Additional Agenda Items for 30th meeting of the Standing Committee on Power System Planning for Northern Region to be held on 19/12/2011

1. Evacuation of power from Sainj HEP

Evacuation of power from Sainj HEP was discussed during the Connectivity/Long term Access Meeting held on 29/12/10, alongwith 29th SCM of NR. During the meeting, it was discussed and agreed that a 400/132kV substation would be created wherein Sainj power would be pooled at 132kV and stepped up to 400kV. Connectivity to ISTS would be by LILO of one circuit of Parbati-II to Parbati-III / Parbati Pooling at proposed 400/132kV substation. The above work was to be carried out by HPPTCL. Now, it is understood that HPPCL have changed the step up voltage to 400 kV instead of 132 kV and intends to carry out the above referred LILO directly at generation project. HPPTCL may confirm the same.

Further, NHPC vide letter dated 29/03/2011, to HPPCL, has indicated that due to various technical constraints, evacuation of power of Sainj HEP (100 MW) through Parbati-II/ Parbati-III is not technically feasible (copy enclosed at **Annexure-1**). They have indicated a constraint in the capacity of the cable at Parbati-III generation. It has been mentioned that the current rating of 400 kV, XLPE cable at Parbati-III switchyard is only 2400 Amps, whereas under contingency of outage of one circuit between Parbati-II to Parbati Pooling Station assuming 0.9 power factor, 0.9 pu voltage & 10% overload generation, the current passing through cable would be 2587 Amps without Sainj generation and 2784 Amps with Sainj generation. Under normal operating condition, no problem is envisaged.

It may be seen that incase of planned common high capacity lines for evacuation of combined generations of HEPs , the rating of switchgear and XLPE feeder cables of the generating station should have been designed equal to the capacity of the power evacuating over head line. Now, in the present case there is no other transmission system available in the vicinity for evacuation of power from Sainj HEP and prima-facie, it appears that the generation of Sainj HEP would have to be evacuated through high capacity Parbati-II / Parbati-III transmission system.

However, considering the constraints of the current rating of 400 kV, XLPE cables provided at Parbati-III HEP, following proposal may be considered:

"Instead of Injection of Sainj power by LILO of Parbati-II – Parbati-III 400kV S/c at Sainj, LILO of Parbati-III – Parbati Pooling Station 400kV S/c at Sainj may be considered. NHPC may ensure that there is no constraint at Parbati-II & III generation switchyards. HPPTCL/HPPCL may ensure that there is no R-o-W problem in construction of the above LILO section."

If the above proposal is also not feasible, the generation at Sainj / Parbati-II and Parbati-III would have to be backed down proportionately incase of contingency of outage of Parbati-II to Parbati Pooling 400 kV circuit. However, occurrence of above situation appears to be very remote as it includes outage of one circuit, 10% overload generation, 0.9 pu voltage and 0.9 power factor.

Member may discuss and concur.

2. Transmission system for Kotlibehl HEP of NHPC

Transmission system for Kotli behl HEP was discussed in the 23rd meeting of the SCM on Power System Planning of Northern Region held on 16/2/2008. A composite 400 kV transmission system for evacuation of Kotlibhel-1A(195 MW), Kotlibhel-1B (320 MW) and Kotlibhel-2 (530 MW) HEPs was evolved.

NHPC vide their letter dated 24/10/2011 informed that Forest Advisory Committee in the meeting held on 30th and 31st May 2011 has recommended clearance only for Kotli Bhel-IA of 195MW and requested for change in step up voltage to 220 kV(copy enclosed at **Annexure-2**). In view of above there is a need to review the transmission system planned earlier.

Keeping in view the reduced generation at Kotlibhel i.e. 195 MW plus 10% overload the connectivity of Kotlibhel may be considered at 220 kV. However, it is proposed that NHPC should apply for connectivity and LTA indicating the time frame, and beneficiaries of the project. Thereafter, the injection point and transmission system for evacuation of power can be evolved.

Members may discuss and concur.

3. Augmentation of Transformation Capacity and provision of additional 220 kV bays in Northern Region

a) Amritsar:

Augmentation of 400/220kV transformation capacity by 1x315 MVA capacity at Amritsar was agreed during the 18th NRPC meeting and during 29th Standing Committee Meeting held on 29/12/2010. PSTCL vide their letter dated 20/06/2011(copy enclosed at **Annexure-3**) desired that the transformer capacity at Amritsar may be changed to 500 MVA instead of 315 MVA due to the load growth in the state. In addition, they have also desired for 3 nos. of 220 kV line bays for drawl of power through 220 kV lines from Amritsar. At Amritsar, space is available for only one additional ICT and after this augmentation no additional ICT can be provided. Considering the request of PSTCL and availability of space, 1 no. of 500 MVA ICT along with ICT bays & 3 nos. of 220 kV line bays has been proposed to be provided at Amritsar.

Members may note

b) Allahabad, Bassi, Meerut and Kishenpur:

Presently Allahabad, Bassi and Kishenpur have a transformation capacity of 2x315 MVA while at Meerut it is 3x315MVA. Loading pattern of 400/220kV ICTs at Allahabad, Bassi, Meerut and Kishenpur Substations of POWERGRID, had revealed consistent loading of more than 200MW on all the ICTs operating at the above Substations. Maximum loading on each ICT at Allahabad had gone up to 294 MW during June 2011, at Bassi, it attained 305 MW on several occasions since October 2010 and at Meerut, it attained 240MW during May 2011. Similarly at Kishenpur Monthly maximum load on each ICT at Kishenpur has exceeded 275MW. Maximum load fed by each ICT at Kishenpur is 300MW. Considering the high loading of existing ICTs, the additional ICT (4x105MVA) at Kishenpur was approved in 21st NRPC meeting while Bassi, Meerut and Allahabad additional ICTs were approved in 24th NRPC meeting. Considering the overall load growth in the region it is proposed to augment the transformation capacity

by 4x105 MVA, ICT at Kishenpur, 1x500 MVA, 400/220 kV ICT each at Bassi & Meerut and 1x315 MVA, 400/220 kV ICT at Allahabad.

Members may note

c) Ludhiana and Moga:

Keeping in view the load growth in Punjab, PSTCL has proposed for an additional transformation of 1x500MVA instead of 1x315MVA at Ludhiana and at Moga existing 3x250MVA transformers may be upgraded to 3x500MVA (copy enclosed **Annexure-4**).

At Ludhiana presently there are 3x315 MVA existing transformers. In addition one spare 1x315 MVA ICT was approved which was to be kept at Ludhiana. This spare ICT was not to be kept under charged conditions and to be utilsied during failures. However, as requested by PSTCL and considering the load growth one additional 1x500 MVA ICT at Ludhiana may be provided. In addition PSTCL has desired for additional 3 nos. of 220 bays. At present there are 6 nos. of 220 kV line bays existing at Ludhiana S/s and additional 3 nos. of 220 kV line bays can be provided with additional 500 MVA ICT.

Regarding Upgradation of Moga ICT, it is to mention that Moga was commissioned in 1994. Hence transformers are about 17 years old. Moga has an existing transformation capacity of 1065MVA, 3x250+1x315MVA. Considering the load growth in Punjab, it is proposed that 2x250 MVA ICT, two out of three may be replaced at Moga with 2x500 MVA ICT, making the total 400/220kV transformation available at Moga as 1565 MVA. It is also proposed that the 2 nos. of 250 MVA ICTs which would be replaced at Moga shall be kept as spare ICTs and shall be utilized incase of failure at any other location. Further PSTCL has requested for two(2) nos of 220kV bays at 220kV Moga substation. Here it is to mention that two nos. of 220 kV line bays can be provided with the above proposed augmentation of ICTs. Accordingly the transformer augmentation and 220kV line bays to be provided are listed below:

400kV S/s	Existing Trf capacity (MVA)	Proposed Augmentation	220kV Line bays to be provided
Amritsar	2x315 MVA	1x500 MVA	4 nos
Bassi	2x315 MVA	1x500 MVA	4 nos
Meerut	3x315 MVA	1x500 MVA	4 nos
Allahabad	2x315 MVA	1x315 MVA	2 nos
Kishenpur	7x105 MVA	4x105 MVA	2 nos
Ludhiana	3x315 MVA	1x500 MVA	3 nos*
Moga	3x250 + 1x315 MVA	2x500 (new)	2 nos

* only 3nos, 220 kV bays can be provided due to space constraint.

Members may discuss and concur.

d) Requirement of 400/220 kV ICTs at other locations

In addition to above, studies have been carried out in the time frame of 2016-17 to work out the requirement of ICTs at other locations also. From the studies following has been observed:

400kV S/s	Trf capacity	MW loading	% loading	Remarks	Aug. proposed	220kV Line bays to be provided
Samba	2x315	565	91%	Under outage of one trf. remaining trf. gets loaded to 368 MW	1x315 MVA (3x105 MVA Single Phase)	2 nos
Jallandhar	2x315	610	95%	Under outage of 315 MVA trf. the remaining 315 MVA Trf. gets loaded to 378MW	1x500 MVA	4 nos
Abdullapur	3x315	718 MW	81%	Under outage of one trf. remaining 630MVA trf.s gets loaded to 643 MW	1x500 MVA	4 nos
Panchkula	2x315	515	81%	Under outage of one trf. remaining 315MVA trf. gets loaded to 354MW	1x500 MVA	4 nos
Gurgaon	2x315	529	83%	Under outage of one trf. remaining trf. gets loaded to 318MW	1x500 MVA	4 nos
Mandaula	4x315	1630		Trf. getting loaded even under base case	1x500 MVA	4 nos
Ballabhgarh	4x315	1260	103%	Trf. getting loaded even under base case	1x500 MVA	4 nos
Hamirpur	2x315	421	73%	Under outage of one trf. remaining 315MVA trf. gets loaded to 332MW	1x315 MVA (3x105 MVA Single Phase)	2 nos

Members may discuss and concur

e) 1x105 single phase spare unit at Wagoora

Presently there are 4 nos. of 315 MVA ICTs (105 MVA, Single Phase units) at Wagoora substation. There is one, 105 MVA spare unit which was provided with the initial two ICTs. For installation of 4th ICT bank additional land was acquired. The spare unit which is available with the earlier 3 ICT banks cannot be used for 4th ICT bank due to the difficulty in mobility of this spare in switchyard and its switching arrangement is also not feasible due to constraints of switchyard layout and orientation.

Keeping above in view, it is proposed to provide one, 105 MVA, 400/220 kV additional spare ICT along with 4th bank of transformer.

4. Creation of 400/220 kV Substation at Patran

Patiala and Sangrur district of Punjab has a lot of agriculture load. To meet the growing load, Punjab has requested a 400/220kV substation at Patran. A partial Grid Disturbance had taken place on 20th July 2011 and POSOCO which had carried out analysis of partial Grid disturbance in Punjab on 20/7/2011 had also proposed a 400/220kV substation in this area **(copy enclosed at Annexure-5)**. Patran is surrounded by 5 nos of 220kV grid stations, namely Mansa, Rajla, Sangrur, Sunam & Patran, having total transformation capacity of 1180 MVA. In addition, 3 nos of 220kV new substations are also coming up in the area, at Pasiana, Bangan & Kakarla. Keeping above in view, it is necessary to establish a 400kV substation in this area. It is proposed to establish new 400 kV S/s at Patran by LILO of Patiala-Kaithal 400kV D/c. To avoid unbalanced loading, LILO of both circuits is proposed. From these substations, 220kV lines can be drawn to new Patran, Mansa, Pasiana etc S/s. Looking into load growth potential it is expected that 800-900MW load would be there in the vicinity. In view of the above it is proposed that 2x500MVA transformers may be considered. Accordingly following is proposed as regional strengthening scheme:

- LILO of both circuits of Patiala – Kaithal 400 kV D/c (Triple) at Patran

- Establishment of a 2x500 MVA, 400/220 kV substation at Patran with 8 nos. of 220kV line bays.

Members may like to discuss and concur.

5. Evacuation of power from RAPP

Power from RAPP-5&6 is presently evacuated through following 400kV lines:

- RAPP-Kankroli 400kV D/c
- RAPP-Kota 400kV S/c

RAPP-5&6 generating station is facing high voltage condition. Under some operating conditions, one circuit of 400kV RAPP-Kankroli D/c is kept open and under such conditions tripping of 400kV RAPP-Kota S/c results into oscillations. To contain the high voltage and improve connectivity following measures have been proposed by NPCIL:

- Preponement of 125 MVAR bus reactor under RAPP-7&8 for early commissioning for containing high voltage
- Installation of transformer at RAPP-5&6 and connecting with existing RAPP-3&4 or Preponement of RAPP-Kota section of RAPP-Jaipur 400kV D/c (with one circuit via Kota) under RAPP-7&8 thus making two numbers of 400kV lines from RAPP to Kota

As per LTA application, RAPP-7&8 generation is scheduled for commissioning in December 2015. NPCIL may confirm the same. Considering the high voltage in RAPP generating complex, it is proposed to pre-pone the commissioning of 125 MVAR bus reactor approved under RAPP-7&8 evacuation system.

Regarding provision of 400/220 kV transformer at RAPP complex, it is observed that with proposed RAPP-7&8 generation even under normal condition there would be injection of power from 400kV RAPP bus into RAPP-3&4, 220 kV bus. Under certain conditions this may result in overloading of 220kV lines from RAPP-3 &4. Further studies carried out for 12^{th} plan end time frame, indicate that with the inter-connection of Anta and Kota by a 400kV S/c, there is injection of power from Anta to Kota and this line gets critically loaded. This may also lead to additional injection into

220kV RAPP bus. NPCIL vide letter 8/12/2011 has also indicated constraints in installation of transformer (copy enclosed at **Annexure-6)**. In view of the above following is proposed:

- Pre-ponement of 125 MVAR bus reactor approved under RAPP-7&8 evacuation system for early commissioning.
- Pre-ponement of RAPP-Kota section of RAPP-Jaipur 400kV D/c (with one circuit via Kota) approved under RAPP-7&8 evacuation system for early commissioning. This will provide two numbers of 400kV lines from RAPP to Kota.

Further, to analyse the critical loading of Anta – Kota 400 kV S/c line, it is proposed that a joint study may be carried out by CEA, RRVPNL and POWERGRID.

Members may like to discuss and concur

6. Evacuation of power from Luhri

SJVNL vide letter dated 03/11/2011, (copy enclosed at **Annexure-7)**, has informed that Luhri generating station would be Air Insulated Substation(AIS) and there would be difficulty in providing 4 nos of 400KV bays for LILO of Rampur – Nalagarh 400 kV D/c line. In this regard, it may be mentioned that during the 29th standing committee POWERGRID indicated tentative evacuation system after the preliminary system studies and It was decided that SJVNL would apply for connectivity and LTA to the POWERGRID (CTU) and thereafter the transmission system for the project would be taken up for consideration of the committee. SJVNL is yet to apply for connectivity and LTA.

Regarding deletion of LILO, it is to mention that in the absence of the proposed LILO, the Luhri generation would be radially connected with a 400 kV D/c line without any anchoring at generation end. The problem of oscillations may arise at Luhri during contingency conditions as experienced by Tehri

machines. However, the evacuation system for Luhri HEP will be finalized after receipt of connectivity and LTA application by CTU from SJVNL.

Members may like to discuss and concur.

7. Proposal for LILO of Jallandhar-Hamirpur 220kV line at Nehrian near Amb by HPSEB

Jullnadhar-Hamirpur 220kV D/c is an ISTS line for facilitating transfer of power to Hamirpur. During the 11th NRPC Meetings held on 06.01.2009 the proposal of LILO of 220 kV Jullundhur - Hamirpur line near Gagret 220/132 kV S/S of Himachal Pradesh was discussed. HPSEB Ltd vide letter dated 22/10/2011 has now intimated that they intend to construct 220/132 kV, 1x160/200 MVA substation by LILO of both circuits of 220kV D/c Jalandhar-Hamirpur at Nehrian near Amb instead of Gagret, (copy enclosed at **Annexure-8)**. This is in addition to the LILO of Jullandhar – Hamirpur (HPSEB) 220 kV D/c line at Hamirpur 400/220 kV (PG) substation as discussed in main agenda item no. 6.0. It is also to be mentioned that the above proposal has been received from HPSEB Ltd.

Members may discuss and concur the proposal.

8. Provision of 400kV bays at Bhinmal and Sikar S/s

The renewable energy development in Rajasthan is as tabulated below.

	Wind	Solar
Rajasthan State Potential	5896 MW	>100000 MW
Installed Capacity of Renewable Energy(March'11)	1397MW	5MW
Capacity Addition Target upto 2013-14	1250 MW	1400MW
Total	2647 MW	1405 MW

Renewable energy addition of the order of 2650 MW is expected in next 3-4 years in Rajasthan. The proposed generation is in six major locations i.e. Ramgarh, Bhadla, Akal, Phalodi, Tinwari, Bapi and Amarsagar. For evacuation of power from these generations, within Rajasthan a composite transmission system has been evolved by CEA & RRVPNL as below:

Transmission Line

- Ramgarh- Bhadla 400kV D/c – 180 km
- Bhadla- Bikaner 400kV D/c – 180 km
- LILO of Jodhpur-Merta 400kV S/c at Bhadla -160 km
- Ramgarh – Akal 400kV D/c- 90 km
- Akal – Jodhpur 400kV D/c(Quad)-240 km
- Bikaner – Sikar(PG) 400kV D/c-210 km
- Barmer – Bhinmal (PG) – 140 km
- LILO of both circuits of Rajsthan West LTPS –Jodhpur line at Jodhpur (NEW)- 10 km
- Strengthening in 220kV and 132kV system

Substation

- Establishment of 3x315 MVA 400/220kV Substation at Ramgarh (Jaisalmer)
- Establishment of 3x315 MVA 400/220kV Substation at Bhadla (Jodhpur)
- 1x500 MVA transformer augmentation at Akal

The system is proposed to be integrated with ISTS at two locations, Bhinmal and Sikar. As the works are to be carried out in existing substation of CTU and is required by 2013-14, it is proposed that the two nos. of 400 kV bays each at Bhinmal and Sikar S/s may be approved as ISTS, under on-going/ approved regional strengthening scheme of Powergrid.

Members may discuss and concur.

----------xxxxx---------