भारत सरकार
Government of India
विद्युत मंत्रालय
Ministry of Power
केन्द्रीय विद्युत प्राधिकरण
Central Electricity Authority
प्रणाली योजना एवं परियोजना मूल्यांकन प्रभाग
System Planning & Project Appraisal Division [ISO: 9001:2008]
सेवा भवन, आर. के. पुरम, नई दिल्ली–110066
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No.66/5/2013-SP&PA/ 1579 - 1591 **dated: 12.9.2013**

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11. Executive Director (T&RE), NHPC Ltd, NHPC Office complex, Sector 33, Faridabad-121003. Tel. No. 0129-2255805, Fax No. 0129-2256055	12. General Manager, Eastern Regional Load Dispatch Center, 14, Golf Club Road, Tollygange, Kolkata-700033. Tel No. 033-24235867 Fax No. 033-24235809

Sub: Summary record of discussions of the 2nd - 2013 meeting of the Standing Committee on Power System Planning of Eastern Region held on 27.08.2013 at NRPC, New Delhi.

Sir,

Minutes of the above 2nd -2013 Standing Committee Meeting held on 27.08.2013 at NRPC, Katwaria Sarai, New Delhi has been uploaded on the CEA website: www.cea.nic.in. (path to access: *Wings of CEA/Power Systems/Standing Committee on Power System Planning/EASTERN REGION)* for kind perusal.

Yours faithfully,

12/9/13

(Dr. R. Saha)
Director (SP&PA)

Copy to: Sh. S K Soonee, CEO, POSOCO, B-9, Qutab Institutional Area, Katwaria Sarai, New Delhi-110016.

Summary Record of Discussions of the 2nd 2013 Standing Committee Meeting on Power System Planning in Eastern Region held on 27-08-13 at NRPC, New Delhi.

List of participants is at Annex-I.

Chief Engineer I/C (SP&PA), CEA welcoming the participants stated that the last Standing Committee meeting (SCM) on Power System Planning in Eastern Region was held on 5-1-13 at PGCIL, Gurgaon. The main and supplementary agenda for the present meeting was circulated through the CEA website in advance. COO (CTU), POWERGRID had also extended warm welcome to all the members in the meeting. Thereafter, Chief Engineer I/C (SP&PA) requested Director (SP&PA), CEA to take up the agenda.

Director (SP&PA) stated that in addition to the agenda circulated, additional proposals from Bihar State Power Transmission Company Ltd. (BSPTCL) and WBSETCL were received very recently and those proposals would be also deliberated in this meeting and took up thereafter the agenda for discussions.

1. Confirmation of Minutes of the Meeting held on 05-01-2013

Director (SP&PA), CEA stated that Minutes of the Standing Committee Meeting (SCM) held on 05-01-2013 at PGCIL, Gurgaon were circulated vide CEA letter No. 66/5/99/SP&PA/142-158 dated 12-02-2013. No comments were received on the minutes. The minutes of the Meeting held on 05-01-2013 were thereafter confirmed.

2. Establishment of 400kV Sagardighi TPS – Berhampur D/C line as ER system Strengthening Scheme (ERSS-X)

Director (SP&PA, CEA informed that a 400kV switching station at Berhampur (West Bengal) with LILO of Farakka STPS-Jeerat 400kV S/c line is under construction for supply of about 500 MW power to Bangladesh shortly through 500 MW HVDC back-to-back cross-border interconnection (Bangladesh) between electrical grids of India and Bangladesh, and it could result in overloading of the Farakka-Berhampur-Jeerat-Subashgram 400kV section and low voltage problems around Jeerat and adjoining areas of West Bengal. He further stated that to overcome congestion in Farraka-Jeerat and Farraka-Malda sections of the ER grid, development of the planned inter-state 400/220 kV S/s at Rajarhat and Rajarhat – Purnea 400 kV D/c line with one circuit to be LILOed at Gokarna S/S of

West Bengal and the other ckt at Farraka STPS) as part of "ERSS-V Scheme" by POWERGRID is getting delayed due to issues in land acquisition/procurement for Rajarhat sub-station. As an alternate grid strengthening measures, he referring to the decision of the 24th ERPC meeting for establishment of a 400kV D/c line from Sagardighi TPS (West Bengal) to Baharampur 400 kV sub-station (PG) of 30km length, informed that MoP/CEA have decided the line to be constructed on compressed time schedule by POWERGRID. Ministry of Power, Govt. of India vide its letter dated 31st July 2013 approved the scheme for implementation by POWERGRID under compressed time schedule. It was added that the termination of this line would require additional land at Baharampur substation and requested WBSETCL to extend its support in this regard. Chief Engineer I/C (SP&PA) stressed the need for early implementation completion of the line by POWERGRID.

CEO, POSOCO suggested that since this would be a short line, it should be constructed as a high capacity line to meet present and future system requirements. After further discussions, it was agreed to construct the Sagardighi – Baharampur 400 kV D/c line with high ampacity HTLS (High Temperature Low Sag) conductor. He further suggested that conversion of Baharampur Switching station into a sub-station and feeding some load in and around that area would provide better controllability from system operation angle. WBSETCL opined that they would examine the issue. On query from POSOCO about the time line for implementation of the line, COO (CTU), POWERGRID stated that it would be about 18-20 months from the date of award.

CEO, POSOCO stated that in order to overcome congestion in Farraka-Malda corridor, construction of the 400kV Rajarhat – Gokarna/Farraka section of the approved 400kV Rajarhat-Purnea D/c line should be developed first as part of the ERSS-X scheme of POWERGRID and subsequently, remaining works under the scheme including the 400kV Rajarhat S/S could be built up when land acquisition/procurement issue would get settled. COO(CTU), POWERGRID stated that they would look into the POSOCO's proposal.

Members noted and agreed to the construction of the 400kV D/C line with HTLS conductor from Sagardighi TPS (West Bengal) to Baharampur 400 kV sub-station (PG).

3. Transmission System for immediate evacuation of power from North Karanpura STPP (3x660 MW) to Ranchi and Gaya Pooling stations of POWERGRID

Director (SP&PA), CEA informed that transmission system associated with North Karanpura STPP (3x660 MW) was finalized and approved in the meeting of Standing Committee on Power System Planning in Eastern Region held on 05-05-2007 at Puri. But, NTPC could not take up the project for want of some clearances from the Govt. of India. NTPC vide letter dated 25-06-2013 informed that Govt. of India cleared implementation of North Karanpura STPP (3x660MW) generation project and requested to initiate activities for implementation of the associated transmission system.

POWERGRID is to implement the following interconnecting lines from North Karanpura STPP to Ranchi & Gaya Pooling Stations for immediate evacuation of power:

POWERGRID Scope

- North Karanpura – Ranchi (New) 400kV D/C line with quad moose conductor
- North Karanpura – Gaya 400kV D/c line with quad moose conductor

NTPC is to implement the following works at their North Karanpura switchyard.

NPTC Scope

- 4 nos. 400 kV line bays for termination of above lines at North Karanpura STPP
- 2 nos. 125 MVAR Bus Reactor at North Karanpura STPP (400 kV Bus)

On query in regard to the status of North Karanpura generation project, NTPC informed that the issue of coal bearing area has been resolved and Ministry of Power has recently (i.e. in March 2013) cleared for immediate implementation of North Karanpura STPP (3x 660 MW). The coal allocation of the project has also been re-instated from North Karanpura mines of Coal India Ltd. NTPC further informed that the project has been conceived as EPC mode of tendering. The tendering activities are already under process and award is scheduled by March 2014.

After deliberation, it was agreed that the above scope of works would be implemented by POWERGRID and NTPC.

4. Long Term Access for 750 MW from Essar Power (1200MW) in Jharkhand and 260 MW from GMR Kamalanga (1050 MW) in Odisha to Bihar

POWERGRID informed that Essar Power (Jharkhand) Ltd. has signed Power Purchase Agreements with Bihar for supplying 750 MW from their generation project in Latehar district of Jharkhand. Similarly, GMR Kamalanga Energy Ltd. has signed Power Purchase Agreements with Bihar for supplying 260 MW from their generation project in Angul district of Odisha.

Bihar representative confirmed that they have signed above mentioned PPAs and are ready to sign the requisite commercial agreements with POWERGRID for payment of transmission charges for the above mentioned quantum of power.

5. Addition of 1x125 MVAr Bus Reactor each at Baripada & Maithon 400 kV sub-stations (PG)

Director (SP&PA), CEA stated that installation of 1x125 MVAr bus reactor at Baripada S/S was discussed in the previous meeting of Standing Committee held on 05-01-2013. However, the proposal was dropped due to space constraint. Subsequently, space availability at Baripada was explored and in the 24th TCC / ERPC meeting held on 26-27 April, 2013 and the same was agreed to.

Regarding the proposal of 1x 125 MVAr bus reactor at Maithon, POWERGRID stated that presently, there is a 1x50MVAr bus reactor at Maithon sub-station and 1 no. 125 MVAr bus reactor was approved in the standing committee meeting held on 05.01.2013. But, keeping in view the bus splitting to be implemented at Maithon, installation of 1x125 MVAr bus reactor (2nd) at Maithon would be required to arrest high system voltage.

In regard to reactor requirements, CEO POSOCO opined that fault level at sub-station where new reactor would be planned and its time frame and reasons for selection of reactor capacity (MVAr) should be given. PGCIL took a note of it.

After deliberation, Members agreed to the following Bus Reactors :

- Installation of 1x125 MVAr Bus Reactor with **GIS bay** at Baripada sub-station of POWERGRID

- Installation of 1x125 MVAr Bus Reactor with **GIS bay** at Maithon sub-station of POWERGRID

6. Eastern Region System Strengthening Scheme-IX (ERSS-IX)

Referring to the last Standing Committee for Power System Planning in Eastern Region held on 05-01-2013, Director (SP&PA) stated that the following reactive power compensation as part of ERSS-IX were agreed to be implemented by POWERGRID as a regional project of Eastern Region.

i. Installation of 1X125 MVAR Bus Reactor at Gazuwaka 400 kV (East) bus.

ii. Installation of 2X125 MVAr Bus Reactor at Rengali.

iii. Installation of 1X125 MVAr Bus Reactor at Maithon.

iv. Installation of 1X125 MVAr Bus Reactor in parallel with existing 50 MVAr (3X16.67) Bus Reactor at Biharsharif, using existing Reactor bay.

v. Installation of 2X125 MVAr Bus Reactor in parallel with existing 2X50 MVAr Bus Reactor at Jamshedpur.

vi. Installation of 1X125 MVAr Bus Reactor in parallel with existing 1X50 MVAr Bus Reactor at Rourkela.

vii. Installation of 2X125 MVAr Bus Reactor at Durgapur (Parulia). Out of 2x125 MVAr Bus Reactor, 1X125 MVAr Bus Reactor would be in parallel with existing 1X50 MVAr Bus Reactor, using existing Reactor bay.

viii. Converting 2X80 MVAr Line Reactors at Gorakhpur end of Barh-II – Gorakhpur 400 kV Quad D/c line to 2X80 MVAr(Switchable) Line Reactors.

Director (SP&PA) CEA stated that the above requirements were agreed in the last SCM held in January 2013 by all the constituents of ER. Subsequently, Bihar had raised some reservation on item-i & item-viii in the TCC/ERPC forum. After further deliberation, BSPTCL representative agreed to the entire proposal.

However, CEO POSOCO stated that 2x80 MVAr line reactors at Gazuwaka end of the 400kV Jeypore-Gazuwaka D/C line are already existing and possibility for using the same reactors as shunt reactor at Gazuwaka could be explored instead of a new 1x125 MVAr bus reactor. It was decided that POWERGRID would examine the case. Subsequently, after examination of the same, POWERGRID had informed that the **1x125 MVAr bus reactor at Gazuwaka would be in order**, in view of the fact that the short circuit level of Gazuwaka east bus would increase after completion of Talcher – Behrampur – Gazuwaka 400kV D/c line under Talcher-II backup system.

As regards termination of transmission lines of Talcher-II backup system at Talcher-II, NTPC stated NIT for 4 nos. of bays in their Generation switchyard. was being prepared. But as the associated transmission lines under TBCB route is getting delayed, the implementation of 4 nos. line bays could be deferred. NTPC requested CEA/CTU that as soon as there would be some progress on the implementation of Talcher-II back up transmission system, the same might be informed well in advance (i.e. 30 months before) so that the bays at Talcher generation switchyard could be installed.

7. Requirement of additional single phase spare converter transformer of 2x234MVA units at 2x500 MW Gazuwaka (one for each pole : One AREVA make, other ABB make) and 1x234MVA unit at Sasaram 500 MW HVDC back-to-back (B-t-B) stations (AREVA make).

Director (SP&PA) CEA stated that the above system requirement of spare converter transformer i.e. one spare converter transformer at Sasaram (AREVA make) and two spare converter transformers at Gazuwaka (one for each pole : One AREVA make, other ABB make) were discussed and agreed in the last Standing Committee for Power System Planning in ER held on 05-01-2013, Gurgaon. Subsequently, BSPTCL Bihar had some reservation for procurement of spare single phase unit of converter transformer. POWERGRID explained the requirement of the spare converter transformer keeping in view the reliable and efficient operation of the B-t-B station. BSPTCL agreed to the above requirement of spare single phase Converter transformer units.

Regarding procurement of spare single phase unit for Sasaram 500 MW B-t-B station, CEO POSOCO opined that provision of spare single phase unit at Sasaram B-t-B station at the present stage could be an issue.

After deliberations, it was agreed to provide additional single phase spare converter transformer unit of 2x234MVA **at Gazuwaka 2x500 MW HVDC Back-to-Back station** (one for each pole : One AREVA make, other ABB make) by POWERGRID, whereas provision of an additional single phase spare converter transformer unit at Sasaram (AREVA make) was dropped for the time being.

8. Strengthening of 400kV Farakka-Malda corridor

Director (SP&PA), CEA stated that the existing 400kV Farakka-Malda D/C lines is creating a major operational constraint to transfer power from ER to NR and NER during lean months from November to March, when NER used to import power from ER due to being low hydro generation in the region, and this constraint becomes severe during n-1 condition resulting in supply of limited power to NER. Further tripping of surviving circuit would result in severe power swing across Farakka-Kahalgaon-Biharshariff-Muzaffarpur-Purnea-Siliguri corridor. In view of above, re-conductoring of this section with high capacity HTLS conductor (without any change to tower structures) was deliberated. The requirement of strengthening the Farakka - Malda corridor was impressed upon by CTU and POSOCO. CEO, POSOCO stated that strengthening in this corridor is an immediate operational requirement to transfer power to NR/NER and should be implemented at the earliest. On query about the necessity of re-conductoring while Purnea – Rajarhat 400 kV D/c being implemented, CEA stated that re-conductoring of Farraka-Malda line would greatly improve the reliability of power transfer to NR/NER during any credible contingency and it is a short line.

After detailed deliberations, Members were agreeable for re-conductoring of Farakka – Malda 400 kV D/c line with high ampacity HTLS conductor and upgradation/replacement of associated bay equipment.

9. Procurement of two single Phase Spare ICT units (2x500 MVA), 765/400kV for Eastern Region

POWERGRID representative stated that there are ten (10) units of 500 MVA, 765/400 kV ICTs at Gaya Sub-station and Four(4) units of 500 MVA, 765/400 kV ICTs at Sasaram. These transformers are manufactured and repaired at off-shore works of the foreign manufacturers. Any failure of these units may lead to overloading of the other units operating in parallel and may cause transmission constraint at 765 kV level. In the last standing committee meeting held on 05-01-2013, one 500 MVA, 765/400 kV single phase ICT unit was approved.

Further, POWERGRID stated that thirteen(13) single phase units of 500 MVA each of 765/400 kV ICTs i.e.3x1500MVA ICTs are scheduled for commissioning at Angul Substation and seven(7) units of 500MVA 765/400kV i.e.2x1500 MVA

ICTs would be commissioned at Jharsuguda Substation. Similarly, seven(7) more units of 500MVA, 765/400kV i.e. 2x1500 MVA ICTs at 765/400kV Ranchi-New Substation (PG) and an additional 1500 MVA 765/400kV ICT (i.e.3x500 MVA) at Gaya (PG) would be commissioned shortly.

Looking into the upcoming huge population of single phase 500 MVA transformer units and to enable reliable transfer of power through ICTs, POWERGRID proposed to procure two (2) nos. additional single phase 765/400 kV ICT of 500 MVA capacity as spare for Eastern Regional Grid to be stationed at the Angul and Jharsuguda substation.

After deliberations, Members agreed to the provision of above two single phase transformer units.

10. Augmentation of Transformation capacity at 400/220kV Baripada S/S (PG)

In view of the loading on the existing Baripada 2x315 MVA ICTs exceeding 400MW on several occasions with maximum loading up to 501 MW during April 2013, POWERGRID proposed for augmentation of transformation capacity by an additional 1x500MVA ICT as tripping of any one of the ICTs may lead to overloading of the other ICT and might cause cascaded tripping of remaining ICTs in service leading to complete outage.

In this context, OPTCL informed that they have planned to shift the load of Baripada sub-station to nearby sub-stations, which would reduce the loading on Baripada ICT. Keeping this in view, the proposal of additional ICT at Baripada was dropped.

11. Augmentation of Transformation capacity at the existing 400/220kV Jamshedpur (PG) and Sasaram (PG) sub-stations

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BSPTCL's proposals for Augmentation of 400/220kV Transformation capacity at the Muzaffarpur,Sasaram,Purnea and Patna sub-stations of POWERGRID, and establishment of 220kV MTPS (Extn.)- Muzaffarpur (PG) D/C line (3rd & 4th Circuits)

POWERGRID stated with instances during May'13 that loading on each of the 400/220kV 2x315MVA ICTs at Sasaram had exceeded 250MW on several

occasions with maximum loading of upto 305MW during May'13 and similarly, loading on each of the 400/220kV 2x315MVA ICTs at Jamshedpur (PG) had reached upto 210 MW.

In order to meet any eventuality due to failure of anyone of the ICTs at the above sub-stations, POWERGRID proposed for augmentation of transformation capacity at Jamshedpur and Sasaram.

In this context, Director, CEA mentioned that BSPTCL has proposed very recently some additional requirements for augmentation of transformation capacity at 400kV grid sub-stations of POWERGRID in Bihar viz. Muzaffarpur, Purnea, Pausali(Sasaram) and Patna. MD, BSPTCL explained that the peak demand in Bihar has already touched 2200 MW and it would be expected to cross 5000 MW by 2015-16 due to rapid load growth in Bihar. Bihar has already taken up implementation of major transmission and distribution expansion Plan in the entire State grid. He added that in order to meet load growth being envisaged at various parts of the State including demand of Patna area, augmentation of 400/220kV transformation capacity from 2x315 MVA each at Muzaffarpur, Purnea, Pausali (Sasaram) and Patna sub-stations of POWERGRID to 2x500 MVA ICTs were recently proposed to CEA by BSPTCL.

About the above proposals of BSPTCL, CEA informed that augmentation of transformation capacity at Muzaffarpur (PG) with an additional 500 MVA, 400/220 kV ICT, was approved in the last SCM and it is under the process of implementation. With this, the 400/220kV sub-station capacity of Muzaffarpur would reach to 1130 MVA. It was felt that no further augmentation at this stage would be required at Muzaffarpur (PG) at this stage. Provision for augmentation of 2x315 MVA 400/220kV ICTs at Sasaram by replacement with 2x500 MVA ICTs, due to severe space constraint at Sasaram, has been already included in the agenda for concurrence.

POWERGRID stated that there is also severe space constraint at Purnea, Pusauli (Sasaram) & Patna sub-stations for addition of transformer(s), and only available alternative would be to replace existing 2x315 MVA ICTs by 2x500 MVA ICTs. 315 MVA ICTs thus released from Purnea, Pusauli and Patna could be kept in the pool of regional spares.

CEA stated that there would be number of spare 315 MVA ICTs and these ICTs should not go waste. POWERGRID stated that these ICTs could be utilized at any other places after refurbishment. MD, BSPTCL suggested that out of the 315 MVA ICTs emerging as spare, two ICTs (one at Sasaram and one at Patna) could be kept as stand-by/spare, and one could be utilized for augmentation of transformation capacity at Jamshedpur (PG) as 3rd ICT. AGM, NTPC stated that at present there is only 1x315 MVA 400/22kV ICT at Farakka and stressed upon the need for augmentation of the transformation capacity. On query about the space availability for an additional ICT at Farakka, NTPC confirmed that space for 2nd ICT would be made available by shifting the location of 50MVAR bus reactor. It was decided that one 315 MVA ICT released after replacement of ICTs at Purnea, Pusauli and Patna would be installed as additional (2nd ICT) at Farakka.

After deliberations, **the following were decided and agreed.**

- Replacement of 2x315 MVA, 400/220 kV ICTs at Purnea (PG) by 2x500 MVA, 400/220 kV ICTs.

- Replacement of 2x315 MVA, 400/220 kV ICTs at Pausali (Sasaram (PG) by 2x500 MVA, 400/220 kV ICTs, and one of the 2x315 MVA ICTs being released to be kept as stand-by/spare.

- Replacement of 2x315 MVA, 400/220 kV ICT at Patna (POWERGRID) by 2x500 MVA, 400/220 kV ICT, and one of the 2x315 MVA ICTs being released to be kept as stand-by.

- Shifting of 1X315 MVA, 400/220 kV ICT from any suitable location (after replacement by 1x500MVA ICT) to Jamshedpur 400/220 kV S/S (PG) as 3rd ICT and installation of the same along with associated bays.

- Shifting of 1X315 MVA, 400/220 kV ICT from any suitable location (after replacement by 1x500MVA ICT) to Farakka STPS as 2nd ICT and installation of the same along with associated bays.

- Thus, out of the 6 nos. 315 MVA 400/220kV ICTs to be released from Purnea, Patna & Pusauli substations, one would be kept as spare at Patna and one as spare at Pusauli, one to be diverted and utilized at Jamshedpur as 3rd ICT, one to be diverted and installed at Farakka as 2nd ICT, and remaining ICTs would be utilized as Regional Spare.

As regards the proposal of BSPTCL for establishment of 220kV MTPS (Extn.)-Muzaffarpur (PG) D/C line (3rd & 4th circuit), this requirement was agreed and it was decided that the line, including the associated bays, would be constructed by BSPTCL at their own cost.

12. Modification of 132kV Bus arrangement at 220/132kV Siliguri S/S(PG)

POWERGRID representative stated that the presently, Single Main & Transfer Bus Scheme at 132kV level and Double Main & Transfer Bus Scheme at 220kV level are existing. In order to improve reliability of 132kV system, the 132kV Bus scheme including switchgear should be upgraded to Double Main Scheme. For any space constraint, 132kV GIS bays could be considered at Siliguri Sub-station. After deliberation, Members agreed to the proposal.

13. Procurement of 110MVA, 765kV Single Phase Spare Reactor unit at Sasaram

POWERGRID representative informed that there are 3 units of 110MVAr, 1-ph Bus Reactors at 765kV Sasaram S/S (PG). 765kV Bus voltage at Sasaram is generally high, and failure of any one single phase unit of the Reactor would aggravate the high voltage problem. So, it was proposed that one 765kV, 110MVAr 1-ph Reactor should be kept as spare. Members agreed to the proposal.

14. WBSETCL's proposal for (i) establishment of Gazol 220/132kV Sub-station in Malda by LILO of Malda-Dalkhola 220kV D/C line of POWERGRID and (ii) Interconnection between Melli (Sikkim) and Kalimpong 132kV S/S of WBSTCL by 132kV D/C line.

WBSETCL stated that load growth at Malda area is taking place rapidly and existing 220kV and 132 kV systems in Malda and its adjoining districts are inadequate to supply present load demand of about 224 MVA. The proposed Gazol 220/132kV Sub-station in Malda by LILO of Malda-Dalkhola 220kV D/C line of POWERGRID would cater to the system requirement. On query from Director CEA about the provision of 220/132kV substation capacity at Gazol, WBSETCL informed that 2x160 MVA ICTs would be provided at Gazol with 132kV interconnections to the nearby 132kV sub-stations of the State. WBSETCL has also informed that the entire work would be executed by WBSETCL at their own cost. Members including POWERGRID agreed to the proposal.

Regarding the interconnection proposal between Melli (Sikkim) and Kalimpong 132kV S/S by 132kV D/C line, CE (WBSETCL) referred to the decision taken in the SCM held on 28-12-10 and stated that as decided in that meeting, WBSETCL

and Sikkim Energy Department subsequently conducted a joint site visit (19th July, 2013) at Melli to find space for constructing 2 nos. 132kV line bays associated with the proposed D/C line. Accordingly, both WBSETCL and Sikkim confirmed the availability of space at Melli for construction of the 132kV Kalimpong-Melli D/C line by replacing/converting the existing 66kV Kalimpong-Melli D/C line. Director, CEA stated that the proposed interconnection would be primarily inter-state in nature and whether any operational problem would be there. CEO, POSOCO stated that such interconnection would not be advisable due to the reason that Melli S/S is a load centre and fairly connected to Sikkim grid and power import by WBSETCL through the proposed 132kV Kalimpong-Melli line could be from any source in Sikkim. He suggested that such interconnection should be planned with a greater perspective as inter-state system. In view of above, it was felt that that WBSETCL should review the matter.

15. Installation of OPGW on new transmission lines of Eastern Region

GM POWERGRID stated that the PMUs would be installed at upcoming Darlipalli, Nabinagar & North Karanpura Thermal Power Stations, and fiber based Communication System with OPGW in place of one earth-wire on lines originating from the above Plants should be in place. Accordingly, installation of OPGW would be required on the following inter-state transmission lines:

i. 765 KV D/C Darlipalli TPS–Jharsuguda line (37 Km)
ii. 400 KV D/C Nabinagar – Patna line (146 Km)
iii. 400 KV D/C Nabinagar – Gaya line (95 Km)
iv. 400 KV D/C North Karanpura – Ranchi line (101 Km)
v. 400 KV D/C North Karanpura – Gaya line (102 Km)

It was also proposed that similar communcation facility (OPGW based) should be installed on the aforesaid 400 KV D/C Sagardighi – Behrampur (30 Km) and 400kV Punatsangchu – Alipurduar D/C line (ongoing) of the Indian portion (71km) associated with Punatsangchu HEP in Bhutan. Members agreed to the OPGW requirement on the above seven transmission lines.

In this context, CEO POSOCO stated that OPGW based communication is the most critical infrastructure for grid and substation operation, and should be made integral part of transmission system at the time of system planning. He further

stated that communication planning in piecemeal manner would not reflect the overall idea about the existing and under implementation communication network. MD BSPTCL also agreed to the view of POSOCO. It was decided that installation of OPGW based communication should be considered by default and not to be put for approval of the standing committee. CEO, POSOCO opined that communication system being planned by CTU should also be based upon some criteria. It was agreed that the criteria for communication system planning would be recorded. CTU derived the following the criteria for OPGW requirement.

- All the main and back up control centers shall be provided with fiber connectivity with physical path redundancy.
- Each Substation and Power Plant shall be provided with the Fiber connectivity with physical path redundancy.
- All the HVDC lines shall be provided with one OPGW in place of earth wire.
- Each Region should be connected with its neighboring region with at least two physical path.
- Physical Path redundancy in addition to equipment and fiber redundancy shall be ensured from each node.
- All LILO portion of the lines shall be implemented with OPGW connectivity if the existing line is provided with fiber cable.
- Any other substations/power plants as decided by LDC.
- The planning should also take in to account the residual life of existing fiber links based upon the design life of fibers.
- All international links shall be provided with Fiber Optic connectivity.
- STUs may take up the planning of communication system for their system based upon the above criteria.

16. Development of Analytics as part of Unified Real Time Dynamic State Measurement (URTDSM) Scheme

Development of analytics using PMU based measurements as part of Unified Real Time Dynamic State Measurement (URTDSM) scheme was discussed. POWERGRID informed that as decided in the Joint meeting of all the five(5) Regional Standing committees on Power System Planning held on 05.03.2012 for development of following analytics in association with premier academic institutions like IIT, activities undertaken with IIT Bombay.

i. Line Parameter Estimation
ii. Vulnerability analysis of distance relays
iii. Linear state estimator
iv. Supervised Zone-3 distance protection scheme to prevent unwanted tripping of backup distance relays
v. CT/CVT calibration
vi. Control Schemes for improving system security (based on angular, voltage and frequency instability)

The aim, deliverables, timelines and cost of each of the above analytics is enclosed (Annex-II). It was informed that these analytics are being developed in association with CEA, POSOCO, CTU/POWERGRID. Director CEA requested POWERGRID to closely associate CEA and POSOCO in the various phases of development. After deliberations, it was also decided that upon certain developments of analytics, same might be informed to the RPC.

Members noted.

17. Dynamic Reactive Power Compensations by STATCOM in Eastern Region

COO(CTU), POWERGRID mentioned that in the last standing committee meeting held on 5-1-2013, procurement and installation of Static Var Compensators(SVC) of ± 400 MVAr capacity at four locations of POWERGRID's substations in ER viz. Rourkela, Kishanganj, Ranchi and Jeypore were agreed. But, technological evaluation on the choice of SVC or STATCOM (Static Synchronous Compensator) was yet to be carried out. In this regard, Director, CEA stated that STATCOM is the state-of-the–art 3rd generation dynamic shunt controller in FACTS family based on the voltage source converter (VSC) technology, whereas SVC is a 2nd generation and relatively old technology. He made a brief presentation on the STATCOM technology and its versatile applications and various merits of the controller over SVC. He stated that STATCOM should be adopted to control system dynamics of the Indian grid. COO(CTU), POWERGRID added that they had detailed discussions with various manufacturers regarding the choice of STATCOM and SVC and also, appointed Dr. Narain G. Hingorani, an expert/Consultant in the field of HVDC, FACTS, Power System as consultant and hold detailed discussion with him in the office of POWERGRID, Gurgaon. In order

to optimize rating of STATCOM at the various locations and economize investment, as advised by the Consultant, hybrid configurations i.e. STATCOM with a co-ordinated control of mechanically switched Reactor and/or Capacitor, have been adopted. STATCOM would be primarily for dynamic compensation while the mechanically switched reactors / capacitors would be for reactive compensation under steady state.

On query from CEO, POSOCO about selection of locations and rating of STATCOMs, it was explained that in addition to the studies conducted earlier with SVC modeling, further detailed dynamic and steady state studies with STATCOM model were conducted jointly by POWERGRID and CEA corresponding to peak and light load conditions of 2016-17 scenario. POWERGRID presented the study results indicating the performance of STATCOM vis-à-vis SVC at 400kV Rourkela, Kishanganj, Ranchi and Jeypore sub-stations. According to the studies, hybrid configurations using STATCOM in combination with mechanically switched Reactors (MSR) and Capacitors (MSC) and co-ordinated control mechanism of MSCs and MSRs were evolved as given below.

Sl. No.	Location /Sub-Station of POWERGRID in ER	STATCOM - Dynamic Shunt Controller (MVAr)	Mechanically Switched Compensation (MVAr)	
			Reactor (MSR)	Capacitor (MSC)
1.	Rourkela	± 300	2x125	-
2.	Kishanganj	± 200	2x125	-
3.	Ranchi(New)	± 300	2x125	-
4.	Jeypore	± 200	2x125	2x125

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After detailed deliberations, members agreed to the above requirements of the dynamic STATCOM controllers with co-ordinated control of the MSCs and MSRs at the aforesaid sub-stations of POWERGRID. As regards funding for the above scheme, Member Secretary I/C, ERPC opined that the source of funding from Govt. of India may be explored.

Annex-I

STANDING COMMITTEE ON POWER SYSTEM PLANNING IN ER
27th Aug 2013 at NRPC, New Delhi

List of Participants

SL.NO.	NAMES S/Shri	DESIGNATION	ORGANISATION
1	K K Arya	Chief Engineer I/C (SP&PA	CEA
2	Dr. R Saha	Director (SP&PA)	CEA
3	P Jindal	Director (SP&PA)	CEA
4	Santosh Kumar	Dy. Dir.	CEA
5	Ugrasen Prasad	Dy. Dir.	CEA
6	Vikas Kr. Sahu	Engr.	CEA
7	Y K Sehgal	COO (CTU)	POWERGRID
8	Ashok Pal	AGM (CTU)	POWERGRID
9	Ramchandra	CE (CTU)	POWERGRID
10	Manish Ranjan Keshari	Engineer	POWERGRID
11	Pratyush Singh	Engineer	POWERGRID
12	NK Jain	GM (Comml)	POWERGRID
13	S K Soonee	CEO	POSOCO
14	K V S Baba	GM	POSOCO
15	S R Narsimhan	DGM	NLDC
16	U R Verma	GM	ERLDC
17	S Banerjee	CM	ERLDC
18	D K Bauri	EE	ERPC
19	B Sarkhel	SE (PS)	ERPC
20	A K Bandopadhay	MS I/C	ERPC
21	S K Singh	MD	BSPTCL
22	Rakesh kumar	Sr. EEE	BSPTCL
23	S P Kazi	Addl. CE	Sikkim
24	P K Pradhan	Dir (Comml)	GRIDCO
25	S R Sarangi	L.O.	GRIDCO
26	B P Mishra	Sr. GM (Elect)	OPTCL
27	S K Das	Dir (Engg)	OPTCL
28	Dinkar Devate	GM (Elect)	NTPC
29	P K Goyal	AGM (PP&M)	NTPC
30	S S Mishra	AGM (Elect)	NTPC
31	Umesh Ambani	DGM (Comml)	NTPC
32	S K Sharma	Mgr. (PE EI)	NTPC
33	Shilpa Aggarwal	Mgr. (Comml)	NTPC
34	P Saha	CE	WBSETCL
35	A Karmakar	SE (CPP)	WBSETCL
36	M Bandopadhyay	Dir (O)	WBSETCL

Annex-II

DEVELOPMENT OF ANALYTICS USING PMU BASED PHASOR MEASUREMENTS

Sl No.	Task	Aim	Deliverables	Est. Cost (Rs. Cr.)	Timeline
1.	Line Parameter Estimation	▪ Estimate & Validate transmission line parameter. Inputs required: ▪ PMU based phasor measurement at both ends of line, bus voltage phasor	▪ Positive and Zero sequence Line parameter estimation (R,X,B) ▪ Errors in line parameters will be logged for information to operator & correction in linear state estimator parameter.	1.20	February 2014
2.	On line vulnerability analysis of distance relays	▪ Development of software for validating distance relay characteristic (Zone-1, Zone-2, Zone-3) in real time basis by superimposing on field setting of distance relays. Inputs required: ▪ PMU based phasor measurement at both ends of line, bus voltage phasor ▪ Distances relay characteristic and settings.	▪ Visualization of relay characteristic and apparent impedance trajectory in the R-X plane. ▪ Alarm / messages when thresholds are violated or apparent impedance is some margin (say 20%) from Zone 1, 2 or Zone 3 characteristics of the relay. ▪ Identification of power swing beyond a configurable threshold due to any disturbance in the system. ▪ Identification of load encroachment condition in the system ▪ Creation & storage of distance relay characteristics of different lines using templates & available settings ▪ Data available in standard format(CSV, excel, comtrade) Trigger input for DSA	1.20	February 2014
3.	Linear State Estimator	▪ Development of 3-phase linear state estimator, software based on weighted least square technique. Inputs required: ▪ PMU based phasor measurement at both ends of line and bus voltage phasor, ▪ ▪ Substation bus switching scheme/topology ▪	▪ Network topology processor to update the bus model ▪ Bad data detection ▪ Topology error detection to identify the switch device errors ▪ Observability analysis to identify maximum observable network with available measurement. ▪ Pseudo & historical measurement generation in case of lack of observability. ▪ Alarms & warnings for model inconsistencies & limit violation. ▪ Network connectivity/graph to provide: ▪ Island details ▪ Issue alarm for loss of connectivity ▪ visualisation by making line dotted/different colour ▪ Component outage ▪ Visualization of state estimator output in tabular & graphical form. ▪ Power system condition can be played-back along with topology connectivity and flow measurement ▪ Three phase State Estimator	6.00	August-2014

4.	Supervised Zone-3 distance protection scheme to prevent unwanted tripping	▪ The analytics will provide adaptive Zone-3 backup protection to avoid unwanted Zone-3 tripping. Inputs required: ▪ PMU based phasor measurement at both ends of line and bus voltage ▪ Distance relay characteristics and settings of candidate line ▪	▪ Identification of presence of persistent fault in the observable system. ▪ Identification of presence of power swing & load encroachment in the observable system. ▪ The software will generate control signal for disabling of Zone -3 protection based on system condition and adopted protection philosophy	2.40	February 2015
5.	CT/CVT Calibration	▪ This module will evaluate the accuracy of these instruments. Inputs required: ▪ PMU based phasor measurement at both ends of line, bus voltage phasor ▪ Benchmarked PT to act as reference ▪ Linear State Estimator	▪ Evaluation of CT/CVT errors in magnitude ▪ Evaluation of CT/CVT errors in phase ▪ Identification of faulty CT/CVT from steady state and transient response ▪ Computation of compensation factors for correcting the steady state response of CT/CVT for state estimation ▪ Verification of measurements against benchmark-CT/CVT ▪ Highlighting the variation using graphs	1.20	May 2015
6.	Control scheme for improving system security (Based on angular, voltage & frequency stability)	▪ The module will continuously monitor and analyse the stability (like voltage & angular) based on the trajectories of various parameters like voltage, current phasors, breaker status etc Inputs required: ▪ PMU based phasor measurement at both ends of line, bus voltage phasor	▪ Based on the analysis of the evolving trajectories a decision on whether to take an automatic control action and its quantum & location shall be taken by such a scheme. ▪ Five such Wide-Area Emergency Control Schemes shall be developed, which will involve appropriate action in any or all regions, adaptively, depending on the event, such as Controlled system separation (adaptive islanding), Adaptation of relays and control systems using wide area Information etc.	5.50	January 2016