loading limits of the transmission lines are found

to be lower than the maximum demand during any period, but for the worst scenario maximum demand has been considered. Considering the worst loading conditions of the sub-stations to which these lines are connected, it has been concluded by the consultant that the rating of the substation equipment is adequate.

In the report of PSPCL, consultant found that on analysis of the data furnished by PSPCL as on 30.07.2013, there are a total of 304 Nos. 66 kV substations which are loaded beyond 70% of their rating, out of which only 100 substations are proposed to be augmented up to paddy season of 2014. The remaining substations need to be considered for augmentation. 35 Nos of these sub-stations are loaded beyond 90% of their rating. There are a total of 11 numbers 33kV substations which are loaded beyond 70% of their rating. One out of these is loaded more than 90% of its rating. Out of these, only 7 no. substations are proposed to be augmented. The remaining substations need to be considered for augmentation.

Total 11.5% of 66kV & 33kV substations are loaded above 90% as on 30.07.2013.

North Zone has the highest percentage of substations as 20%, amongst all the Zones and South zone has the highest number of 66kV substations which are loaded above 90%.

The maximum demand, in Amperes, of 304 substations which are loaded above 70% as on 30.07.2013 were analysed as a worst scenario. The maximum demand of 299 substations is less than 800 A. The rated current of the substation circuit breakers and L&E Switch as informed vide Memo No. 5711/TSW-55 dated 16.12.2013 by PSPCL was 800A. The substation equipment rating such as Circuit Breaker, L&E Switch and other associated Current Carrying equipments are adequate with

respect to the loading limits of the sub transmission lines. Five nos. of the substations as listed in the report, out of 304 substations, have their maximum demand above 800A and the ratings of these equipments are not within adequate limits, if the Circuit Breaker ratings, L&E Switch ratings are to be assumed as 800A as intimated vide memo no. 5711/TSW-55 dated 16.12.2013. Hence, PSPCL need to identify the ratings of equipment installed in these sub-stations. As PSPCL has not provided the maximum demand of the transformers under each substation therefore, overloading of the transformers could not be assessed for the years 2010-11, 2011-12 & 2012-13. Although, PSPCL has identified substations planned for expansion/augmentation in the list of substations that are loaded above 90%, but the details regarding scheduled date of commissioning and the actual date of commissioning have not been furnished by PSPCL and hence it could not be ascertained by consultant if PSPCL has taken timely action to address the issue of transformers loaded above 90%/70%. PSPCL has not included the substations listed in the report which are loaded above 90% under their planning list. PSPCL to bring out the reasons for not including these substations in the 2011-2014 planning list of works.

(ii) PSTCL has not made any observation on the Audit Report but has given only the list of 220kV and 132kV transmission lines commissioned before and after 1985.

(iii) In their comments, PSPCL submitted as under:

(a) Regarding non inclusion of some 66kV sub-stations having loading more than 90%/70% under the planning list of 2011-14, PSPCL mentioned that while formulating this list, the maximum demand of Paddy 2010 was taken into account.

- (b) CPRI audit team evaluated the above list with reference to maximum demand of paddy 2013, due to which some 66kV sub-stations loaded more than 70%/90% got excluded from year 2011-14 list.
- (c) Based on maximum demand of paddy 2013, additional 130 no. Sub-stations including the above mentioned excluded sub-stations were planned through amendment during January, 2014.
- (d) As a matter of routine, Planning Organization continues to review the planning list from time to time and of late, a comprehensive list of transmission works for the period 2014-17 has already been issued which includes spill over work of previous years as well as additional augmentation works keeping more than 70% loading in mind.
- (e) For planning of sub transmission lines, the norm for planning is taken as more than 80% loading.

**The Commission agrees with the Report and directs PSTCL and PSPCL to under-load the overloaded transmission lines and substations in fixed time frame, with quarterly intimation to the Commission regarding its progress.**

**21. Capital expenditure incurred/planned to be incurred towards development of smart grid operations, SCADA & SLDC. The intended purpose achieved/to be achieved in terms of energy accounting, checking of over drawl, outage detection and well coordinated outage recovery. Losses on account of delay in executing various schemes e.g. Procurement and integration of RTUs, Interstate and Intra-state ABT metering system etc.**

(i) The consultants concluded in the report from the data/information furnished by PSTCL that

- (a) From the snap shot figures of single line diagram downloaded from the Punjab SLDC website, the parameters monitored from the existing RTUs like MW, MVAR, voltage have either some errors or have not been reported.
- (b) RTUs have not been covered for the upcoming generating stations of Talwandi Sabo, Rajpura and Goindwal Sahib under Phase 2.
- (c) RTUs have also not been included under Phase 2 for the upcoming interstate lines. SLDC has not provided the detailed information to ascertain the benefits to be achieved w.r.t the following as compared with the existing practice:
  - Details regarding scope of work for ULDC phase 1 and the benefits achieved by the existing EMS system with regard to load forecasting, resources scheduling and commitment, state estimation, power flow studies, contingency analysis, optimal power flow and Real Time Generation application.
  - Historical Data Recording (HDR), Historical Information management (HIM), Sequence of Events (SOE) recording for better post-dispatch analysis of events and perturbations in the Power System.Losses on account of delay in executing various schemes e.g. Procurement and Integration of RTUs, Interstate & Intra-state ABT metering system etc.

Losses due to SCADA/EMS, RTUs Implementation are based on the Purchase order placed by PGCIL. Also, losses with reference to the Interstate and Intra-state ABT Metering System could be ascertained based on the Implementation of the Energy Accounting System and its compliance to the Grid Code.

SLDC has informed that the Energy accounting Software, interface and installation of some more energy meters are still under progress. SLDC has not defined properly the existing practice of Energy Accounting which is done without software on monthly basis for payment of charges to PSTCL, Central Utility (Inter State Lines), BBMB etc. As some of the interstate ABT meters are yet to be installed, the existing practice of metering & billing and payments of the Interstate Energy Flows has to be informed by SLDC, as inaccuracy in the method used without proper metering could lead to errors and losses.

(d) Phasor Measurement Unit (PMU):

Installation of PMUs has been recommended at major power exchange lines (interstate), substations and all generating stations which will provide a very good visualization of the load angle between the generation in Punjab under normal and contingency condition and the same could be recommended to BBMB generating stations as they are associated with Punjab network. This installation of PMUs could pave for recording in real time the behaviour of the network during perturbation in the Punjab network and for verification of the load shedding

scheme & Islanding scheme by checking the frequency and df/dt in real time.

The consultant mentioned that this point is not applicable to PSPCL.

- (ii) PSTCL submitted in its comments that:
- (a) The data shown in the snapshots pertains to a particular instant of time and which varies as per the real time field conditions. The error in data being shown in the snapshot may be due to monetarily field/communication problem. Moreover, 1<sup>st</sup> generation RTUs are being replaced/retrofitted for achieving higher rate of accuracy.
  - (b) For telemetry of data at the generating stations through IPPs viz. Talwandi Sabo, Rajpura and Goindwal Sahib, SAS has been installed/commissioned at their end by the respective generating plants. The data in SAS has been integrated/being integrated with the SCADA system at SLDC Control Centre, Ablowal, to get the real time data. Hence, there is no need of placing additional RTUs at these sites.
  - (c) Action for procurement/installation of RTUs is being taken separately as scope of work under ULDC Phase-II include mainly the upgradation/replacement of existing Areva make SCADA/EMS system at control center only.
  - (d) ULDC Phase-I was implemented by Power Grid Corporation of India Limited in nine number constituents of Northern India, including BBMB, on a unified basis along with setting up of Northern Region Load Despatch Center (NRLDC) at New Delhi. The broad scope of work was to implement SCADA/EMS in all the Northern Region constituents and RTUs. In Punjab, SLDC

Control Center at Ablawal and 2 nos. ALDCs at Lalton Kalan & Jamsheer were setup for real time display/control of load. Further, 19 nos RTUs were supplied/commissioned in Punjab under the scheme covering generating substations and critical 220kV/132kV substations. The scope of work also includes providing communication link (i.e. microwave link) for transmission of real time data to ALDC/SLDC/NRLDC. All the required hardware i.e. Servers, Workstations, Printers, large Display Screen etc. and Software were also in the scope of the work which were supplied and commissioned by the firm (M/s Areva Ltd.). In addition, reliable power supply system, i.e. online UPS for smooth functioning of the SCADA/EMS was also provided/installed under the project. Various applications covered under Energy Management System (EMS) includes load forecasting, resource scheduling and commitment, state estimation, power flow studies, contingency analysis, optimal power flow, real time generation application etc. Load Forecasting application was used for the purpose of load forecasting on hourly basis based on inputs such as weather data/parameters, load patterns of the concerned constituent in the past etc. But, later on, ABT regime was implemented, in which load is maintained on 15-minute basis. Similarly, correct status data, analog data etc. from all the constituents is a prerequisite for running the state estimator application and to get desired output. All other applications like power flow studies, contingency analysis, optimal power flow etc. utilize the output of State estimator application as their input to give results. These features are being used up to the extent of data availability from various constituents.

Real time data is stored in the HDR/HIM for study/later use during post disturbance analysis of power system. SCADA feature of Historical Data Recording (HDR), Historical Information Management (HIM) and Sequence of Events (SOE) recording are being extensively used to pin point the source of system disturbance so that the corrective/preventive measures can be taken in future. Data requirements to NRLDC, particularly after incidence of system collapse/disturbance, are being met by the help of this system.

### Procurement of RTUs

49 nos RTUs were installed initially at all the Generating Stations of PSPCL, Interstate tie lines, important 220kV & 132kV grid substations of PSTCL for remote data acquisition and control of online power system since last decade. Subsequently, to improve visibility of the grid from SLDC, the left out/new 220kV sub-stations were also covered, for which PSTCL ordered 47 no. RTUs during 2011. Out of 47 Nos. RTUs (41 Nos. left out/upgraded/ new 220kV level substations in PSTCL and 6 Nos. RTUs for cannibalizing the existing RTUs), 24 Nos. RTU have been commissioned, 1 is under commissioning and remaining 22 nos. RTUs which were deferred due to non readiness of data communication connectivity and/or due to non readiness of substation itself, have been released to the firm and shall be commissioned by July 2014. With commissioning of these 41 RTUs at left out/upgraded/new 220kV substations, there shall be a total of 90 substations (49 Nos. RTUs already existing plus additional 41 No. under present order) shall be covered with SCADA system. A tender for procurement of 90 nos. RTUs for remaining/upcoming 220kV and 132kV substations in PSTCL alongwith additional new RTUs for replacement of old RTUs is under process and these RTUs are expected to get commissioned in FY 2014-

15 itself. With the commissioning of these RTUs, the SLDC will have full visibility of Punjab Grid above 66kV.

Implementation of Intrastate Boundary Metering cum Transmission Level Energy Audit Scheme in PSTCL using ABT type and Conventional Energy Meters on Turnkey basis

To calculate the grid/transmission losses, SLDC/PSTCL is implementing Intrastate Boundary Metering cum Transmission Level Energy Audit Scheme. Around 702 Availability Based Tariff (ABT) meters and 410 Conventional Energy Meters (CEMs) have been installed at 190 substations/locations of PSTCL, PSPCL, PGCIL & BBMB in Punjab. ABT meters have been installed at all the locations to be covered under this project for energy accounting purposes. Due to poor communication signal problem at many remote locations, the requisite data of energy meters from such locations for these calculations is not available online at SLDC and have to be fetched manually through CMRI (Common Meter Reading Instrument) and is integrated manually with the control centre at SLDC. Due to inherent delay and possibility of mistakes in this procedure, on the firm's request, it has been allowed to install the suitable energy meters at the far end where the signal connectivity is available. This shall be completed by May, 2014 end. As such, the transmission losses of PSTCL from this project are expected to be available by May, 2014 end.

Present method of energy accounting being used for interstate energy transactions

At present, for interstate energy transactions, the ABT meters (data fetched through manual CMRI process) already installed since 2002 by PGCIL/NRLDC, are being used by NRLDC/NRPC.

In view of the above, the Commission directs PSTCL as under:-

(i) PSTCL to change first generation RTUs within a fixed time frame and intimate the Commission regarding progress of the same, along with progress of procurement and commissioning of 90 no RTUs for remaining/upcoming 220kV/132kV sub-stations of PSTCL.

(ii) PSTCL to ensure correctness of data received from various constituents to utilise the benefit of EMS and its applications.

(iii) PSTCL submitted that installation of ABT meters for energy accounting will be installed by May, 2014 at remote locations where there is communication signal problem. PSTCL to intimate the final status regarding the same and also whether work of monthly accounts and energy drawl by licensee, open access customers, injection/drawl from BBMB system have been started or not?

(iv) PSTCL to intimate present status of installation of phase measurement units by PGCIL.

22. Expenditure on safety measures and training as per CEA (Safety Requirements for construction, O & M of Electrical Plants and Electric Lines) Regulations, 2011 vis-a-vis loss due to accidents. Implementation of already approved 'PSEB Training Policy'.

(i) The consultant in its report of PSTCL has brought out that as per information supplied by PSTCL, their training cell came into existence in November 2012, therefore, expenditure incurred during years 2010-11 and 2011-12 is not applicable to them. Total expenditure incurred by

PSTCL on safety and training from Nov 2012 to March 2013 is ₹19,95,713/-, expenditure incurred from April 2013 to October 2013 is ₹52,33,139/-. Expenditure incurred on compensation due to accidents is ₹3,47,213 and ₹8263.00 for years 2010-11 and 2011-12 respectively.

The consultant in their report of PSPCL has brought out the expenditure incurred by PSPCL for FY 2010-11, FY 2011-12 and 2012-13 including compensation paid by PSPCL due to accidents, zone wise. It has been mentioned in the report that true figures have not been intimated by PSPCL and figures seem to be manipulated. PSPCL need to follow the CEA provisions.

(ii) PSTCL submitted that action on this issue is to be taken by PSPCL.

(iii) PSPCL submitted in their reply that as per the directions of the Hon'ble Supreme Court, occupational health and safety policy is being implemented in Thermal Plants of PSPCL.

(iv) PSPCL submitted on comments of PSTCL that PSTCL is also deputing its officers/officials regularly for training. Therefore, necessary detailed reply needs to be supplied by PSTCL. Safety measure is a subject to be implemented by all the organizations. PSTCL works also require the implementation of detailed safety measures for ensuring safe working conditions for its manpower. The network of EHT transmission lines, 400kV & 220kV substations should be safe for the human life. PSTCL should also submit detailed reply regarding these aspects.

**The Commission observes that PSTCL and PSPCL have not given proper reply on this issue and directs PSPCL and PSTCL to comply and follow the CEA Regulations, 2011 (Safety Requirements for Construction, O&M of Electrical Plants and Electric Lines).**

**23. Cross checking the Transmission System Projects executed by PSTCL to ascertain their necessity in view of PSPCL's view that PSTCL has been executing some of the Transmission System Projects (Substations and Transmission Lines) which were otherwise the responsibility of PGCIL thereby burdening the distribution licensee (PSPCL) financially. Necessary System studies and techno-economic analysis be carried out to establish the factual position.**

(i) The consultants mentioned that PSPCL has not intimated any Transmission System project that has been executed by PSTCL which were otherwise the responsibility of PGCIL, thereby burdening PSPCL financially. Even during various meetings taken by the Commission with PSTCL, PSPCL & consultant, PSPCL reconfirmed that there were no such projects in their knowledge.

Consultant further reproduced in their report of PSPCL, the Objection of PSPCL (Issue No. 4-Transmission Capital Expenditure) PSERC Tariff Order for FY 2013-14 in respect of PSTCL as under:

“As per the Transmission Capital Expenditure, PSTCL has projected the revised cost of transmission of Talwandi Sabo as ₹1250 crore which contains 513.9 Km of transmission line whereas the Rajpura Project transmission cost of ₹516 crore which includes 285.28 Km of transmission lines. The excess cost of Talwandi Sabo transmission lines project needed to be justified by PSTCL as the same is ultimately going to be levied to PSPCL. Further, with respect to the above cited two projects of generation capacity (1980 MW + 1320 MW) i.e. 3300 MW, Transformer Capacity of 3890 MVA has already been proposed at five 400 kV substations, which are already under construction. Accordingly, the need of two more 400 kV substations was not justified as there was

no more generation available in the State of Punjab on 400kV and already proposed transformer capacity meets the N-1 criteria laid by Central Electricity Authority. The additional power which is likely to be purchased from out of the State Projects is going to flow through the PGCIL network for which PGCIL has already installed a huge network in Punjab. Furthermore, in case, PSTCL starts doing the job which is otherwise the responsibility of the PGCIL, PSPCL shall be unnecessarily burdened due to the unfruitful capital expenditure made by PSTCL.” PSPCL need to explain the reason for not bringing this information for the purpose of this audit.

(ii) PSTCL submitted in its comments that this point relates to PSPCL.

(iii) PSPCL, in its comments submitted that the new 400kV substations at Amloh and Doraha (Near Machiwara/Ludhiana) were planned due to generation capacity addition planned at Rajpura and Talwandi Sabo Thermal Plants and expected new generation of Mukerian Thermal Plant and are justified. PSTCL intimated PSPCL that due to uncertainty of these future generation projects, the cases of new 400kV substations are under review.

(iv) PSPCL submitted, on comments of PSTCL, that comments of PSPCL on this point remain the same as previously furnished. However, regarding 2 nos. 400kV sub-stations (Amloh & Doraha (Ludhiana), PSTCL had told PSPCL that they are reviewing their cases for planning due to uncertainty of future generation of Mukerian Thermal & generation capacity addition at Rajpura & Talwandi Sabo Thermal Plants. PSTCL yet to intimate about their decision on the same.

(v) In the additional reply submitted to consultant, PSTCL mentioned that comments offered by PSPCL are agreed to.

(vi) In the supplementary report, the consultant have mentioned that no further observations are required.

**The Commission advises PSTCL to be careful in future and not to plan any Transmission System work which is otherwise responsibility of PGCIL.**

**24. Laid down 'Future Road Map' for development of sub-transmission system aligned with tenets laid down under the "Manual of Transmission Planning Criteria (MTPC)" issued by Central Electricity Authority of efficient, economical and coordinated Technical Interface with other transmission and distribution licensees.**

(i) The consultant in their report have brought out the lists of works proposed by PSTCL for future road map and their observations on these works as under:

- (a) 220kV line from Phaggan Majra to 220kV substation Patiala is overloaded. Additional 220kV line from Phaggan Majra to Patiala needs to be constructed and is not covered under the future road map.
- (b) Under Scenario 4, considering generation of only one unit at Talwandi Sabo and one unit at Rajpura, 400 kV/220 kV ICT at Moga is overloaded and additional ICT needs to be provided. However, for providing additional ICT, short circuit studies should be carried out.
- (c) Overloaded lines as appear in the tables for overloaded 220kV and 132kV lines in respect of each scenario require

strengthening either with up gradation of the voltage level or with additional lines.

- (d) Keeping in view the future load requirement of 13100 MW in the year 2017 and considering N-1 contingency, 400kV/220kV ICTs at Moga, Patiala, Dhuri, Amritsar and Ludhiana 400kV substations, either require up gradation of the transformer capacity or additional transformers need to be installed. However, in these cases also, short-circuit studies are required to be carried out.
- (e) Consultant have given the list of 400kV lines to meet the future load requirement of 13100 MW in the year 2017 which will be loaded maximum up to 2.5% and 14%.

The execution of the line works which have not been taken up in hand out of these lines, can be reviewed provided these lines are not getting loaded even during winter season.

- (f) In the scenario when all the four units of Talwandi Sabo and three units of Rajpura are generating, the evacuation lines get overloaded as brought out in scenario 3 of the load flow report. These lines need to be strengthened.
- (g) In the scenario when only one unit of Talwandi Sabo and one unit of Rajpura are generating, power has to be imported through 400 kV lines of PGCIL. Under such circumstances, the 400kV interstate line contingencies shall lead to instability. This condition of instability is also apparent in other scenario also. This situation needs to be resolved at appropriate northern region authority.

- (h) LILO of 400kV Rajpura – Dhuri line at Patiala is not recommended as this option would lead to overloading of 400kV/220kV ICT at Patiala Substation.
- (i) LILO of 400 kV Talwandi Sabo – Nakodar line at Moga is also not recommended as this option would lead to overloading of 400kV/220kV ICT at Moga substation.
- (j) Execution of 400kV Malerkotla- Dhuri link would reduce loading of 400kV/220kV ICT at Dhuri substation by 60 MW and increase the load of 400kV/220kV ICT at Malerkotla and at the same time the ICT at Dhuri will still remain loaded by about 90%. This option is not viable.
- (k) The evacuation of power generation of Talwandi Sabo through existing 220kV lines is not feasible due to non availability of adjacent load centres. The load centers are Muktsar, Nakodar, Moga and Dhuri. Talwandi Sabo power evacuation is feasible with the proposed 400kV lines and 400kV/220kV substations.

It has been observed by consultant that out of the proposed 400kV lines, the lines from Muktsar to Makhu, Makhu to Amritsar and Moga to Nakodar would be loaded below 40% and their execution can be reviewed.

Evacuation of power generated from Rajpura Power Plant is feasible with the existing 220kV substations but by adding 220kV lines from Rajpura to Bahadurgarh and Bassi Pathana, Patiala – Bahadurgarh and Patiala-Rajpura.

- (ii) PSTCL have given the same comments as given in para 8.
- (iii) PSPCL in their comments on the report has submitted the list of works from the year 2014 to the year 2017.

(iv) In the additional information given to consultant, PSTCL has stated that point has been noted for compliance.

(v) In the supplementary report, consultant has stated that no further observations are required.

**The Commission directs PSPCL that it should coordinate with PSTCL for planning its works to cater for realistic future load growth for each load centre/substation over the previous years. PSPCL and PSTCL should hold monthly meetings for exchange of information/data on this issue. PSTCL and PSPCL should use softwares for load assessment/demand forecast and do the load flow analysis, contingency analysis, short circuit analysis and dynamic analysis of the system. PSTCL is directed to keep in view the various load flow studies carried out by the consultant for different scenarios as brought out in the Audit Report while planning transmission system in future.**

**The Commission in the Tariff Order for FY 2014-15 had directed that PSPCL should establish System Analysis Wings under Chief Engineer/Planning and Chief Engineer/PPR to conduct Planning and System Operation Studies respectively. PSPCL shall intimate to the Commission action taken in the matter within one month of issue of this Order.**

The petition is disposed of with the above directions.

**Sd/-  
(Gurinder Jit Singh)  
Member**

**Sd/-  
(Virinder Singh)  
Member**

**Sd/-  
(Romila Dubey)  
Chairperson**

**Chandigarh  
Dated: 04.12.2014**