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Report of the Comptroller and Auditor General of India on Planning and implementation of transmission projects by Power Grid Corporation of India Limited and Grid management by Power System Operation Corporation Limited For the year ended March 2013

The Report has been laid on the table of the Parliament house on 04-08-2014

Union Government (Commercial)
Ministry of Power
No. 18 of 2014
(Performance Audit)

Report of the
Comptroller and Auditor General of India
on
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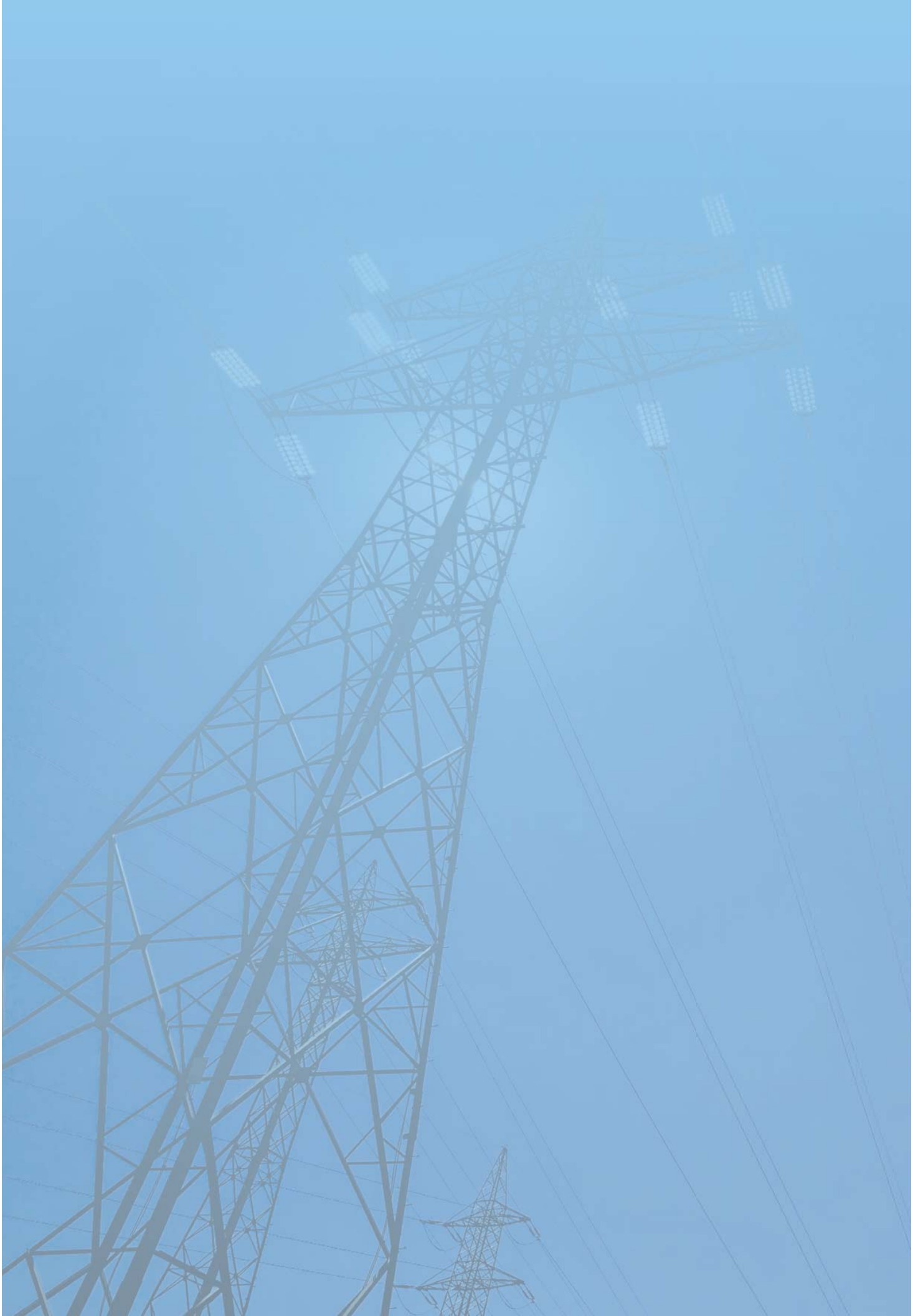


Preface

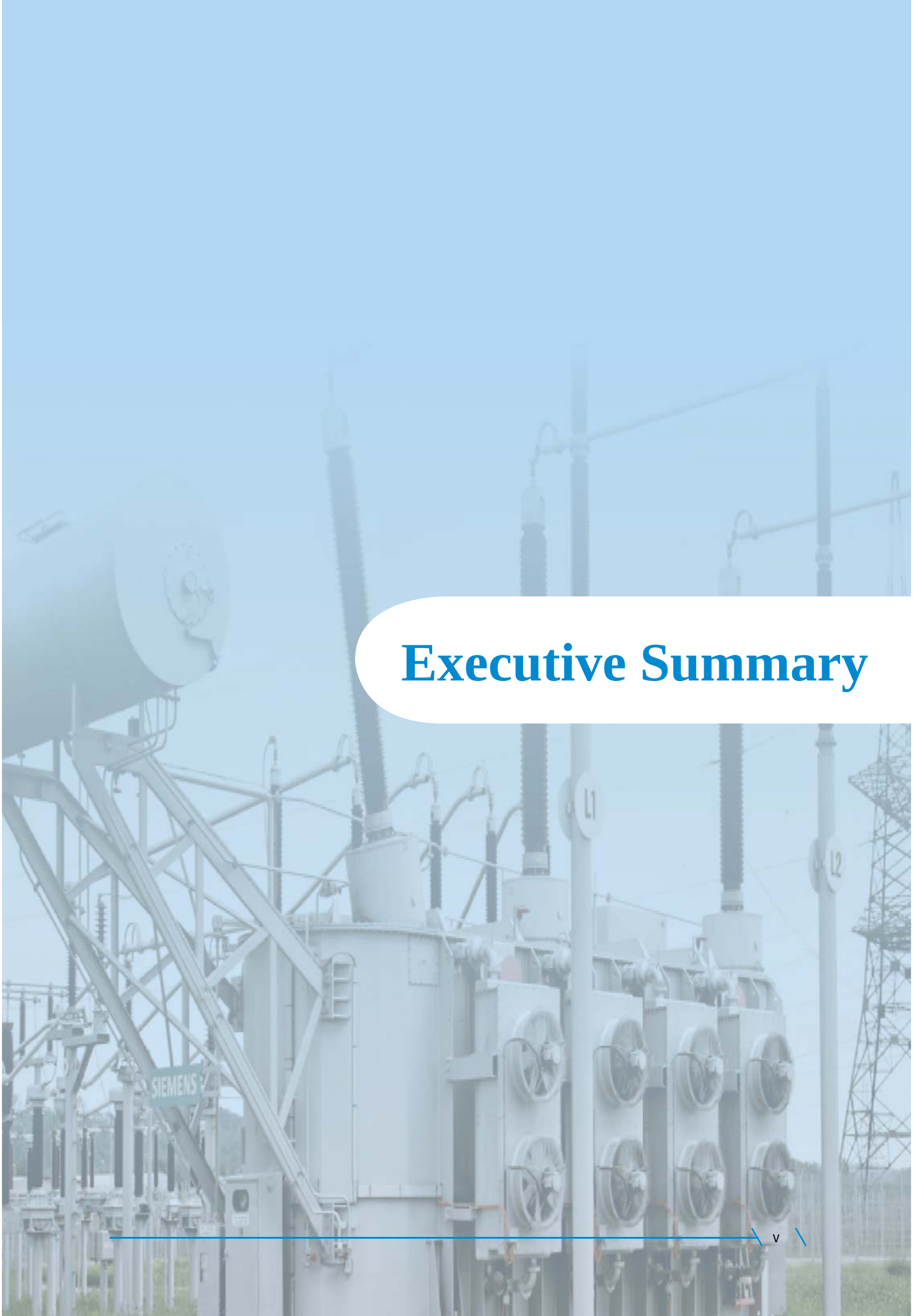
Power Grid Corporation of India Limited (PGCIL), a Navratna Central Public Sector Enterprise, is mandated under the Electricity Act to ensure development of an efficient, coordinated and economical system of inter state transmission lines for smooth flow of electricity from generating stations to load centres. Power System Operation Corporation Limited (POSOCO), a wholly owned subsidiary of PGCIL, is the apex organisation to ensure integrated operation of power system including scheduling and despatch of electricity through national and regional load despatch centres. Transmission service provider is a key intermediary between generator and distributor of electricity and an efficient and effective transmission network facilitates generation and utilization of power. Inadequacies in transmission network and delay in commissioning of transmission projects may not only result in loss of revenue to PGCIL but may also lead to congestion in evacuation of power. On the other hand creation of lines of higher capacity than required or abnormal redundancies in transmission assets may result in extra financial burden on beneficiaries and public at large.

In the above backdrop, performance audit was taken up to assess the effectiveness of planning and implementation of transmission projects by PGCIL during XI Plan (2007-2012) along with status of augmentation of transmission network up to March 2013. Besides, an attempt has been made to assess shortcomings, if any, in Grid Management by POSOCO in ensuring uninterrupted power supply, including Grid Security and Grid Monitoring, in view of the major Grid disturbances of 30 and 31 July 2012.

The Audit Report has been prepared in accordance with the Performance Audit Guidelines and Regulations on Audit and Accounts, 2007 of the Comptroller and Auditor General of India.

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

Executive Summary



Executive Summary

Introduction

Inter state and intra state power transmission systems are inter connected and together constitute the grid. In 1984, a working group constituted by Government of India (GOI) for development of 'National Grid' recommended formation of a separate central sector corporation for manning, constructing, operating and maintaining transmission facilities in the country. Accordingly, Power Grid Corporation of India Limited (PGCIL), a Navratna Central Public sector undertaking,[1] was established under the administrative control of Ministry of Power (MOP) in 1989 to implement the decision of GOI to form a 'National Grid'.

Transmission facilitates generation and utilization of power. Inadequacies in transmission network and delay in commissioning of transmission projects may not only result in loss of revenue for PGCIL but may also lead to congestion in evacuation of power. Creating lines of higher capacity than required or abnormal redundancies in transmission assets may result in extra financial burden on beneficiaries[2] and public at large. Accordingly, performance audit was taken up to assess the effectiveness of planning and implementation of transmission projects executed by PGCIL during XI Plan (2007-2012). Besides, an attempt has been made to assess shortcomings, if any, in Grid Management by Power System Operation Corporation Limited (POSOCO) a wholly owned subsidiary of PGCIL, in ensuring uninterrupted power supply, including Grid Security and Grid Monitoring.

Audit scope and sample

The performance audit examined activities from conceptualisation to implementation of selected major transmission projects executed by PGCIL between April 2007 and March 2012 along with the status of augmentation to transmission network made by PGCIL up to March 2013. A sample of 20 transmission projects representing 14 *per cent* in terms of number and 37 *per cent* in terms of value of the projects planned and executed by PGCIL during April 2007 and March 2012 was taken based on materiality and coverage of all Regional Offices of PGCIL. In the wake of the incident of Grid disturbances on 30 and 31 July 2012, the aspect of Grid management by POSOCO, which is mandated with the responsibility to ensure integrated operation of the 'National Grid', was also included in the scope of audit.

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1 ***PGCIL was granted Navratna status in May 2008.***
2 ***State Discoms***

Major Audit Findings

One of the major objectives of formation of PGCIL was to bring about integrated operation of the regional transmission systems by undertaking construction of inter-regional links. This was to facilitate the growth of economic exchange of power (replacing costly energy transactions within a region with cheaper ones from another region to reduce the cost of power) which would ultimately lead to formation of a 'National grid' and ensure better utilisation of available generation resources. The process of integration of five regional grids was progressively taken up from the 1990s and with the synchronisation of Southern Grid with the rest of the grid on 31 December 2013, the entire Indian power transmission grid was being operated at the same frequency completing the technical process of formation of 'National Grid'. However, when viewed in terms of inter-regional power transfer capability and congestion scenario, the objective of formation of 'National Grid' remained to be fully achieved.

In 24 years of its operation up to March 2013, PGCIL built 45 inter-regional transmission lines (220 kV and above), connecting five regions in the country, which works out to 1.2 *per cent*[3] of total such lines in the inter-state transmission grid. Four out of six inter-regional corridors (WR-NR, WR-ER, ER-NER and WR-SR) were capable of carrying only 1.5 *per cent* to 3 *per cent* of installed power generating capacity in the respective power surplus regions. In three out of six inter-regional corridors, there is zero margin (WR-SR) /negligible margins (ER-SR, WR-NR)[4] over and above the capability required to cater to long term customers. Low level of inter-regional transfer capability implied limited scope for transfer of power among regions. Hence the objectives of formation of National Grid *i.e.* meeting deficit from surplus regions and facilitating economic exchanges remained to be fully achieved. Low transfer capability also led to persistent congestion due to transmission constraints. Power exchange data showed that percentage of time congestion occurred above 75 *per cent* increased from two months in 2010-11 to five/six months in 2011-12 and all the 12 months in 2012-13. Similarly, volume of electricity that could not be cleared due to congestion (as a percentage of the actually cleared volume), went above 75 *per cent* for 3 months in 2011-12 and increased to six months in 2012-13. Impact of congestion was visible in large variations in electricity prices. Buyers in S1 and S2 bid areas (Tamil Nadu, Kerala, Andhra Pradesh, Karnataka, south Goa and Union Territory of Pondicherry) consistently incurred higher prices during the last two years (₹ 5.1 to ₹7.3 per unit of electricity as against unconstrained market clearing price of ₹3.5 per unit) to procure power due to transmission constraints. On the other hand, sellers in W3, E1 and E2 bid areas (Chhattisgarh, Orissa, West Bengal, Sikkim, Bihar and Jharkhand) received lower prices (₹2.8 to ₹2.9 per unit) as they could not sell surplus power to deficit areas due to transmission constraints which could have been reduced through strengthening WR-SR and ER-SR links.

(Para 3.1.1)

[3] Total lines – 3743; inter-regional – 45 (765kV, 400 kV and 220 kV).
[4] ER-SR Margin 93 MW in March 2014 (00 to 05 and 10-19 hours) and WR-NR margin 219 MW in March 2014.

XI Plan (2007-2012) noted that planning and operation of the transmission system had shifted from the regional level to the national level necessitating a strong all-India grid. Towards this end, XI Plan stipulated target of inter-regional transfer capacity of 17000 MW. Against the XI Plan target of 17000 MW, PGCIL achieved 13900 MW of inter-regional capacity leaving a shortfall of 3100 MW in achievement. While shortfall to the extent of 1000 MW was due to annulment of one of the projects, the remaining shortfall of 2100 MW was due to controllable factors like delay in submission of proposal for forest clearance and land acquisition issues. MOU targets for inter-regional capacity augmentation by PGCIL for 2007-12 were fixed at 10100 MW which were short of the corresponding XI plan target by 6900 MW (17000 MW minus 10100 MW). In two years (2007-08 and 2010-11) MOU targets were fixed at 'Nil'.

(Para 4.1 and 4.2)

Two parameters *viz*. Transmission Capacity and Transfer Capability are relevant for assessing the capacity of inter-regional corridors. Transmission capacity of a corridor is arrived at by adding the ratings of all transmission lines connecting two regions. Transfer capability on the other hand, is a measure of the ability of a corridor, as a whole, to reliably move power from one region to another. However, PGCIL assesses the need for augmentation of capacity of inter-regional corridors based only on 'Transmission capacity' and does not monitor augmentation of total transfer capability (TTC). Though transmission capacity at the end of XI Plan was 25650 MW, capacity for transfer of power *i.e.* TTC was 11530 MW. PGCIL added (2007-12) transmission capacity of inter-regional transmission corridors of 13900 MW. However, TTC increased from 9400 MW in 2008-09 to only 11530 MW in 2011-12. Thus, for better appreciation of the ability of transmission network to transfer power across regions, it is necessary that TTC is also declared and disclosed alongwith transmission capacity.

(Para 3.1.2)

Bulk of the inter-regional augmentation efforts achieved in XI Plan and planned for XII Plan have been across the ER-NR and ER-WR corridors to wheel power from the pit-head power plants in the coal rich ER to the demand centers in the north and the west. 63 *per cent* of total inter-regional transmission capacity of 25050 MW[5](cumulative at the end of XI Plan) was concentrated along these corridors. Offline simulation studies conducted by an Expert Group constituted by MOP following two major Grid disturbances of 30 and 31 July 2012 have shown that the WR-NR link is the 'short tie' (transmission link shorter in length and tying/connecting two regions) for import of power by NR and in the case of loss of the 'short tie', the 'long tie' of WR-ER-NR could also be lost due to angular separation and power swings[6]. Hence, high level of augmentation of the 'long tie' would not yield desired results for transmission of increased

[5] ***Transmission capacity i.e. summation of ratings of individual lines.***

[6] ***The rotors of generators connected to the grid run at the same electrical speed and in case of small disturbances affecting the speed, restorative forces bring back the rotors to the same speed. However for large disturbances, the restorative forces may be unable to bring all the generators to the same speed. If this happens, the angular difference between the generators goes on increasing (Angular separation) which causes large variations in voltage and power flow in lines.***

power to the NR and there is a need to prioritise implementation of the three new links planned by PGCIL in the WR-NR corridor.

{Para 3.1.3(i)}

Agra-Gwalior double circuit line, a trunk line of the WR-NR corridor, was upgraded from 400 kV voltage level to 765 kV in March 2013. The upgradation created a 765 kV line in parallel with a 220 kV network without any 400 kV system in the WR-NR inter-regional corridor. The impact of such a formation was that in the event of loss of both the circuits of 765 kV line, there would be a 'cascade tripping' of 220 kV network. TTC of WR-NR corridor which was enhanced to 5700 MW from 2000 MW in May 2013 following the upgradation of Agra Gwalior line, was rolled back in October 2013, due to reliability considerations. Thus, the upgradation to 765 kV line in the WR-NR corridor worsened an already delicate nature of WR-NR interconnection.

{Para 3.1.3(ii)}

PGCIL has not put in place a mechanism for assessing utilisation of transmission lines with the result that there were pockets of congestion, as well as areas of redundancy. In Odisha region, there was congestion in the transmission network due to interim 'Loop in Loop out' arrangements made for evacuation of power from Independent power producers without ensuring adequacy of the transmission system. On the other hand, out of 22 high voltage 765 kV lines, six lines remained undercharged at 400 kV for more than 5 years out of which two lines remained undercharged for more than 13 years. During 2011-12, average utilisation of 33 out of 40 inter-regional lines ranged between 0 to 30 *per cent* in all inter-regional corridors except WR-SR and ER-SR. In case of intra-regional lines, 478 (68 *per cent*) out of 706 lines in five regions had average utilisation of less than 30 *per cent*.

(Para 3.1.4 and 3.1.5)

The Country faced a severe Grid disturbance (GD) on 30 and 31 July 2012 which resulted in 757 million units of energy not being served (compared to total generation of 2400 million units per day) to users. The proximate cause for the major GD of 30 July 2012 (involving NR) and 31 July 2012 (involving NR,ER and NER) was the shut down of the trunk line (400 kV Bina - Gwalior-Agra line) between WR and NR for four days (26 to 29 July 2012) in peak season due to construction work. While the shutdown initially planned for four days got extended due to non-completion of work, TTC on WR-NR corridor that was curtailed from 2400 MW to 2000 MW during initially planned shutdown was not restricted to 2000 MW by POSOCO in the extended shutdown though the system had faced a 'near miss' situation on 29 July 2012. TTC was not reviewed on WR-NR corridor on 30 July 2012 which led to scheduling of power by Regional Load Dispatch Centres (RLDCs) beyond the capacity of system. Over scheduling coupled with over-drawals by NR beneficiaries and under-drawals/over-injection

by WR beneficiaries/generators overloaded the system beyond control, which ultimately led to 'cascade tripping' of alternate paths. WRLDC did not instruct WR generators to back down power generation and did not convey effective instructions to beneficiaries to reduce under drawal of power, which was a major cause for GD. Beneficiaries/generators in NR and WR did not comply with RLDCs' instructions which contributed to over- loading of lines.

(Para 7.4.1 and 7.4.2)

Systemic issues such as absence of early warning mechanism by way of declaration of emergency status, fragile interconnection of NR with connecting regions due to skewed *inter-se* distribution of power flow among the links, heavy volume of Unscheduled Interchange (UI) flows due to commercial consideration, demand-supply gap and inter-play between UI and congestion mitigation measures also contributed to GDs in July 2012.

(Para 7.4.5)

Works and Procurement Policy of PGCIL (WPPP) limits the exercise of detailed survey of transmission line route to forest stretches only, contrary to advice of Working Group on Power constituted by Planning Commission which suggested that detailed survey should be carried out before start of procurement process. PGCIL, however, as a practice did not conduct detailed surveys of forest stretches also before preparation of Bill of quantity and cost estimates, as stipulated in the WPPP. In test checked 20 projects, actual length of 17 transmission lines in 12 projects had variations as compared to line length considered in the Feasibility Report. The difference in length in two cases was between 10-25 *per cent*, in three cases it was between 25-50 *per cent* and in one case it was more than 50 *per cent*.

(Para 5.1)

Out of 20 transmission projects selected for Audit, only one project was completed within scheduled time and delay was above 20 months in nine projects. Main reasons for delays in execution of the above projects were delay in acquisition of land, delay in handing over site and approved drawings to contractors, delay in release of advance to contractors, delay in forest clearance which were possible to have been controlled by PGCIL with more effective planning and monitoring. PGCIL also lost the opportunity of earning ₹350.28 crore during the project life towards additional return on equity, which could have been earned in terms of CERC Regulations, for commissioning of projects within the prescribed timeline in case of projects approved after 1 April 2009.

(Para 6.3)

Monitoring mechanism for implementation of transmission projects, though in place, needed further strengthening as project review meetings were not held as per the prescribed frequency of once in two months. Against 30 meetings required to be held during 2007-12, meetings ranging between three and twelve were held in various regions. Minutes of the pre

award meetings as well as follow up action on the decisions taken in the previous meetings were not recorded.

(Para 8.1 and 8.2)

Between 2004-05 and 2012-13, PGCIL received ₹ 906.49 crore as part of Short Term Open Access (STOA) charges that were required to be used for building new transmission systems as per regulations and orders of CERC. However, PGCIL did not maintain project-wise details of transmission schemes where these STOA charges were utilized, with the result that capital cost of new transmission systems/schemes were not reduced.

(Para 5.2)

Recommendations

Based on the audit findings discussed in the report, the following recommendations are made to facilitate improvement in the planning, implementation of transmission projects and management of Grid:-

(i) CEA and PGCIL may enhance capacity of inter-regional corridors appropriately based on analysis of data regarding power transfer requirements between regions to fully achieve the objective of formation of 'National Grid'.

(ii) PGCIL may disclose and monitor the key parameter of TTC in the long and medium term as per CERC regulations and for better appreciation of the transfer capability of the system.

(iii) MOP may evolve norms for assessing efficiency of transmission network and loss reduction in accordance with the tariff policy.

(iv) POSOCO may study the possibility of developing a system for offering un-requisitioned inter-regional transfer capability to needy users and consider making a proposal in this regard before CERC.

(v) To expedite project execution, PGCIL may initiate advance action to conduct detailed survey of forest stretches and submit forest clearance proposals before investment approval of the project.

(vi) Since long shut down to carry out construction work was the starting point for two major GDs, POSOCO may stipulate tolerance limits for antecedent line loadings and 'no-go' periods for key corridors for allowing long shut downs to prevent GDs. POSOCO may also consider taking up with CERC an appropriate warning system that specifies responsibility centres that would be tasked with informing constituents about state of emergency of the system.

(vii) In order to improve diligence in declaring TTC and scheduling power, POSOCO may critically review the existing practices in this regard to ensure secure grid operation.

MOP was generally in agreement with the audit recommendations.

CHAPTER - 1

Introduction

1.1 Background

Inter-state and intra-state transmission systems are interconnected and together constitute the electricity grid. In 1963, India was divided into five regions[1] with a view to integrating State power systems in each region and promoting the concept of regional power development through integrated power systems transcending State boundaries. In 1984, a working group constituted by Government of India (GOI) for development of a national grid, recommended formation of a separate Central Sector corporation for manning, constructing, operating and maintaining transmission facilities. A major objective of this decision was to reduce operational and commercial problems which had resulted from ownership of transmission facilities by various central generating organisations and joint ventures. Another major objective was to achieve improved integrated operation of regional transmission systems.

1.2 Profile of Power Grid Corporation of India Limited

In the above background, Power Grid Corporation of India Limited (PGCIL) was established in 1989[2] to implement the decision (August 1989) of GOI to form a 'National Grid' with the following main responsibilities:

- to plan, promote and build an integrated and efficient power transmission network in all aspects including investigation, planning, engineering and design;
- to prepare preliminary feasibility and detailed project reports;
- to construct, own, operate and maintain transmission lines, sub-stations, load despatching and communication facilities and appurtenant work;
- wheeling of power generated at various power stations in accordance with the policies and objectives laid down by GOI from time to time; and
- keeping abreast of technology development in transmission, load despatching and communication system.

Accordingly, PGCIL took over (April 1991 to August 1993) transmission assets from seven Central Generating Companies[3] and also took control of existing five[4] Regional Load Despatch Centres (RLDC) in the country between 1994 and 1996. PGCIL was notified (December 1998) as the Central Transmission Utility (CTU) by GOI and is mandated under the Electricity Act, 2003 to, *inter-alia.* ensure development of an efficient, co-ordinated and economical system of inter-state transmission lines for smooth flow of electricity from generating stations to load centers.

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[1] ***Northern Region (NR), Western Region (WR), Eastern Region (ER), Southern Region (SR) and North Eastern Region (NER)***

[2] ***PGCIL was incorporated as a Government Company on 23 October 1989.***

[3] ***NTPC Ltd., NHPC Ltd., North Eastern Power Corporation Ltd., SJVN Ltd. (earlier known as Nathpa-Jhakri Power Corporation Limited), Neyveli Lignite Corporation Limited, Nuclear Power Corporation Limited and THDC India Ltd.***

[4] ***Northern Regional Load Despatch Centre, Southern Regional Load Despatch Centre, Western Regional Load Despatch Centre, Eastern Regional Load Despatch Centre and North Eastern Regional Load Despatch Centre.***

PGCIL was conferred Miniratna[5] (Category-I) status by GOI in October 1998 and thereafter Navratna[6] status in May 2008. As on 31 March 2013, PGCIL had paid up capital of ₹4629.73 crore, of which 69.42 *per cent* was held by GOI and balance equity was held by others[7]. After a 'Follow on Public Offer' in December 2013, the paid up capital of PGCIL increased to ₹5231.59 crore, of which 57.90 *per cent* was held by GOI and balance equity was held by others. Equity shares of PGCIL were listed on National Stock Exchange (NSE) and Bombay Stock Exchange (BSE) on 05 October 2007.

1.3 Profile of Power System Operation Corporation Limited

As envisaged in the Electricity Act, 2003, National Load Despatch Centre (NLDC) was established (February 2009) as an apex body to ensure integrated operation of 'National Grid'. Till 30 September 2010, RLDCs and NLDC were being operated by PGCIL and from 01 October 2010, a separate company named Power System Operation Corporation Limited (POSOCO), incorporated on 20 March 2009 as a wholly owned subsidiary of PGCIL, took over the operations of RLDCs and NLDC.

POSOCO was to act as the apex organization to ensure integrated operation of power system including to own, operate and maintain NLDC and RLDCs and ensure optimum scheduling and despatch of electricity in accordance with the Electricity Act 2003, regulations laid down by Central Electricity Regulatory Commission (CERC) and Indian Electricity Grid Code. POSOCO is primarily a knowledge based organization. The assets of RLDCs and NLDC comprise of Supervisory Control and Data Acquisition (SCADA) and IT systems for operation of Regional Grids and the National Grid.

1.4 Physical performance of PGCIL

The physical performance of PGCIL during the period of last six years ended 31 March 2013 are given in Table 1.1.

Table 1.1

Physical performance of PGCIL

Particulars/Years	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13
Length of transmission lines (in ckm) at year end	67,000	71,500	75,290	82,355	92,981	1,00,200
Number of sub-stations at year end	111	120	124	135	150	167
Transformation capacity (in MVA) at year end	73,000	79,500	83,100	93,050	1,24,525	1,64,763
Transmission Network Availability (*per cent*)	99.65	99.55	99.77	99.80	99.94	99.90
Power transmitted on PGCIL Network (MUs)	3,28,709	3,34,013	3,63,723	4,00,596	4,30,992	4,50,027

ckm: circuit kilometre, MVA: Mega Volt Ampere, MUs: Million Units

[5] ***Which provided powers to the Board of the Company to undertake new projects, modernisation, purchase of equipment, etc up to ₹300 crore or equal to their net worth which ever is lower without approval of GOI.***

[6] ***Which provided powers to the Board of the Company to undertake new transmission projects of any amount without approval of GOI***

[7] ***Foreign Institutional Investors: 14.09 per cent, Indian Public: 4.13 per cent, Body Corporates: 4.14 per cent, Mutual Funds: 2.38 per cent, Bank & Financial Institutions: 5.40 per cent and Others: 0.44 per cent.***

1.5 Roles of PGCIL and POSOCO

Transmission system projects are conceived based on requirements assessed by PGCIL in consultation with Central Electricity Authority (CEA), power generators, beneficiaries, regulators and other utilities. PGCIL carries out the work of planning, execution, operation and maintenance of the inter-state transmission system projects for evacuation of Central Sector power generation, within and across regions. POSOCO manages the grid including supervision and control of inter-state transmission systems for grid control and despatch of electricity within regions and country through secure and economic operation of regional grids. It also monitors and regulates operation of grids carrying out all such functions required as an interface with power exchanges as may be related to the business of POSOCO.

1.6 Performance Audit

Transmission facilitates better utilisation of available power generation resources. Inadequacies in transmission network and delay in commissioning of the transmission system may not only result in loss of revenue to PGCIL but may lead to congestion in evacuation of power. Creating lines of higher capacity than required or abnormal redundancies in transmission assets may result in extra financial burden on beneficiaries[8] and public at large.

Keeping in view the above, a performance audit was taken up with defined audit objectives (detailed in Chapter 2) to assess the effectiveness of planning and implementation of transmission projects executed by PGCIL during 2007-2012. Besides, an attempt has been made to assess the efficiency and effectiveness of Grid Management (Chapter 7) by POSOCO/ PGCIL in ensuring uninterrupted power supply, including Grid Security and Grid Monitoring.

[8] ***State Discoms***

CHAPTER - 2

Audit Framework

2.1 Scope of Audit

The performance audit covers all activities from conceptualisation to implementation of selected major transmission projects executed by PGCIL between April 2007 and March 2012 along with the status of augmentation to the transmission network made by PGCIL up to March 2013. In the wake of the incident of Grid disturbance on 30 and 31 July 2012, the aspect of Grid management by POSOCO, which is mandated with the responsibility to ensure integrated operation of the national grid, was also included in the scope of audit.

2.2 Audit objectives

Audit objectives of the performance audit were to assess whether: (i) projects were conceptualised and identified properly, expeditiously and in consultation with all related parties; (ii) the system of procurement of goods and services was economic, efficient and effective; (iii) projects were executed economically, efficiently and effectively; and (iv) proper system existed for ensuring effective and efficient Grid management including Grid Security and Grid Monitoring.

2.3 Audit criteria

Audit criteria adopted for the performance audit included: (i) Electricity Act, 2003; (ii) National Electricity Policy, 2005; (iii) Regulations issued by the Central Electricity Regulatory Commission (CERC) relating to transmission and grid management including Indian Electricity Grid Code (IEGC); (iv) CEA's Technical Standards; (v) CEA Transmission planning criteria; (vi) National Electricity Plan; (vii) CEA Reports including Load Generation Balance Review; (viii) XI and XII Plan documents and Mid-term Appraisal of XI Plan; (ix) Report of the Working Group on Power for XI[9] Plan; (x) Memorandum of Understanding signed by PGCIL with Ministry of Power (MOP); (xi) Works & Procurement Policy and Procedure (WPPP) of PGCIL; (xii) Feasibility Reports and Detailed Project Reports of selected transmission projects in the audit sample; (xiii) Minutes of meetings of Standing Committee for power system planning, Regional Power Committees (RPC), Board of Directors (BOD) of PGCIL, Project Sub-Committee and other Board level committees of PGCIL, Project Review Meetings and meetings with contractors, vendors, sub-vendors; (xiv) Bidding Documents and evaluation reports; (xv) Reports of Grid Disturbances (GD) of 30 and 31 July 2012 by PGCIL and POSOCO submitted to CERC, Record of Proceedings before CERC and CERC Order dated 22 February 2014 on GD[10]; (xvi) Report of the Expert Committee constituted by MOP to investigate GDs of July 2012; (xvii) Report of the US-Canada Power System Outage Task

[9] ***Working Group on power was constituted by Planning Commission in April 2006 to formulate power programme for XI Plan with Secretary (Power) as Chairman of the Working Group and Member (Planning) of CEA as Member Secretary.***

[10] ***Accessed from website of CERC***

Force on the blackout of August 2003; (xviii) Manuals and operating procedures formulated by POSOCO; (xix) Operational and other feedback sent by POSOCO to CEA and PGCIL; and (xx) Published papers by power system experts.

2.4 Audit Methodology

An entry conference was held with the Management of PGCIL on 24 July 2012, wherein scope, objectives, audit criteria and audit sample were discussed. A meeting was also held on 9 November 2012 with the Managements of PGCIL and POSOCO apprising them of coverage of the aspect of Grid Management in the performance audit. Relevant records in PGCIL and POSOCO were examined and discussions held with the senior management from time to time during August 2012 to August 2013 for firming up audit conclusions. The draft performance audit report was issued to Managements of PGCIL and POSOCO for their comments on 18 January 2013. The draft report was updated after considering replies of PGCIL and POSOCO and revised (November–December 2013) based on further examination, especially of various aspects of Grid Management. As the draft report covered various technical issues, extensive discussions were held by Audit from time to time with the senior management of PGCIL and POSOCO to firm up audit observations and conclusions. The draft report was issued to MOP on 7 January 2014. A Pre-exit Conference was held with the managements of PGCIL and POSOCO on 12 February 2014 wherein audit findings and conclusions were discussed. After receipt of MOP's reply dated 31 March 2014, to the draft Report, an Exit Conference was held with MOP and managements of PGCIL and POSOCO on 15 April 2014. Representatives from CERC and CEA also attended the Exit conference wherein audit findings and suggestions for improvement proposed in the draft report were discussed. MOP's views on the recommendations contained in the draft report were also obtained during the meeting and duly incorporated in this report.

2.5 Audit Sample

A representative sample of 20 transmission projects representing 14 *per cent* in terms of number and 37 *per cent* in terms of value of the projects planned and executed by PGCIL during April 2007 and March 2012, as detailed in ***Annexure-2.1,*** was taken based on materiality and coverage of all Regional Offices of PGCIL. All 424 contracts pertaining to above selected 20 projects awarded up to March 2012 by the corporate office of PGCIL were examined. Besides, a representative sample of 10 *per cent* of the contracts locally awarded by the concerned Regional Offices in connection with execution of above 20 projects was also selected for examination on the basis of materiality[11]. Further, relevant records pertaining to Grid Management including Grid Security and Grid Monitoring for the period April 2007 to March 2014 were also examined in POSOCO and corporate office of PGCIL.

2.6 Audit findings

Audit findings are discussed in subsequent chapters under the following headings:

Chapter 3: Planning and Project Conceptualisation

Chapter 4: Targets and achievements

[11] ***Top 10 per cent contracts in terms of value (60 contracts)***

Chapter 5: Investment Approval and Project Funding

Chapter-6: Project Implementation and Execution

Chapter-7: Grid Management

Chapter 8: Monitoring system

Chapter 9**:** Conclusion and Recommendations

2.7 Acknowledgment

The cooperation extended by MOP and Managements of PGCIL as well as POSOCO in facilitating smooth conduct of performance audit is appreciated and acknowledged.

CHAPTER 3

Planning and Project Conceptualisation

3.1 Planning of transmission projects by PGCIL

PGCIL is responsible for planning of inter-state transmission projects and these projects fall under the following two categories:

(i) Projects connected with evacuation of power from Central sector generating stations and

(ii) Projects connected with strengthening of power system network.

The proposal for a new transmission project is technically approved by the Standing Committee for Power System Planning (SCPSP)[12] of the concerned regions. Further, each region has a separate committee called Regional Power Committee (RPC)[13] which approves these projects from commercial point of view. Once the project is approved by RPC, it becomes a part of Bulk Power Transmission Agreement (BPTA) and beneficiaries are liable to pay transmission charges to PGCIL. After approval of the project by the concerned Regional SCPSP, PGCIL initiates action for obtaining investment approval, clearances and procurement activities.

Records relating to conceptualisation and planning of 20 selected transmission projects taken up for implementation during April 2007 to March 2012 along with the status of augmentation to the transmission network made by PGCIL up to March 2013 were examined in audit. Results of the examination are given in subsequent paras.

3.1.1 Progress in the formation of National Grid

One of the major objectives of formation of PGCIL was to bring about integrated operation of the regional transmission systems by undertaking construction of inter-regional links. This was to facilitate the growth of economic exchange of power (replacing costly[14] energy transactions within a region with cheaper ones from another region so that cost of power is reduced) which would ultimately lead to the formation of a national grid and ensure better utilisation of available generation resources. Electricity Act, 2003 envisaged 'open access'[15] in transmission to promote competition amongst the generating companies which could sell electricity to different distribution licensees across the country, leading to availability of cheaper

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[12] ***SCPSP for each region is constituted by CEA for carrying out its duties of integrated planning under section 73 (a) of the Electricity Act, 2003. These committees are headed by Member CEA and State Transmission Utilities, Central Transmission Utilities, Central Generating Units (CGUs), etc. are members. SCPSP provides technical approval to the projects.***

[13] ***This Committee is chaired by heads of state utilities on rotational basis and CEA, State Transmission Utilities, Central sector generating units, CTU, Load Despatch Centres, traders and Discoms, etc. are its members.***

[14] ***Cost of energy varies according to type of fuel, age of the plant, whether cost plus project or tariff based project, etc.***

[15] ***As per definition given in the Electricity Act, 2003, Open access means non-discriminatory provision for use of transmission lines or distribution system or associated facilities with such lines or system by any licensee or consumer or a person engaged in generation in accordance with the regulations specified by the Appropriate Commission.***

power. National Electricity Policy 2005 envisaged that network expansion should be planned and implemented keeping in view anticipated transmission needs that would be incident on the system in the open access regime.

The process of integration of regional grids through construction of inter-regional links began in the 1990s, initially with High Voltage Direct Current (HVDC) links and later through synchronous interconnections[16]. Southern Region remained interconnected to the rest of the country through 4000 MW of HVDC links till it was synchronously connected through Raichur-Sholapur 765 kV single circuit on 31 December 2013 completing the technical process of formation of 'National Grid'.

Though the technical process of formation of 'National Grid' can be regarded as complete, when viewed in terms of overall inter-regional power transfer capability, the objective of formation of 'National Grid' remains to be achieved (April 2014) as explained below:

(i) Actual power flows exceeded transfer capability of four corridors in 16 months during 2009-13 as detailed in Table 3.1 indicating that the capability of these corridors was inadequate to handle the increasing demands of power exchanges amongst these regions.

Table 3.1

Instances of actual power flows in excess of Total Transfer Capability

Corridor	Month	TTC (in MW)	Actual Flow (in MW)
WR-NR	September 2009	1500	1523
	October 2009	1500	1653
	January 2010	1500	1630
	July 2011	1900	2291
	January 2013	1700	2004
WR-SR	April 2011	800	913
	July 2011	800	901
	October 2011	800	911
	July 2012	800	880
	August 2012	800	909
	September 2012	800	881
	October 2012	800	921
	November 2012	800	896
	December 2012	800	814
ER-SR	March 2011	2330	2431
	April 2011	2330	2382
	December 2011	2120	2186
ER-NER	January 2010	200	233
	March 2013	400	422

[16] ***HVDC links are point to point lines through which flow of electricity can be regulated by system operators. Synchronous interconnections on the other hand are Alternating Current (AC) links, through which power flow happens as per the laws of physics. ER and NER were synchronously interconnected first, followed by WR and NR.***

(ii) In 24 years of its operation (till 31.3.2013), PGCIL built 45 inter-regional transmission lines (220 kV and above), connecting five regions, which works out to 1.2 *per cent* [17] of total lines (220 kV and above) in the inter-state transmission grid. Further, four out of six inter-regional corridors (WR-NR, WR-ER, ER-NER and WR-SR) were capable of carrying only 1.5 *per cent* to 3 *per cent* of installed power generating capacity in respective power surplus regions ***(Annexure 3.1)***.

When the issue of adequacy of inter-regional capability was discussed in the Exit Conference (April 2014), it transpired that there were no specific norms to assess adequacy of inter-regional capability with reference to operating requirements. However, MOP had reservations about using installed capacity as a benchmark for assessment of adequacy of transmission capacity of inter-regional corridors. It is, however, pertinent to note in this connection, that the European council as per their Ten year Transmission Network Development Plan 2012, had proposed a criterion for interconnection development, asking Member States a minimum import capacity level equivalent to 10 *per cent* of their installed production. Thus, comparison of adequacy of transmission system with reference to installed generation capacity would appear to be an international good practice. Capital investment made by PGCIL in eleven inter-regional links commissioned during XI plan was ₹ 4287 crore (7.7 *per cent* of the total capital investment of PGCIL in XI Plan) while capital investment in intra regional links was ₹ 51043 crore (92.3 *per cent* of total capital investment of PGCIL in XI plan). Thus, efforts of PGCIL in XI Plan were directed more towards strengthening intra regional network as compared to inter regional linkage.

(iii) POSOCO expected the present achievement of linkage of SR with National Grid to be operated as a weak link in the initial few years, as PGCIL was required to commission twenty elements in WR and SR before import of power by SR could be scheduled across the new Raichur-Sholapur link. Further, synchronous interconnection was achieved by PGCIL through a single circuit while the second circuit of Raichur-Sholapur line which is important for safe and secure operation of interconnected grid was yet (March 2014) to be commissioned by an independent transmission project developer selected through tariff based bidding by REC Transmission projects Limited, a subsidiary of Rural Electrification Corporation Limited (REC).

Low level of inter-regional transfer capability implies limited scope for transfer of power among regions. Hence the objectives for formation of National Grid *i.e.* meeting deficit from surplus region and facilitating economic exchanges remained largely unfulfilled**.**

MOP stated (March 2014) that National Grid was not restricted to links that were crossing regional boundaries but covered up-stream and downstream network as well; total transmission lines under inter-state increased from 22000 ckm in 1992-93 to more than 105000 ckm in January 2014; Inter-regional power exchange takes place on account of supply-demand

[17] ***Total lines – 3743; Inter-regional – 45 (765 kV, 400 kV and 220 kV)***

gap in inter-connected regions and are planned as per projected transfers; at present there is no congestion in long term power exchange but in certain scenario, congestion may occur under medium and short term depending upon quantum, period and duration of requirement; National grid development is a continuous process and shall keep pace with power sector development.

The reply is to be viewed against the following facts:

(i) According to note of MOP (August 1989) to Cabinet for setting up of PGCIL, the role of PGCIL is not limited to serving projected demand-supply gap but also to facilitate economic exchanges across the country and ensure better utilization of available generation resources. This is possible only if regional grids are adequately 'meshed' and integrated which is yet to be achieved as inter-regional links are still weak.

(ii) In the deliberations before the Coordination Forum[18] in August 2009, it transpired that occasional congestion indicates optimum investment in transmission while regular congestion indicates inadequacy. Analysis of power exchange data ***(Annexure 3.2)*** of Indian Energy Exchange and Power Exchange India Limited showed that instances of percentage of time[19] congestion occurred above 75 *per cent* increased from two months in 2010-11 to all 12 months in 2012-13. Similarly, volume of electricity that could not be cleared due to congestion (as a percentage of the actually cleared volume), in Power Exchange India Limited went above 75 *per cent* for 3 months in 2011-12 and increased to five months in 2012-13.

(iii) Impact of congestion and inadequacies of transmission networks is visible in large variations in the electricity prices over regions. Comparison of Market Clearing Price (MCP *i.e.* clearing price for cleared transactions in the whole country, if there is no congestion at all) with the Area Clearing Prices[20] in Indian Energy Exchange ***(Annexure 3.2)*** showed that buyers in S1 and S2 bid areas (States of Tamil Nadu, Kerala, Andhra Pradesh, Karnataka, Goa and Union Territory of Pondicherry) paid higher price during the last two years (₹ 5.1 to ₹ 7.3 per unit as against MCP of ₹3.5 per unit) to procure power. On the other hand, sellers in W3, E1 and E2 bid areas (Chhattisgarh, Orissa, West Bengal, Sikkim, Bihar and Jharkhand) received lower price (₹ 2.8-2.9 per unit as against MCP of ₹ 3.5 per unit) due to transmission contraints. These trends indicate the need for strengthening WR-SR and ER-SR links (W3, E1, E2 to S1 and S2 *i.e.* generation

[18] ***Coordination forum was constituted by MOP in February 2008 under Section 166 (1) of the Electricity Act, 2003 for smooth and coordinated development of power system in the country. The forum is chaired by Chairman, CERC and inter-alia had the following members- Chairperson CEA, Member (Power Systems) of CEA, Members of CERC, CEO of CTU, representatives from generating companies, both PSEs and private. Additional Secretary/Joint Secretary, MOP is the member convenor. The Coordination Forum held its last meeting in March 2010.***

[19] ***Number of hours congestion occurred/ Total number of hours in a month.***

[20] ***The country is divided into 12 bid areas (IEX) for power exchange transactions. The criterion for defining these areas is the location of the physical constraints in the structure of transmission network, including national and/or control area borders. In case of congestion across a transmission corridor, the net sale of upstream areas will not flow to downstream deficit areas. The cleared prices in all areas i.e. Area Clearing Prices are adjusted so that the flow of power across transmission corridor is same as available transfer capability.***

surplus to power deficient states). However, comparison with inter-regional corridors augmentation plans for the XII Plan ***(Annexure 3.3)*** revealed that no links were planned for the ER-SR corridor and 6400 MW only has been planned for WR-SR corridor (16 *per cent* of total inter-regional augmentation of 40500 MW).

(iv) As regards the argument that there is no congestion in long term power exchange, there is zero margin (WR-SR) /negligible margins (ER-SR, WR-NR)[21] as of March 2014 in three out of six inter-regional corridors over and above the capability required to cater to long term customers. Allocation of 276.83 MW power from Indira Gandhi Super Thermal Power Station, Jhajjar, Haryana to Andhra Pradesh made by MOP (customers receiving allocation from Central Sector Generating Stations are long term customers in terms of CERC Regulations of August 2009) had to be kept in abeyance (May 2014) due to the absence of available margins in May 2014. This indicated that transmission constraints were being faced by long term customers also.

Thus, though technically the 'National Grid' had come into existence with the synchronous inter-connection of SR with WR on 31 December 2013, there is a need and scope for making the inter-connections robust enough by augmenting inter regional power transfer capability to fully achieve the objectives of formation of National Grid.

3.1.2 Planning of capacity addition of inter-regional transmission corridors without giving due regard to increase in their power transfer capability

Two parameters *viz*. Transmission Capacity and Transfer Capability are relevant for assessing the capacity of inter-regional corridors. Transmission capacity of a corridor is arrived at by adding the ratings of all transmission lines connecting two regions. Transfer capability on the other hand, is the measure of the ability of the corridor, as a whole, to reliably move power from one region to another. Transfer capability is often less than the transmission capacity in view of system limitations and strength of the weakest link in the corridor. While transmission capacity is decided by physical characteristics of components and is static in nature, transfer capability is assessed by system operators considering system conditions such as generation, customer demand *etc* and is dynamic. For example, WR-NR corridor has nine lines and the sum of the physical ratings comes to 4220 MW which is denoted as its transmission capacity whereas the transfer capability of the corridor was 2000 MW (2011-12). A part of the Transfer Capability is kept as a 'Reliability margin' to handle contingencies and errors in assumptions and the balance capability, called Available Transfer Capability (ATC) is offered for scheduled power flows.

NLDC assesses the Total Transfer Capability -TTC (full capability including reliability margin) of 12 inter-regional corridors (considering power flow in both the directions across the six corridors i.e. WR-NR, NR-WR and so on) based on off-line simulation studies and real

[21] ***ER-SR margin was 93 MW in March 2014 (00 to 05 hours and 10-19 hours) and WR-NR margin was 219 MW in March 2014.***

time data. TTC so arrived at is declared on the web sites of RLDCs and NLDC for information of users who may enter into contracts for transfer of power, apply for grant of open access, *etc*. Thus, TTC is a significant factor that should be considered to assess the needs of augmentation of inter-regional capacity. However, PGCIL assesses the need for augmentation of capacity of inter-regional corridors based only on 'Transmission capacity' and does not monitor augmentation of TTC. While NLDC declares TTC in short time horizon (three months and below), such declaration in the long run was not being done by PGCIL though it was required to do so as per 'Procedure for making application for Grant of long term access and medium term open access to Inter state transmission systems' approved by CERC.

PGCIL increased (2007-12) the transmission capacity of inter-regional transmission corridors by 13900 MW. However, TTC increased from 9400 MW in 2008-09 to only 11530 MW in 2011-12. During 2011-12, TTC decreased by 750 MW as compared to that in 2010-11 (reduction in ER-SR by 350 MW, ER-NR by 100 MW, ER-NER by 100 MW and WR-ER by 200 MW).

Further, in the Annual Report for 2011-12, PGCIL indicated that cumulative inter-regional power transfer capacity of National Grid was 28000 MW. However, this being equal to summation of ratings of all transmission lines, was basically transmission capacity as against the actual power transfer capability denoted by TTC which was 11530 MW as detailed in Table 3.2 given below.

Table 3.2

TTC and transmission capacity of inter regional corridors

Corridor	Transmission Capacity (As on 31.3.2012)	TTC (Highest during 2011-12)	%age of TTC to Transmission capacity	Capital Investment made in XI Plan (`₹ in crore)	%age of Total Investment
WR-NR	4220	2000	47	465	11
WR-ER	4390	1000	23	1009	24
ER-NER	1260	500	40	-	-
WR-SR	1520	1000	66 *	-	-
ER-NR	10030	4200	42	2706	63
ER-SR	3630	2830	78 *	106	2
Total	**25050 #**	**11530**		**4286**	**100**

In addition to 25050 MW comprising of 220 kV and above lines, 132 kV lines also exist along various inter-regional corridors.

* Higher TTC due to HVDC links through which power flows can be regulated.

It can be seen that TTC as a percentage of transmission capacity was less than 50 in four out of six inter-regional corridors and was less than 30 *per cent* in case of WR-ER. Thus,

for better appreciation of ability of transmission network to transfer power across regions it would be a useful good practice if TTC is also declared and disclosed alongwith transmission capacity.

MOP did not offer any remarks regarding non-declaration of TTC by PGCIL in the long and medium term. However, it was contended in the Exit Conference (April 2014) that non-materialisation of assumed facilities hampered the loadability and hence TTC at a given instant might not match with the planned figure. Further POSOCO added in the Exit conference that even in Europe when the transmission capacity was of the order of 1000 MW, TTC was of the order of 60-70 per cent and when the transmission capacity increased in the range of 10000-20000 MW, TTC reduced drastically to the order of 20 to 30 per cent.

The reply is to be viewed against the fact that TTC does not increase commensurately with the increase in transmission capacity. It is thus essential to monitor and declare it in the long run as per the requirements of CERC regulations. This view was also held by POSOCO in their comments on draft National Electricity Plan to CEA when they emphasised (May 2012) that quantifying growth of transmission capacity in terms of inter regional capacity was an inadequate index of performance. POSOCO added that it was the transfer capability across regions that was important.

3.1.3 Development of inter-regional corridors

The bulk of the inter-regional augmentation efforts achieved in XI Plan and planned for XII Plan have been across the ER-NR and ER-WR corridors to wheel power from the pit-head power plants in the coal rich ER to the demand centers in the north and the west. Similarly there were plans to build a network in the 'chicken neck'[22] area of NER so that the hydro potential of NER could be tapped and power could be brought to NR and WR through NER-ER-WR corridors. 63 *per cent* of total inter-regional transmission capacity of 25050 MW[23](cumulative at the end of XI Plan) was concentrated along these corridors. (***Annexure 3.3)***. Audit examination revealed the following:

(i) Significance of short-tie *vis a vis* long-tie for import of power by NR

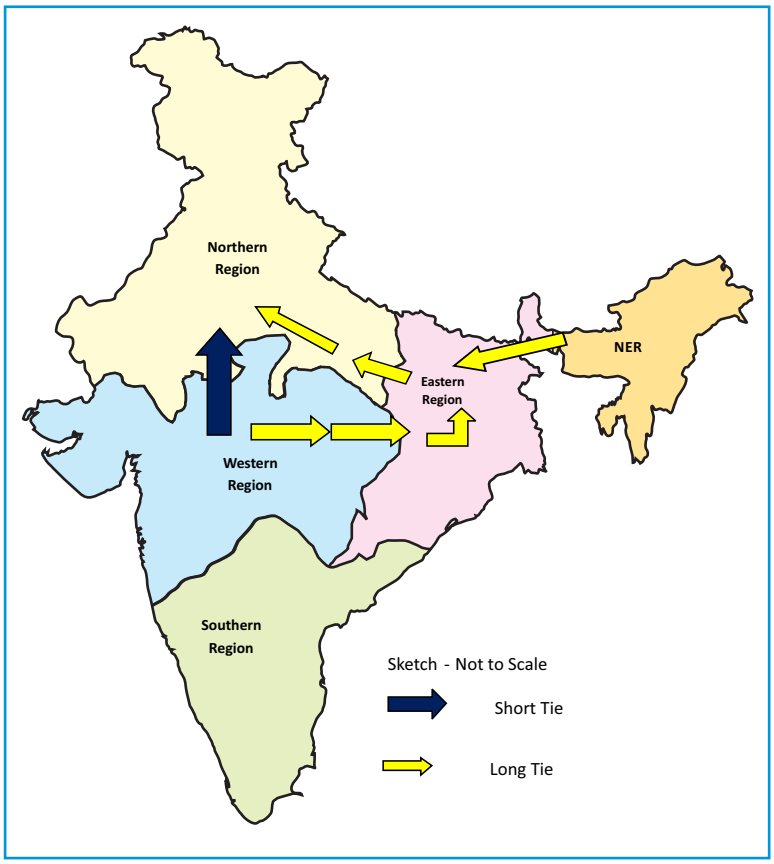
Offline simulation studies conducted by an Expert Group constituted by MOP following the two major Grid disturbances of 30 and 31 July 2012 had shown that the WR-NR link was the 'short tie' (Transmission link shorter in length and tying/connecting two regions) for import of power by NR and in the case of loss of the short tie, the longer tie of WR-ER-NR could also be lost due to angular separation and power swings[24]. This meant that import by NR was dependent on the transfer capability of the 'short tie' rather than that of the 'long tie' (depicted

[22] ***Formally, Siliguri Corridor, a narrow strip of territory connecting north eastern states to the rest of India.***

[23] ***Transmission capacity i.e. summation of ratings of individual lines.***

[24] ***The rotors of generators connected to the grid run at the same electrical speed and in case of small disturbances affecting the speed, restorative forces bring back the rotors to the same speed. However, for large disturbances, the restorative forces may be unable to bring all the generators to the same speed. If this happens, the angular difference between the generators goes on increasing (Angular separation) which causes large variations in voltage and power flow in lines.***

in map given below). Hence high level of augmentation of the longer tie *i.e.* ER-NR, ER-WR and NER-ER-WR without appropriate augmentation in WR–NR would not yield desired results for transmission of increased power to NR.



Thus, due consideration was required to be given to aspects relating to angular separation and power swings while planning inter linkages of various regions.

MOP stated (March 2014) that the issues of angular separation and power swings were considered as along with Agra-Gwalior double circuit link (765 kV charged at 400 kV) another double circuit viz. 400 kV Zerda-Kankroli was also planned. MOP added that to address the issue, three additional links[25] were planned in the WR-NR corridor which were in different stages of implementation.

The reply is to be viewed against the fact that though Agra-Gwalior and Zerda-Kankroli were both of 400 kV, the power flow handled by the former was 72 *per cent* of the entire WR-NR flows while the latter could take only 9.47 *per cent* of flow (during 2011-12).Thus, power flows through the backup system did not materialise as planned. Further TTC of WR-ER (1000 MW) was only half of TTC of WR-NR (2000 MW) with the result that once the WR-NR tie was lost, sufficient capacity was not available in WR-ER route for required power flows. As regards additional links in WR-NR corridor, there is a need to prioritise their implementation.

[25] ***(Gwalior –Jaipur 765 kV (2 single circuits), Champa-Kurukshetra (800 kV HVDC) and Jabalpur – Orai (765 kV double circuit).***

(ii) Impact of up gradation of link on reliability of WR-NR corridor

WR-NR corridor had faced seasonal congestion during high demand periods and actual power flows (monthly) had breached TTC of the corridor on five occasions between 2009-10 and 2012-13. Agra-Gwalior double circuit line was the trunk line of the corridor which was upgraded from 400 kV voltage level to 765 kV in March 2013. As per the advisory issued (May 2013) by POSOCO to the constituents, the upgradation created a 765 kV line in parallel with a 220 kV network without any 400 kV system in the Agra-Gwalior-Bina section of WR-NR inter-regional corridor. The impact of such a formation was that in the event of loss of both the circuits of 765 kV line, there would be a 'cascade tripping' of 220 kV network. Onset of the contingency *i.e.* tripping of one of the circuits of 765 kV Agra-Gwalior actually happened on 11 June 2013 and POSOCO had to curtail energy flows to avert a major grid disturbance.

MOP stated (March 2014) that the upgradation was planned for strengthening the WR and NR inter-connection to facilitate higher power transfer. To address reliability considerations, three additional links had been planned which were under different stages of implementation.

The reply is to be viewed against the fact that WR-NR TTC, which was enhanced from 2000 MW to 5700 MW in May 2013 following the upgradation, was rolled back in October 2013, due to reliability considerations. Thus, the upgradation to 765 kV line in the WR-NR corridor which was fraught with the risk of 'cascade tripping' as per advisory of POSOCO, worsened an already delicate nature of WR-NR interconnection {discussed in para 7.4.5 (b) titled 'Inter-connection of NR with neighbouring regions} till the new links are implemented. This is further evident from the fact that the number of instances when RLDCs/NLDC issued congestion notice for WR-NR corridor increased from five in 2012-13 to 23 in 2013-14 (till February 2014).

3.1.4 Congestion due to delayed planning and approval of transmission system for transfer of power from generation projects

PGCIL did not have a policy to firm up the time for commissioning of generation linked transmission projects. As CERC regulations on "Grant of Connectivity, Long Term Access and Medium Term Open Access" allow injection of infirm power (*i.e.* power generated by a power station prior to its date of commercial operation) for a period of six months since synchronization of the power plant, commissioning of a transmission system associated with a generation project should precede the date of commercial operation of the generating station at least by six months. However, there was delay in commissioning of transmission system[26] associated with generation projects, in the State of Odisha due to which there was congestion in evacuation of power in the State.

As an illustration, it was noticed that seven generating projects[27] in Odisha involving installed capacity of 10090 MW of Independent Power Producers (IPPs) were scheduled for

[26] ***Transmission Phase-I generation projects in Odisha Part B***
[27] ***Sterlite, GMR, Nav Bharat, Monnet, Jindal, Lanco Babandh, and Ind Bharat***

commissioning between February 2010 and December 2013. However, BOD of PGCIL approved the transmission system associated with these generating projects only in December 2010 with scheduled completion by December 2013 *i.e.* coinciding with the commissioning of the last project. The delay on the part of PGCIL to plan the transmission system resulted in congestion in evacuation of power from four units of 600 MW each of Sterlite project commissioned between October 2010 and April 2012[28]. Also one unit (350 MW) of Kamalanga TPP of M/s GMR was commissioned in March 2013 while execution of the associated transmission system by PGCIL was still in progress (April 2014).

MOP stated (March 2014) that

(i) Out of seven generation projects, only two projects have been commissioned as of January 2014. If the associated transmission system was commissioned matching with the committed schedule, the same might remain unutilised till the time the generation project actually got commissioned.

(ii) Under Section 10 of Electricity Act, 2003, it is the duty of every generating company to co-ordinate with the CTU for transmission of electricity generated by it; but the generators have submitted the LTA applications late, repeatedly revised them and also delayed signing of agreement for payment of transmission charges. Generators had not completed their dedicated lines connecting the power stations to the pooling substations, though PGCIL had commissioned the substations in March 2013.

(iii) The projects were connected to the grid through interim arrangement and the transmission corridors required for evacuation of power were planned to be commissioned progressively by December 2014.

The reply is to be viewed against the facts that:

(i) The transmission system was not ready even for two projects which were commissioned, though it is an agreed principle that transmission should precede generation.

(ii) As regards the statement that the generators had not yet built their dedicated line from the generating plant to the pooling station, it is seen that CEA and PGCIL agreed in the meeting held on 15 September 2009 to provide an interim arrangement of loop-in-loop out[29] (LILO) of an inter-regional line to provide connectivity from the plant to the pooling substation, though as per the Bulk Power Transmission Agreement signed with the generator, it was the responsibility of the generator to build the dedicated line for bringing electricity from the plant to the point of connection in the grid.

(iii) As per CEA (Technical standards for connectivity to the Grid) Regulations, 2007, when a request for connection is received, the CTU shall carry out interconnection study and

[28] ***14 October 2010, 29 December 2010, 16 August 2011 and 25 April 2012.***

[29] ***The interim arrangement was that one circuit of Rourkela-Raipur – 400 kV double circuit (inter regional) would be looped in and looped out at Sterlite power station.***

determine modifications required on the existing grids to accommodate the inter-connection. Interim connectivity through LILO was given in the above two cases, without adequacy of transmission system for evacuation of power which was causing congestion in Chhattisgarh and adjoining areas[30].

3.1.5 Sub-optimal utilization of transmission lines

Presently, transmission of electricity in India is carried mainly through a grid made up of 400 kV Alternating Current (AC) network (comprising 71505 ckm of PGCIL network). PGCIL also built 22 transmission lines (4833 ckm) of high voltage level of 765 kV mainly to augment the power transfer capability[31]. However, out of these 22 lines, 14 lines were initially charged[32] at 400 kV. PGCIL justified high capacity lines in the initial stage itself on the grounds of future hydro potential and possible Right of Way (ROW) constraints[33] that would be faced during subsequent upgradation. However, the operational status (March 2014) of the 765 kV lines revealed that two of these lines (Kishenpur - Moga I and II) remained undercharged at 400 kV level for more than thirteen years (yet to be upgraded) while four lines had remained under charged at 400 kV for more than five years. (Two of them upgraded during the last one year and two lines *viz.*, Tehri-Meerut I and II were yet to be upgraded). Two of the 765 kV lines (Satna-Bina-I and Seoni-Wardha-I) were regularly kept 'open' (taken off the grid through a switching mechanism) to control high voltage, indicating inadequate power flow through them.

The implication of charging 765 kV lines at a lower voltage level of 400 kV is that the beneficiaries, who share the capital cost incurred on these transmission lines, pay for 765 kV lines[34] though actual operation of the lines is at 400 kV. Based on benchmark cost fixed by CERC vide order dated 27 April 2010, the extra cost incurred on laying of these four 765 kV lines which are undercharged at 400 kV lines was ₹158.46[35] crore (recoverable in the tariff period of 35 years). PGCIL, however, does not suffer any revenue loss as it recovers its investment, as the 'as built' capital cost is recovered through tariff.

MOP stated (March 2014) that PGCIL constructed higher capacity lines keeping in mind future hydro generation potential and also to overcome right of way and environmental issues; CEA's Transmission planning criteria allowed adoption of higher voltage levels for final system and operating one level below in the initial stage; investment in capital cost of substations

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[30] ***As per POSOCO's feedback to CEA and PGCIL on system constraints.***

[31] ***765 kV line can carry over 4000 MW of power while 400 kV line can carry around 2000 MW.***

[32] ***Charged means the electric circuit is closed and power is allowed to flow through the line. 'Not-charged' means the line is not connected to the grid, the circuit is kept 'open' or kept idle on air. Keeping the line 'not charged' (or charged at a lower voltage level) is resorted to because charging the line without corresponding quantum of electricity flow would lead to voltage fluctuations and resultant grid problems.***

[33] ***Right of way denotes the right for placing of electric lines for transmission of electricity along the path through which such lines pass through; 765 kV transmission towers occupy more space (64-69 m) than 400 kV transmission towers (46-52m).***

[34] ***Transformer and associated bays at higher voltage level are constructed later and capital cost to that extent is postponed.***

[35] ***Worked out on the basis of difference in minimum cost of laying 765 kV line (₹ 60.65 lakh) and 400 kV line (₹ 43.97 lakh) per ckm with standard porcelain insulation, single circuit and Aluminium Conductor Steel Reinforced Moose. Total length of four 765 kV lines charged at 400 kV being 950 km. (i.e. ₹ 16.68 lakh (₹ 60.65 lakh less ₹ 43.97 lakh) X 950 km).***

was deferred thereby relieving tariff burden to that extent; and the undercharged lines would progressively be brought up to their full voltage level.

The fact remains that out of the useful life of 35 years of the transmission projects, there are two cases where 13 years went by just waiting for generation to come up. There may be a need to achieve a proper balance between capacity creation and operational requirement so as to ensure optimum utilisation of transmission network.

Despite a network of 1,00,200 circuit kilometres (ckm) of transmission lines in the grid (40739[36]ckm added during 1 April 2007 to 31 March 2013), PGCIL has not put in place a mechanism for assessing utilisation of transmission lines with the result that, there were pockets of congestion as explained in para 3.1.4 *supra* and areas of redundancy evident from analysis of Line Loading' of 40 of 45 interregional lines[37] in six corridors through a ratio of average power flow and maximum loadability (***Annexure 3.4).*** Average utilisation of 33 out of 40 inter-regional lines ranged between 0 to 30 *per cent* in all inter-regional corridors except WR-SR and ER-SR during 2011-12. 478 (68 *per cent*) out of 706 intra-regional lines[38] in five regions had average utilisation of 0-30 *per cent*. Utilisation was especially low in ER and NER regions.

Absence of mechanism to assess efficiency of network construction results in infirmities in system development in the form of skewed power flow across lines (WR-NR)[39], low line load factor, planning 'surprises' such as power flows in directions opposite to those envisaged while planning (ER-WR and SR-WR)[40] etc.

Regarding underutilisation of transmission lines, MOP stated (March 2014) that transmission serves a public service function and sometimes additional lines may have to be built[41] towards this objective; another aspect of public service is that after interconnection of grids, the frequency of the entire system also stabilizes.

In the Exit Conference (April 2014) also, MOP was of the view that the focus should be on availability of transmission system and not on its utilisation.

This stand is to be viewed against the provisions given in tariff policy notified by MOP in January 2006 which laid down that the overall tariff framework for transmission pricing should

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[36] ***100200 Ckm (as on 31.3.2013) minus 59461 ckm (as on 31.3.2007) = 40739 ckm.***

[37] ***For which data was available.***

[38] ***For which data was available***

[39] ***In WR-NR corridor 72 per cent of power flow was through one link viz. Agra-Gwalior link***

[40] ***ER-WR corridor was planned to carry power from ER to WR in the planning horizon but in the operating horizon, the power flows were from WR to ER. Similar is the case for SR-WR interconnection***

[41] ***This has been explained though an example - The transmission in the Kashmir Valley is connected to Jammu region through two 400 kV lines and two 220 kV lines. During winters due to reduced generation at Uri hydro power station and other hydro power stations in the Kashmir valley coupled with heavy power demand due to winters, the Kashmir valley imports a substantial quantum of power from the Jammu region. There have been instances in the winter of 2007, 2012 and 2014 when due to heavy snowfall, these lines went under breakdown near the Pir Panjal mountain range leading to islanding of Kashmir valley and blackout. Due to adverse weather conditions, restoration of the transmission system is also delayed as even helicopters find it difficult to land. The Kashmir Valley faces a serious power crisis during this period leading to great discomfort amongst the public. This situation can be mitigated only if additional lines over alternate route from Samba to the Kashmir Valley is constructed.***

be such as not to inhibit planned development/augmentation of the transmission system, but should discourage non-optimal transmission investment. The policy further states that financial incentives and disincentives for Central Transmission Utility (CTU) and State Transmission utility (STU) should be implemented around key performance indicators (KPI) which would include efficient network construction, system availability and loss reduction. While norms had been laid down for system availability based on which incentives are paid to PGCIL, norms had not been evolved for assessing efficiency of transmission network construction and loss reduction which prevented an assessment of the impact of sub-optimal utilisation of transmission assets.

3.1.6 Access to transmission corridors

Transmission service provider is a key intermediary between the generator and distributor of electricity and unless access to transmission corridor is provided, generation capacity is bottled up[42]. Access to the transmission system is given to users through Long Term Access (LTA), *i.e.*, for period exceeding 12 years but not exceeding 25 years or through Medium Term Open Access (MTOA), *i.e.*, for periods exceeding 3 months but not exceeding 3 years[43] or through Short Term Open Access (STOA), *i.e.*, for a period up to one month at one point of time. Further, as per CERC Regulations[44], the LTA customer and the MTOA customer shall have priority over STOA customer for use of the inter-state transmission system. The STOA customer shall be eligible for use of inter-state transmission system after LTA and MTOA customers by virtue of (i) inherent design margins (ii) margins available due to in-built spare transmission capacity created to cater to future load growth or generation addition, and (iii) margins available due to variation in power flows.

Examination of the extent of margins in inter-regional transmission corridors revealed that the average margins available under category (i) and (ii) above for STOA (*i.e.* margins available after considering the LTA/MTOA) were in the range of 41 to 85 *per cent* of Total Transfer Capability (TTC) across six inter-regional corridors. Based on above margins, there were rejections of STOA requests by POSOCO for purchase in NR (657.61 MW) and SR (898.58 MW) approximately during April 2007 to November 2012. Besides, PGCIL curtailed (February 2012) MTOA by 785 MW[45] in respect of 17 applications pertaining to SR, due to lack of margins.

This showed that in some corridors (WR-NR, ER-SR and WR-SR), the margins, despite appearing to be large were not sufficient during peak demand months to cater to open access demands. However, substantial quantum of allocated transfer capability remained unutilised

[42] ***Any constraint in the transmission chain from generation of power to load leads to a situation where generation has to be backed down. This is referred to as bottling of power.***

[43] ***Regulations do not envisage grant of access for period ranging from three years to 12 years.***

[44] ***Grant of LTA and MTOA is governed by CERC Regulations dated 7.8.2009 on 'Grant of Connectivity, Long-term Access and Medium-term open Access in inter-state transmission and related matters'. Grant of short term open access is governed by CERC Regulations dated 25.1.2008 (amended on 20 May 2009) regarding 'Open Access in inter-state transmission Regulations 2008'. The nodal agency for grant of LTA and MTOA is the CTU while the nodal agency for grant of STOA is RLDC.***

[45] ***Against the MTOA request of 1846.5 MW for the period 1February 2012 to 31 May 2012, MTOA granted was 1062 MW***

as the LTA/MTOA/STOA applicants who had been granted access had not utilised it while seeking scheduling of electricity ***(Annexure 3.5).*** Thus, there was a scope for POSOCO to optimally utilise variations in power flows and margins arising out of non scheduling of power by applicants to reduce rejections of STOA applications.

MOP stated (March 2014) that as per the Indian Electricity Grid Code, LTA customers had the freedom to seek schedule at one and half hour notice; considering this flexibility, corridor has to be made available for long term; in case the same was allocated for STOA or power exchange transactions assuming that the corridor would not be utilised by LTA customers, and if they later sought schedule, there would be congestion; STOA transactions would then have to curtailed; this would make STOA market highly uncertain unless the CERC laid down clear ground rules for long term customers under 'Use it or lose it' approach; POSOCO could do little for optimum utilisation without such an explicit mandate from CERC.

As the gap between access granted to customers and schedule actually availed by them appeared significant, there might be a need to evolve a system for offering such un-requisitioned capability to others who might utilise the same. As NLDC had the mandate to achieve maximum economy and efficiency in the operation of national grid, POSOCO may need to consider moving an appropriate proposal for optimum utilisation of un-availed transfer capability before CERC.

In the Exit Conference held on 15 April 2014, while MOP stated that there is a need to study the audit suggestion, CERC representative stated that they would examine the proposal, when received from POSOCO, in consultation with stake holders.

3.2 Scope for reducing time taken in planning activities

As per provisions contained in Works & Procurement Policy and Procedure (WPPP) of PGCIL, a time limit of eight weeks has been prescribed for approval of Feasibility Report (FR) by CMD after in-principle clearance from Central Electricity Authority (CEA). PGCIL, however, clarified that projects were finalized after joint studies with CEA; as such, the date of Regional Standing Committee meeting, in which project was approved, had been taken as the date of in-principle approval by CEA.

Examination of 20 selected projects in Audit revealed that against eight weeks stipulated in WPPP for obtaining internal clearance of FR from CMD, time of 11 weeks to 142 weeks was actually taken in obtaining such clearance after approval of 20 selected projects by the concerned Regional Standing Committee.

While assuring that PGCIL would put all efforts to adhere to the time limit for preparation and approval of FR/DPR, MOP stated (March 2014) that

(i) Despite CMD approval in eight weeks, there might be delay due to non-availability of RPC approval or GOI approval under Section 68.

(ii) In five out of nine system strengthening schemes, FR had been approved before either RPC/GOI approval. Excessive delay in two cases (Sasan/ Mundra Ultra Mega Power Projects and Northern regions system strengthening scheme V) was to align the same with the concerned generation projects which were getting delayed.

The reply, however, does not deny the fact that PGCIL did not adhere to the time limit for preparation and approval of DPR by CMD as prescribed in WPPP. Moreover, fulfilling its own obligations in time would have enabled PGCIL to pursue RPC and GOI for faster approvals. Further, in respect of six out of the above 20 projects, approval to FR was obtained from CMD, between 7 and 58 weeks after approval of these projects by RPC and sanction of these projects under Section 68 of the Electricity Act, 2003. The fact remains that Mundra UMPP was commissioned ahead of schedule and three units of Sasan UMPP had also been commissioned[46] but the related system strengthening transmission projects were anticipated to be commissioned in December 2014.

3.3 Submission of proposal for Forest clearance

PGCIL had not laid down any timelines for submission of applications for forest clearances after completion of detailed survey. Out of 164 forest clearance applications submitted by PGCIL during January 2005 to May 2012 for execution of 20 projects selected for audit, 81 applications were submitted after 3 to 41 months of completion of detailed surveys. Further, in nine[47]out of 20 selected projects (***Annexure- 3.6),*** even the earliest application for forest clearance was submitted after investment approval of the respective project. In the remaining eleven projects also, applications for forest clearance in respect of all stretches of transmission lines were not filed by PGCIL before investment approval.

MOP stated (March 2014) that various measures such as advance expenditure for survey work in forest and river crossings, targets for submission of forest proposals through internal MOU, dedicated forest coordinates in all regions etc. have been initiated to minimise the controllable delays on its part.

Audit appreciates the measures initiated by PGCIL to expedite forest clearance. However, there is a need for PGCIL to monitor the situation closely to assess the effectiveness of the measures initiated in terms of minimising delays in obtaining forest clearance.

[46] ***As per monthly report of CEA on broad status of power projects in the country –March 2014***

[47] ***Kahalgaon-II, Sasan (UMPP), Parbati-III HEP, Generation Projects in Odisha-Part B, SRSS-VII, System Strengthening in Northern Region for Sasan & Mundra (UMPP), SRSS-III, NRSS-XVIII, and 765 kV System for Central Part of Northern Grid (Part-III) projects.***

CHAPTER - 4

Targets and Achievements

XI Plan (2007-2012) noted that planning and operation of the transmission system had shifted from regional level to national level necessitating the need for a strong all-India grid. Towards this aim, XI Plan stipulated target of inter-regional transfer capacity of 17000 MW.

4.1 Performance vis-à-vis targets

Against the XI Plan target of 17000 MW, PGCIL achieved 13900 MW of inter-regional capacity and there was a shortfall of 3100 MW. PGCIL prepared an Investment Plan of ₹54,982 crore for constructing inter-state transmission systems during XI Plan which also included inter-regional lines.

MOP stated (March 2014) that the shortfall was due to annulment of South- West HVDC Back-to-Back Project and delay in forest clearance of Ranchi –WR Pooling point 765 kV single circuit line.

The reply regarding delay in forest clearance is to be viewed against the fact that the proposal for forest clearance for Ranchi-WR pooling point, 765 kV Single circuit line[48] was submitted by PGCIL in August 2010 *i.e.* with a delay of two years from investment approval of the project in August 2008.

4.2 Fixation of Targets in MOU

PGCIL had been signing Memorandum of Understanding (MOU)[49] with its Administrative Ministry *viz*, MOP every year and had secured 'Excellent' rating (the highest rating) in each of the five years between 2007-08 and 2011-12.

Examination in audit revealed scope for refinement in the process of fixation of targets for MOU as follows:

(i) MOU Targets for inter-regional capacity addition fixed less than Plan targets

The XI Plan target for inter-regional capacity addition was 17000 MW. Against this, year-wise MOU targets and achievements during XI Plan (2007-08 to 2011-12) are given in Table 4.1

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[48] ***Ranchi-Sipat (Jharkhand) 756 kV Single circuit line***

[49] ***Memorandum of Understanding (MoU) as applicable to CPSEs is a negotiated document between the Government of India (i.e. the concerned administrative Ministry) and the Management of the CPSE specifying clearly the objectives of the Understanding and the obligations of both parties. MoU is meant to evaluate the operating performance of the CPSE which includes the progress of project implementation through fixation of targets for various parameters.***

Table 4.1

MOU targets and achievement during XI Plan

Year	MOU Targets (MW)	MOU Achievements(MW)
2007-08	Nil	Nil
2008-09	3300	3800
2009-10	2600	Nil
2010-11	Nil	Nil
2011-12	4200	5600
TOTAL	**10100**	**9400**

It is noted that:

- MOU targets for 2007-12 were fixed less than XI plan target by 6900 MW (17000 MW minus 10100 MW). In two years (2007-08 and 2010-11) MOU targets were fixed at 'Nil'
- Achievements during 2009-10 were less than MOU target.
- No MOU targets were fixed in the first year (2007-08) of XI Plan indicating delay in initial start-up of projects.

MOP stated (March 2014) that year-wise targets were not envisaged in XI Plan and that at the time of setting targets for MOU, the inter-regional lines which were expected to be commissioned in the coming year, based on readiness of generation project/system requirement, were included.

The reply is to be viewed against the fact that details of XI Plan targets in terms of year-wise MOU targets would have helped PGCIL in ensuring effective monitoring of achievement of XI plan targets.

(ii) Decreasing weightage to Non-Financial Parameters

As per DPE Guidelines, non-financial performance parameters fixed should be SMART (Specific, Measurable, Attainable, Result-oriented, Tangible) and consistent with the Annual Plan/Budget/Corporate Plan of the CPSE. MOU signed by PGCIL included ten[50] major non- financial parameters. There was dilution of weightage in respect of the following important non-financial parameters related to project implementation and network availability over the years in the MOU signed by PGCIL as given in Table 4.2 (dilution depicted in bold italics):

[50] ***Quality, Customer satisfaction, Business development, R&D for sustained & continuous innovation, Project implementation, Commercial targets, Human resource development, Environment and social management of new projects, Operational targets and Inventory management.***

Table 4.2

Details of MOU parameters where weightage was decreased

Criteria	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13
Customer satisfaction (no. of trippings)	4	4	2	2	***1***	***0.5***
Availability of transmission system	13	13	13	***7***	***6***	***5***
Project implementation	20	20	19	*20*	***10***	***8***

Thus, significant parameters reflecting performance of PGCIL in the core activity relating to availability of transmission systems and implementation of projects were progressively scaled down.

MOP stated (March 2014) that weightage of these parameters were decreased since new parameters were introduced under the category of non-financial parameters and the points had to be re-allocated.

The fact however remains that higher reduction of points was made from the above parameters (which represent the performance of PGCIL in the core areas) as compared to reduction from other parameters. *e.g.* in 2011-12 three new parameters with total weightage of 15 points were introduced. Against this, 12 points were reduced from the above three parameters as indicated in Table 4.2 while balance points were reduced from other eight parameters. ***(Annexure.4.1)***

CHAPTER - 5

Investment Approval and Project Funding

5.1 Investment approval

The Report on the Working Group on Power for XI Plan *inter alia* stated (February 2007) that it is desirable that the project is defined to finer details to the extent possible at the Feasibility Report (FR)/Notice Inviting Tender (NIT) stage for effective planning and scheduling of project(s) besides minimization of resources. The Report further provided that detailed survey should be carried out before start of procurement process to avoid large quantity variations during execution which could be a cause of dispute/delay. Works & Procurement Policy and Procedures (WPPP) of PGCIL stipulated that walkover survey be conducted to identify the Bill of Quantities (BOQ) [51] and other details/information for preparation of FR of the project. WPPP, however, required that detailed survey of forest stretches and river crossings should be carried out before preparation of BOQ and cost estimates. Thus WPPP limits the exercise of detailed survey only to forest stretches and not to the whole line route, advised by the Working Group on Power.

PGCIL, however, as a practice did not conduct detailed surveys of forest stretches before preparation of BOQ and cost estimates, as stipulated in WPPP. Quantities for the purpose of FR were estimated based on forest atlas, topo-sheet[52]and walkover survey of the area resulting in significant variations at the time of actual execution of projects.

In test checked 20 projects, actual length of 17 transmission lines in 12 projects had variations as compared to FR line length ***(Annexure 5.1)***. In 11 transmission lines, actual length was less while in six transmission lines, the actual executed length was more. The difference in executed length as compared to FR length in four cases was less than 10 *per cent*, in four cases between 10 to 20 *per cent*, in four cases between 20 to 30 *per cent* and in five cases it was more than 30 *per cent*.

MOP stated (March 2014) that variations in line length considered in FR vis-a-vis actual constructed in most cases had been due to (i) change in the sub-station location, since at the time of preparation of FR, the locations for new sub-stations were tentatively identified and at the time of execution of projects, due to land acquisition Right of Way issues, line route was required to be changed, which was beyond the control of PGCIL; and (ii) detailed survey in forest area was undertaken as a parallel activity to primarily expedite submission of forest clearance proposals; MOP, however, assured that PGCIL was making all efforts to minimise the variation, such as more detailing at the FR stage by use of various tools like Google map, satellite images, topo- sheets, *etc*.

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[51] ***Bill of Quantities is a list containing all items and their respective quantities, rate, etc. to be supplied by the contractor, under a given contract***

[52] ***Topo-sheet or Topographic sheet essentially contains information about an area like roads, railways, settlements, lands, rivers, electric poles, etc. According to their usage they may be available at different scales.***

The reply is to be viewed against the fact that variations at the time of execution of projects were possible to be minimised by conducting detailed survey before the start of procurement process. There is a need to adhere to the advice of the Working Group on Power through appropriate modifications in the relevant provisions of WPPP.

5.2 Non-adjustment of STOA charges from project cost

Transmission charges for use of inter-state transmission system fall under three categories *viz*. Long term Access (LTA) charges, Medium term open access (MTOA) charges and Short term open access (STOA) charges. As per CERC (Open Access in Inter-state Transmission) Regulations, 2004 read with CERC order dated 30 January 2004, PGCIL was allowed to retain 25 *per cent* and 12.5 *per cent* of STOA charges collected in intra regional and inter regional transmission systems respectively and the balance was to be adjusted towards reduction in the transmission charges payable by Long-term customers. While allowing retention of STOA charges, CERC in its order dated 30 January 2004 stated that, "...25% of the revenue received from the short-term customers shall be retained by the transmission licensee, which is expected to be utilised in the core activity of building new transmission system." CERC amended (September 2013) the relevant Regulation relating to collection and disbursement of transmission charges (*i.e*. 75:25 and 87.5:12.5 ratios for intra-regional and inter-regional transmission system usage respectively) and provided that STOA charges had to be returned by CTU (PGCIL) to long term customers through adjustment of monthly transmission charges payable by them.

PGCIL received ₹ 906.49 crore between 2004-05 and 2012-13 on account of the above mentioned 25 *per cent* (12.5 *per cent* in case of inter regional) component of STOA charges but did not maintain project-wise details of inter-regional/intra regional transmission schemes where such STOA charges were utilised. This meant that PGCIL had used this as a revenue stream for itself instead of using it for funding new transmission systems/schemes, which would have resulted in reduction of tariff of such schemes to be recovered from customers.

MOP stated (March 2014) that as per CERC mandate, PGCIL had been utilising STOA charges in core activities of building new transmission system and for discharging CTU activities. MOP further stated that based on the rich experience, expertise, technical knowhow and intellectual assets possessed by PGCIL in the power transmission field, certain large and important activities which were difficult to monetize were performed by PGCIL such as carrying out Transmission System Planning activities in line with the National Electricity Plan, capacity building of State Utilities and DISCOMs, ATC/TTC declaration, communication planning, protection audit carried out for State Utilities, inputs for competitive bidding, coordination & support to State Transmission Utilities (STUs) viz., providing advanced simulation software and organizing training programs for their personnel and R & D and Technology Development. MOP contended that CERC Regulations did not have any provision for adjusting the project cost with STOA charges and added that PGCIL had filed a review petition with CERC, in

respect of the amendment made by CERC in September 2013 regarding full STOA charges to be retained by long term customers.

The reply that the STOA charges were utilized in core activities of building new transmission system is to be viewed against the fact that details of projects wherein such charges were utilized were not available with PGCIL. In the absence of project-wise accounting/disclosure while filing tariff petition for new transmission systems, the condition on which PGCIL was allowed to retain the charges *i.e.* utilization of the funds in building new transmission systems, remained unfulfilled. As regards the claim that the charges were also utilised for discharging CTU activities, the stand is not in line with CERC Order dated 30 January 2004 which envisaged utilisation of charges in the core activity of 'building new transmission system'. Thus, the conditions stipulated by CERC for retention of STOA charges were not followed by PGCIL which resulted in denial of the benefit of reduction in the cost of new transmission projects to the extent of ₹906.49 crore between 2004-05 and 2012-13.

5.3 Non-utilisation of Power System Development Fund

The "Power System Development Fund" (PSDF) was constituted (June 2010) under the CERC (Power System Development Fund) Regulations, 2010 by aggregating the funds available in the following four individual funds/Accounts maintained by RLDCs:

- *Unscheduled Interchange Charges Pool Account Fund* - The fund contained amounts that are payable/receivable by generators and discoms, for deviations from schedule, depending on whether the deviations has improved or worsened the grid frequency.
- *Congestion Charge Account*– RLDCs levied Congestion charge on real time, on entities causing congestion and the charges are distributed to entities relieving congestion.
- *Congestion Amount (Market splitting charge)* – Levy of congestion amount is a methodology adopted by power exchanges for congestion management, by splitting the market into a surplus part and a deficit part and adjusting the prices in the two markets[53].
- *Reactive Energy Charges Account* – Reactive energy charges are payable by discoms and generators who had a net drawal/injection of reactive energy under high/low voltage conditions.

The above charges are settled between those entities who pay and those who need to receive and the surplus amount in the four accounts is transferred to PSDF on a monthly basis. The funds are to be utilised for purposes specified in the respective CERC Regulations *viz.* to relieve congestion including but not limited to carrying out specific system studies to optimise

[53] ***If the flow exceeds the capacity at the common price for the whole market area, it is split in a surplus part and a deficit part. The price is reduced in the surplus area (sale > purchase) and increased in the deficit area (Purchase> sale). This will reduce the sale and increase the purchase in surplus area. In the same way, it will reduce the purchase and increase the sale in the deficit area. Thus, the needed flow is reduced to match the available transfer capability. This method of managing congestion is known as market-splitting.***

the utilisation of the inter-regional links, installation of special protection schemes, installation of shunt capacitors, VAR[54] compensators, series compensators and other reactive energy generators. The fund can also be utilised for creation of additional transmission capacity for relieving congestion and capacity building measures and training of participants of power exchanges, SLDC operators etc. Administration of PSDF was vested with a Management Committee (MC) appointed by CERC having Chief Executive Officer, POSOCO as its Chairman and having representatives from RPC, RLDCs and independent external members. The amount in PSDF as on 31 December 2013 was ₹ 6301.64 crore. (**Annexure 5.2**). Apart from nominal utilisation of ₹ 22 lakh (For meeting travel expenses, audit fees, sitting fees to Members, etc.), the fund remained unutilised since it was constituted. The accounts of PSDF were kept outside CERC Account as well as NLDC account and the unutilised balance was invested in treasury bills and flexi deposits of Indian Bank. In this connection, it is seen that a document titled 'Procedure for disbursement of funds from PSDF' was formulated by the MC and submitted to CERC for its concurrence in December 2010. As per correspondence exchanged by administrators of PSDF with CERC in September 2012, non-receipt of concurrence of CERC to the said procedure has been cited as the reason by the MC for the inability to discharge the functions assigned to it under the PSDF Regulations. Examination of the PSDF Regulations, however, revealed that the MC is vested with the power to prepare detailed procedure for disbursement from the Fund consistent with the provisions of the regulations but disbursement from the Fund shall not be made without the approval of CERC. In other words, it is the disbursement that requires CERC approval and not the procedure.

During the period of three years (December 2010 to December 2013), the MC received proposals for 16 projects, total estimated cost of which was ₹ 655.02 crore, for funding from PSDF, which were kept pending.

In January 2014, a Cabinet Note moved by MOP was approved wherein scheme for operationalisation of PSDF including eligible projects, appraisal committee and monitoring mechanism, etc, were mentioned. It was decided that the Fund, which hitherto remained outside the Government Account Framework[55], would be brought under Public Account.

POSOCO stated (February 2014) that the MC of PSDF not only submitted the procedure for disbursement from the Fund to CERC for approval, but was continuously pursuing the matter with CERC. However, as the procedure was not approved, MC could not start disbursement from the Fund. POSOCO was also of the view that in the regulatory regime, the procedure, even though made under CERC Regulation would have weight only if approved by CERC.

POSOCO's reply indicates that due to avoidable administrative issues, funds lying in PSDF were not utilised towards relief of congestion and system strengthening projects.

MOP informed in the Exit Conference (April 2014) that an initiative had since been taken for proper accounting and utilisation of PSDF.

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[54] ***VAR – Volt-ampere reactive***

[55] ***All Government moneys come under three accounts viz., the Consolidated Fund of India, Contingency Fund and Public Account and all three accounts are audited by the Comptroller and Auditor General of India.***