

**Central Electricity Authority
Government of India
System Planning & Project Appraisal Division
Sewa Bhawan R K Puram,
New Delhi -110066**

No.1/9/06-SP&PA/

Dated: 11.06.2009

-As per List enclosed-

Sub: Minutes of the 27th meeting of the Standing Committee on Transmission System Planning of Northern Region held on 30th May, 2009 at 1000 Hrs. in Nainital, Uttarakhand.

Sir,

Please find enclosed the minutes of the 27th meeting of the Standing Committee on Transmission System Planning of Northern Region held on 30th May, 2009 at 1000 Hrs in Nainital, Uttarakhand. This is for your kind information and further necessary action at your end please. **The minutes is also be available on CEA website under PS wing/standing committee meeting/NR.**

Yours faithfully

**(Naresh Bhandari)
Director (SP&PA)**

List of Addresses-

1	Member Secretary NREB, 18-A Shajeed Jeet Singh Sansanwal Marg, Katwaria Sarai, New Delhi - 110016	2	Director (Projects) NTPC, NTPC Bhawan, Core 7 Scope complex – 6, Institutional Area, Lodhi Road, New Delhi - 110003
3	Director (Technical) NHPC Office Complex, Sector – 33, NHPC, Faridabad - 121 003	4	Director (Projects) POWERGRID, Saudamini, Plot no. 2, Sector - 29, Gurgaon-122 001
5	Sr. Vice President, PTC Ltd, 2 nd floor, 15 NBCC Tower, Bhikaji Cama Place, New Delhi - 66	6	Member (Transmission) HPSEB, Vidyut Bhawan, Shimla - 171 004
7	Director (Transmission) UPPCL, Shakti Bhawan Extn, 3 rd floor, 14, Ashok Marg, Lucknow - 226 001	8	Director (Transmission) Urja Bhawan, Kawali Road Dehradun, Uttaranchal - 248 001
9	Director (Projects) DTL, Shakti Sadan. Kotla Road New Delhi - 110 002	10	Member (Transmission) PSEB, Mall road, Patiala - 147 001
11	Director (Projects) HVPNL Shakti Bhawan, Sector -6 Panchkula - 134 109	12	Director (Transmission) RVPNL, Vidyut Bhawan, Janpath, Jyoti Nagar, Jaipur, Rajasthan
13	Development Commissioner (Power), J&K, Exhibition Ground, Near New Secretariat, Srinagar - 190 001	14	Member (Power) BBMB, Sectot-19 B Madya Marg, Chandigarh-160019
15	Chief Engineer (Transmission) NPCIL, 9- S-30 Vikram Sarabhai Bhawan, Anushakti Nagar, Mumbai - 400 094	16	Chief Engineer (Operation) Ministry of Power, UT Secretariat Sector - 9 D Chandigarh - 161 009

Minutes of the Meeting of the 27th Standing Committee on power system planning of Northern Region held on 30th May 2009 at Nainital, Uttarakhand

The 27th Standing Committee on power system planning of NR was held on Saturday the 30th May 2009 at Nainital, Uttarakhand. The list of the participants is at **Annex-I**.

Executive Director (NR-I), Powergrid welcomed Member (PS) and other participants to the 27th Standing Committee meeting of Northern Region Transmission Planning. Member (PS), CEA welcomed the participants to the 27th meeting for transmission system of Northern Region. He also thanked Powergrid for hosting the meeting.

In the opening remarks, Member (PS) CEA mentioned that many IPPs were coming with new generation projects & uncertainty in materialisation of generation projects was increasing day by day. The total generation envisaged including the ones proposed by the IPPs has exceeded the requirement for meeting the projections of 17th EPS. The transmission planning execution considering the generation addition, which was much more than the requirement and uncertainty involved in coming up of private generation was becoming more complex and challenging. However, these were potential projects and developers were pursuing with activities of land acquisition, MOEF clearance, coal linkage, water tie up etc. but they were not sure of beneficiaries of their generation in view of current Tariff Policy which envisaged procurement of power by the distribution utilities through competitive bidding route (Case-I). However, as per CERC regulation, developer is to specify region where its power is going to be absorbed. Most of the IPPs in pipeline, located outside NR have shown inclination to sell power in NR and with the result large quantum of power would flow towards NR. These generation projects would come in phases and therefore transmission system was to be planned and implemented in phased manner. He requested all the Constituents to consider the issue of transmission development linked to such IPPs in a broader perspective as time available is less and contractors and vendors in transmission sector were limited. Financial institutions would also require time in sanctioning of loan to the developers.

He further emphasized the need for development of Master Plan for evacuation of power from various pockets, which could be implemented in phases.

He further stated that EA-2003 empowered the STUs to develop their own transmission system but at the same time it has to fit into regional transmission system. CEA has developed Master Plan for states of Himachal Pradesh and Uttarakhand for evacuation of power from future projects, in consultation with them and the beneficiaries of NR. The plan has been uploaded on the website of CEA. He stated that the master plan should not be changed by the state on its own as due to uncertainties the developer of the generation project was likely to suffer and could become detriment for developers to take up new hydro projects in the State.

The agenda items were thereafter taken up for discussion.

1. Confirmation of minutes of 26th meeting held on 13.10.2008

Minutes of 26th meeting as issued vide letters dated 27.10.2008 together with corrigendum as brought out in agenda note for 27th meeting were confirmed. Both minutes and corrigendum are given in CEA website.

2. Status of Projects approved in the SCM/RPC

Powergrid furnished the status of transmission schemes in Northern Region, placed at **Annex-II**. Member (PS) observed that the information should be furnished by Powergrid within a week's time after issue of Agenda for the meeting so that the Constituents could go through and in case any modification in target dates is required the same could be discussed. Powergrid agreed and assured to make available the information on its website immediately after issue of agenda note.

3. System strengthening scheme in Punjab

As brought out in agenda, PSEB had indicated additional bays requirement at various 400 kV regional S/S located in Punjab, in line with the decision taken in the 23rd Standing Committee Meeting of Northern region held on 16.02.08 wherein 6 nos. of 220 kV bays to be provided with 2x315MVA transformer and 4 nos. of 220 kV bays with 500 MVA transformer were agreed.

PSEB subsequently informed that in view of CERC regulation – ICT and below system is to be paid by the concerned beneficiary- they were reviewing their requirement and requested to withhold the agenda.

Member (PS) stated that CERC is looking into transmission pricing afresh and discussion paper on apportioning of transmission charges has been issued and public comments have been sought. The proposed approach is broadly towards National Pool and if implemented would result in major shift in payment of transmission charges. He said that PSEB should look into its requirement in the time frame as nearly 24 months are required to complete 220 kV bays. PSEB stated that they would revert back in one month.

RRVPNL stated that requirement of 220 kV bays are going to increase and therefore decision taken in 23rd SCM should be implemented in standard design of S/S. Member (PS) agreed to keep provision but implementation can be done if requirement is indicated in advance.

4. Evacuation of power from Kutehr HEP (260 MW) in the upstream of Chamera III HEP

Member (PS) informed that for evacuation of power from various hydro projects in Himachal Pradesh a master plan was prepared. In line with the master plan during the 23rd Meeting of the Standing Committee for planning of transmission system in NR, it was decided that in phased development, pooling station upstream of Chamera-III would be constructed by PGCIL as a regional pooling station. It was also agreed that power from Kutehar would be injected at 220 kV level at this new pooling station.

Further for evacuation of power from Budhil project it was agreed to LILO one circuit of Chamera-III – Chamera Pooling station 220 kV D/c line (with Twin Moose conductor) at Budhil. It was further informed that HP has changed the mater plan and now proposed two nos. of 220 kV D/c lines instead of 3 nos. of 220 kV D/c lines and also they intend to establish 220 kV pooling station at Lahal which is close to Kutehar HEP. Member (PS) explained that considering the overall power flow requirement of about 1000-1100 MW, 2 nos. of 220 kV D/c lines would not be adequate and proposed that line from Lahal to Chamera pooling station should be a 400 kV D/c line, this would optimize ROW – the requirement of Forest Department of HP. For connectivity of Kutehar it was proposed that a 220 kV D/c line can be constructed by the project developer upto Lahal Pooling station.

For evacuation of power from Budhil two options were discussed i.e. either they should carry out the LILO of Chamera-III – Chamera Pooling station 220 kV D/c line with Twin Moose conductor or they can construct 220 kV S/c line upto Chamera-III utilizing one 220 kV bay at Chamera-III, space for which is available at Chamera-III. It was also informed that second option would not provide any reliability, however it was to be decided by the generation developer.

Further it was also informed that above issue had already been discussed in a meeting held in CEA on 18.5.2009 wherein representatives from HP, Lanco, Kutehar & Powergrid were present.

Powergrid informed that they have received Long Term Open Access Application from the developer of Kutehar HEP & beneficiaries of the project are Northern Region Constituents and since system has already been decided, it was proposed to grant the LTOA. It was agreed by the constituents.

Concluding the discussions, following were agreed:

i) Lanco to confirm about the connectivity of Budhil HEP to Chamera III transmission.

ii) HP would establish a 400/220 kV substation at Lahal in the time frame of Kutehar HEP which would be connected to Chamera Pooling Station by a 400 kV D/c line. Initially this line would be charged at 220 kV level and subsequently with the coming up of more generation this line can be charged at 400 kV level ensuring that the ICTs (2x315 MVA) at Chamera II Pooling station are not overloaded.

iii) CTU can grant LTOA to M/s JSW (developer of Kutehar HEP)

5. Modification of 220 kV transmission line from NTPC Faridabad to Samaypur S/S of BBMB – Regarding power evacuation constraint

Member (PS) informed to the constituents that NTPC has requested that one of the 220 kV Samaypur- Ballabgarh line be bypassed at Samaypur and connected directly to one of the 220 kV Faridabad - Samaypur line, thus creating a alternative route for power evacuation from Faridabad GPP as Faridabad GPP has witnessed several station blackouts on account of major failure at Samaypur S/S.

HVPN informed that they would be establishing Nawada 400 /220 kV substation which would be connected to Palla 220 kV substation via intermediate 220 kV substations. Hence, this would provide desired outlets for reliable evacuation of power from Faridabad GPS even under contingency. Member (PS) enquired about the time frame of Nawada & other 220 kV substations. HVPNL informed that these substations are likely to materialize in about two years.

The proposal was further deliberated in detail and it was observed that there would not be any major advantage in the proposed realignment and this problem would be overcome after the commissioning of Nawada & its connectivity with Palla substation.

Keeping above in view it was decided to drop the proposal.

6. System strengthening of Haryana

6.1 Temporary arrangement for LILO of Moga-Hissar at Rajiv Gandhi TPS (Khedar) for Testing & commissioning power

HVPNL indicated that Rajiv Gandhi Thermal Power Project (Khedar) at Hissar with installed capacity of 2x600 MW was at advanced stage and the first was planned to be commissioned three months ahead of schedule i.e. in September 2009. The 400 kV transmission system associated with RGTPP comprises 400 kV RGTPP – Kirori (HVPNL) D/C line and 400 kV RGTPP – Nuhiyawali (Sirsa) (HVPNL) D/C line with LILO of one circuit at Fatehabad (PGCIL). This system would match with the revised schedule of RGTPP (Khedar) and requested that a temporary arrangement for energization of 400kV switchyard at RGTPP be made by LILO of one circuit of existing Powergrid's 400kV Hisar-Moga D/C line which was passing at about ½ km distance from said plant.

RRVNL stated that the proper coordination of protection system should be done with above arrangement. HVPNL stated that this temporary arrangement would be done at their cost and this would be required maximum for six months. The Committee approved the above temporary arrangement.

6.2 Feeding arrangement for 400 kV substation Nawada

In the last meeting, it was deliberated that to contain short circuit level in the NCR area, Dadri - G.Noida/Maharani Bagh – Nawada –Samaypur 400 kV to be kept open from Delhi ring at samaypur. HVPNL has raised concern that 400kV substation at Nawada and Maharani Bagh would become radial after opening of Dadri-G. Noida/M.Bagh – Nawada – Samaypur line at Samaypur and this would causes reliability problem. HVPNL suggested that Nawada – Samaypur and Maharani Bagh – Samaypur line sections at Samaypur may be solidly joined after opening of these lines at Samaypur.

It was clarified that this issue has already been considered. 400 kV D/C line would be taken on same dia from Ballabgarh side. Greater Noida, Nawada and Maharani Bagh are considered to be interconnected at Ballabgarh through tie breaker. Main breakers shall normally remain open. In case of any requirement of alternate supply, the main breakers at Ballabgarh shall be closed.

The above proposal was agreed to.

7.0 Augmentation of Transformation Capacity at Maharani Bagh Substation

400/220 kV substation at Maharani Bagh was established under Tala project as an associated system for absorption of power in Delhi system. The substation has been planned with 4x315 MVA 400/220 kV ICTs. Against this, the substation has at present only 2x315 MVA 400/220 kV ICTs. With increase in loading, it was proposed that the transformation capacity be augmented by 2x315 MVA 400/220 kV ICTs at Maharani Bagh substation, under Regional transmission projects, to cater to increasing load.

Powergrid suggested that considering the load growth we should provide 500 MVA ICT instead of 315 MVA ICT, which was agreed by the constituents.

After detailed discussions following scheme was agreed by constituents:

Northern Region System Strengthening – XXIII

- Augmentation of 400/220 kV transformation capacity by 2x500 MVA at Maharaniabagh

8.0 Transfer of Power from Lucknow 765/400 kV substation towards Western part of Northern Grid

Member (PS) informed that there was need for system strengthening for transfer of power beyond Lucknow towards western part of the grid as for injection of power at Lucknow (PG) there were six number of 400 kV lines and one no of 765 kV line which were either existing or under implementation, whereas for transfer of power beyond Lucknow, lines would be available at much later stage. Powergrid explained the detailed requirement and presented the system studies. MS, NRPC also informed that the corridor beyond Bareilly is stressed even in the present scenario.

Member (PS) informed that in the time frame of Barh-II, Tillaiya, Nabinagar Lucknow – Bareilly – Meerut 765 kV S/c line was under planning (in addition to Lucknow – Bareilly – Meerut 765 kV S/c line which was proposed with North Karanpura under private sector) and as per present proposal there was a requirement of preponement of the Lucknow – Bareilly 765 kV section. 765 kV Bareilly – Meerut line was preferred to be deferred and instead a new 400 kV corridor was proposed.

Considering the power flow requirement in this corridor, it was suggested that this 400 kV line corridor should be constructed with Quad conductor.

Concluding the discussions following regional transmission strengthening scheme was concurred by the constituents.

Northern Regional System Strengthening Scheme – XXI

- Lucknow - Bareilly 765 kV S/c line
- Bareilly – Kashipur – Roorkee – Saharanpur 400 kV D/c (Quad)
- Establishment of 2x1500 MVA, 765/400 kV substation at Bareilly

9.0 Tehri PSP Transmission System

Powergrid explained that the transmission system to be associated with Tehri PSP was discussed and agreed during the 18th Standing Committee Meeting of Northern Region Transmission Planning held on 06.06.2005 and following transmission system was agreed:

- Tehri Generation – Tehri Pooling Stn. 400 kV (Quad Conductor)
- LILO of Bareilly – Mandaula 400 kV D/c at Meerut
- Charging of Tehri Pooling – Meerut line at 765 kV by establishment of 765/400 kV, 3x1500 MVA substations at Tehri Pool (due to Space constraints, Tehri Pooling station would be GIS) & Meerut.
- Modification of Series Capacitors for operation at 765 kV level

Out of the above transmission system, following transmission elements have been agreed as a part of System Strengthening in Central Part of Northern region during the 26th Standing Committee Meeting:

- LILO of Bareilly – Mandaula 400 kV D/c at Meerut
- Charging of Meerut substation at 765 kV level with 2x1500 MVA transformation capacity

Keeping above in view following transmission system was proposed to be taken up with Tehri PSP

- Tehri Generation – Tehri Pooling Stn. 400 kV (Quad Conductor)
- Establishment of 765/400 kV, 3x1500 MVA GIS substation at Tehri Pool
- Augmentation of 765/400 transformation capacity by 1x1500 MVA at Meerut
- Charging of Tehri Pooling – Meerut line at 765 kV level
- Modification of Series Capacitors for operation at 765 kV level

RVPN enquired about the requirement of series compensation at 765 kV level. Member (PS) explained that the total generation to be evacuated over two 765 kV ckts was of the order of 3400 MW and considering the outage of one ckt there is a requirement of series

compensation. It was also explained that the series compensation equipment had been provided with to increase the height of insulated platform required for 765 kV and no other changes were required.

The above was noted & concurred by the constituents.

10. Establishment of Samba 400/220 kV Substation in J&K and Provision of Second 400 kV S/c for reliable evacuation of power from Dulhasti HEP

Member (PS) informed that establishment of 2x315MVA, 400/220 kV substation at Samba in Jammu region was agreed in the 26th Standing Committee meeting of Northern Region Transmission Planning. However, 400 kV connectivity was to be decided after a survey. Based on the information from site, Samba is situated south of Kishenpur substation at a distance of about 35 km. To provide connectivity to Samba, Kishenpur – Samba 400 kV D/c line was proposed.

Further, the issue of provision of 2nd 400 kV outlet from Dulhasti was discussed in the 23rd Standing Committee of Northern Region Transmission planning. During the meeting it was proposed to link the 2nd 400 kV circuit from Dulhasti with Ramban. However, it appears that Ramban substation would come up at a much later stage and therefore 2nd 400 kV outlet from Dulhasti towards Samba was proposed.

Keeping above in view following transmission scheme was proposed:

Northern Region System Strengthening-XXII

- Establishment of 2x315 MVA, 400/220 kV substation at Samba
- Kishenpur – Samba 400 kV D/c line
- Dulhasti – Samba 400 kV S/c line

The above transmission scheme was agreed and concurred by the constituents.

11. Augmentation of Transformation Capacity at Bahadurgarh and Lucknow

CEA informed that 400/220 kV substations at Lucknow & Bahadurgarh were established with Tala Main and Tala Supplementary transmission Schemes respectively. At both these

substations only 1x315 MVA ICTs at 400/220 kV level were provided and with the outage of this single ICT, the 220 kV connectivity with 400 kV bus was lost. Accordingly to provide the required level of reliability at these substations, augmentation of the transformation capacity at both these substations was proposed.

Powergrid suggested that considering the load growth in towns we should provide 500 MVA ICT instead of 315 MVA ICT, which was agreed by the constituents.

Powergrid informed that there is an urgent requirement of one spare ICT in NR-II as failure of any ICT results into overloading of existing ICTs / restrictions of supply as it takes about 15 months for repair of the failed transformer.

The Committee generally agreed for procurement of spare transformer. However, the members observed that this spare transformer would normally be in circulation. After discussion, it was decided that Powergrid would examine the issues of availability linked incentive of spare transformer as well as of the transformers which would be replaced with this spare transformer and the place where the spare transformer would be kept when not in use. The Powergrid would put up a consolidated proposal in the next meeting.

After detailed discussions, following scheme was agreed by constituents:

Northern Region System Strengthening – XXIII

- Augmentation of 400/220 kV transformation capacity by 1x500 MVA at Lucknow
- Augmentation of 400/220 kV transformation capacity by 1x500 MVA at Bahadurgarh

12. Connectivity with HVDC Bipole Terminal at Mohindergarh

Member (PS) explained that following connectivity at Mohindergarh HVDC bipole was discussed and agreed in the 26th Standing Committee Meeting of Northern Region Transmission Planning:

- LILO of the one circuit of Bhiwadi – Moga 400 kV D/c line at Mohindergarh HVPNL and LILO of other circuit of Bhiwadi – Moga 400 kV D/c line at Mohindergarh HVDC terminal of Adani
- Mohindergarh HVDC Terminal – Mohindergarh HVPNL 400 kV D/c (Triple)

The network configuration was revisited as with the above arrangement, 2 HVDC terminals i.e. Bhiwadi and Mohindergarh would get into direct connectivity which may cause interaction and control problem as any fault in one HVDC system/connected AC system may trigger problem in other HVDC system. In order to avoid direct connectivity, instead of LILO of Bhiwadi – Moga line, a 400 KV DC line could be constructed from Mohindergarh to Bhiwani where Powergrid was establishing a new 765/400 KV substation. Member (PS) stated that instead triple conductor line, Adani Power Limited should have Mohindergarh HVDC – Mohindergarh HVPNL line as quad considering the power flow requirement to Haryana

The Committee approved the following revised transmission system:

- Mohindergarh HVDC Terminal – Mohindergarh HVPNL 400 kV D/c (Quad conductor) – by Adani Power
- Mohindergarh HVDC Terminal – Bhiwani (new) 400 kV D/c – by Adani Power
- Mohindergarh HVPNL – Jhajjar Stage-II (2x660 MW) 400 kV D/c – by HVPNL

The above issue was also discussed during the Long Term Open Access Meeting held on the same day immediately after the 27th SCM wherein APL representative stated that the commissioning schedule of HVDC station was April, 2011 and the connectivity was required by that time. As Bhiwani 765/400 KV was a new substation, suitable arrangement for providing connectivity ahead of commissioning of Bhiwani substation would be required.

Powergrid stated that investment approval & award of Bhiwani S/S was in process and it would take around 3 years for the new S/S. Member (PS) stated that Bhiwani (new) S/S of Powergrid is also to be connected through LILO of Bahadurgarh – Hissar 400 KV line. It was suggested that Powergrid should take up the works on their LILO line on priority so as to provide connectivity to Moindergarh – Bhiwani line of APL directly by connecting to the LILO line. With this arrangement, M/s Adani would get reliable connectivity to the grid for safe operation of their HVDC line in the event of outage of Mohindergarh-Mohindergarh (HVDC) line. Subsequently, when Powergrid's Bhiwani substation was completed, the arrangement as per the planned system may be implemented.

13. Sasan / Vindhychal pool connectivity / Power evacuation system from Rihand III TPS (2x500 MW)

Member (PS) stated that NTPC had raised the issue of short circuit level exceeding the permissible limit at Vindhychal (I, II & III) bus due to its interconnection with Sasan generating station through LILO of Vindhychal- Jabalpur 400 kV D/C at Sasan as agreed under Sasan transmission system and it was decided that the same would be studied. Accordingly, the same had been examined and it is found that LILO of Vindhychal-Jabalpur at 400 kV Sasan could be initially established for supply of start up power and evacuation of power from the initial units at Sasan and at a later date discontinued (through suitable switching arrangement) after establishment of 765/400 kV Vindhychal pooling station but before commissioning of all units of Sasan. To keep the connectivity of Sasan and Vindhychal pooling station, Sasan-Vindhychal pool 765 kV S/C line could be established as a new transmission line to be included under common transmission system for NR and WR.

NTPC proposed interconnection at 400 kV level between Sasan and Vindhychal pooling point in addition to interconnection at 765 kV level in order to provide reliability to the transmission of both Sasan and NTPC projects. It was observed that with the provision of 400 kV D/C interconnection, one 1500 MVA, 765/400 kV ICT at Vindhychal pooling could be dispensed with at this stage as already 2x1500 MVA 765/400 kV ICTs were planned at Sasan switchyard.

Member (PS) stated that Vindhychal-IV, Rihand-III and Aryan Coal were presently proposed to be connected to 765/400 kV Vindhychal pooling station. As the generators would be coming in different time frame, the transmission system from Vindhychal pool onwards up to Gwalior would need to be initially operated at 400 kV to avoid reactive power management problem. He suggested the following phasing of transmission system interconnected from Vindhychal pool.

- (i) When the initial unit at Vindhychal-IV and Rihand-III generation are commissioned they could be connected to Vindhychal Pooling point and the Vindhychal Pooling-Satna-Gwalior 765 kV link is charged at 400 kV level.

- (ii) In this time frame few units at Sasan would only be commissioned and there would not be any short circuit level problems at Vindhachal 400 kV generating bus due to LILO of Vindhyachal- Jabalpur 400 kV D/C at Sasan.
- (iii) When the entire planned generating stations connected to Vindhyachal pooling station were commissioned, at that stage the Vindhyachal Pooling- Satna-Gwalior link can be charged at 765 kV level along with interconnection of Sasan-Vindhyachal 765 kV S/C.
- (iv) After charging at 765 kV level the LILO of Vindhyachal – Jabalpur 400 kV D/C line at Sasan could be disconnected with suitable switching arrangements at Sasan 400 kV switchyard to meet its starting power requirements in future.

Members were in agreement with the above phasing of works and decided that following works could be taken up as a separate project associated with Rihand-III.

Rihand-III Transmission System

Part-I : Generation specific Transmission System – To be Shared by NR

- Rihand-Vindhyachal pooling 2xS/C 765kV (op. at 400kV)

Part-II : To be shared by NR-WR in proportion to allocation of power

- Vindhyachal Pool – Satna 765kV 2xS/c
- Satna – Gwalior 765kV 2xS/c
- 765/400kV 2x1500MVA Plg S/s near Vindhyachal
- Sasan-Vindhyachal Pool 765kV S/c line
- Sasan-Vindhyachal Pool 400kV D/c line

Note: Switching arrangement at Sasan should be made in such a way so that LILO of Vindhyachal-Jabalpur 400 kV D/C at Sasan remains bypass from Sasan S/Y in normal operating condition, however, the same can be utilized during requirement of start up power.

Part –III : NR Strengthening in Regional Pool

- Gwalior – Jaipur 765kV S/c
- 765/400 kV, 2x1500 MVA S/s at Jaipur (Bassi)

14. Transmission System Associated with the Tilaiya Ultra Mega Power Project (4000 MW), in Jharkhand, Nabinagar (1000MW) of Railways and NTPC, Barh-II (1320 MW), and IPPs in Jharkhand, Orissa, MP, Chattisgarh, and Maharashtra”

Member (PS) explained that many new generation projects were coming up under Central sector and in Private Sector and a large quantum of power was targeted to be sold in Northern region. As per broad estimates power of the order of 51000 MW has been targeted to be sold in Northern regions from other regions. It was further informed that these IPP generation projects would come up in a phased manner and it was necessary to develop the transmission system in Phased manner. It was also explained that initially power import of the order of 18000-19000 MW (additional) shall be considered in the first phase. It was explained that master plan has been developed in association with Powergrid for transfer of power from these IPPs. It was stated that the system required for evacuation of power from IPPs was proposed to be developed by Powergrid after taking financial commitments from the IPPs and State utilities shall not be paying the transmission charges till power allocation to them is firmed up.

RVPN stated that they are not aware of such large quantum of import of power requirement as none of the IPPs have approached them for sale of power in their state.

Member (PS) explained that most of the IPPs have not yet firmed up their beneficiaries and also the generation capacity being stated to be implemented for 11th plan / early 12th plan is much in excess of the load demand projected by the state utilities. The figures given in the agenda were based on the target allocation as indicated by the IPPs.

It was further explained that NTPC was setting up Rihand-III & Barh-II, Nabinagar were being implemented as a JV of NTPC & Railways and Tillaiya as UMPP was planned to be implemented. The first unit of Rihand-III has been targeted for commissioning by August 2011 and power from the project would be allocated to Northern region.

Further the details of the projects coming up in Eastern, Western and Southern regions with target beneficiaries have already been given in the agenda.

Subsequently the transmission system Barh-II, Tillayia, Nabinagar etc and various IPPs was deliberated in detail. The details of transmission system, deliberations, and sharing of transmission charges are enclosed at **Annexure-III**.

Additional Agenda

15. Member (PS) stated that following agenda have been proposed by NRLDC to facilitate Grid Operation.

15.1 Enhancing System Reliability by LILO of 400 kV Dehar-Bhiwani and 400 kV Dehar-Panipat

It was explained that LILO 400 kV Dehar-Bhiwani at 400 kV Patiala (PG) or 400 kV Kaithal (PG) and the 400 kV Dehar-Panipat LILO at 400 kV Abdullapur (PG) or 400 kV Panchkula has been proposed to provide sufficient anchoring and control the voltage at Dehar.

Powergrid informed that provision of 125 MVAR bus reactor would be a good solution to control the overvoltage in addition to the proposed LILO. It was also informed to the constituents that there are space constraints at Patiala.

BBMB stated that these are space constraints at Dehar to provide a Bus Raector.

PSEB stated that instead of Patiala S/S, the LILO can be done at their proposed Rajpura 400 kV S/S or some other S/S, the exact location would be informed shortly.

RRVNL stated that proposed LILO at Panchkula and Rajpura would provide connectivity to Haryana and Punjab and therefore only they should share the cost. The members from PSEB and HVPNL agreed to it. The Committee agreed for LILO of 400 kV Dehar-Bhiwani at 400 kV Rajpura or location as intimated by PSEB and the 400 kV Dehar-Panipat to be LILOed at 400 kV Panchkula (To be commissioned).

After detailed deliberation, PSEB and HVPN stated that they would revert back on the issue after detailed analysis.

To contain over voltage, Member (PS) enquired from BBMB whether they could operate machines at Dehar in synchronous mode or change GT tap position. Chief Engineer, LD, BBMB stated that he would revert back. It was decided that NRPC would collect the information from PSEB and BBMB and forward to CEA.

15.2 Enhancing Reliability of Generation at Narora Atomic Power Station

CEA informed that as per NRLDC there are Network related constraints which are being faced in western UP. Also, low voltage problems are being faced. It was further informed that there are overloadings of the 220 kV system in this area. Member (PS) requested UPPCL to respond on the issue. UPPCL stated that they would submit the detailed plan alongwith the time frame of implementation for overcoming the shortcomings to CEA and thereafter these would be discussed in the Standing Committee.

15.3 Enhancing Reliability of Generation at Paricha Thermal

It was brought out that the primary reason for frequent outage of Paricha Thermal power station is the transmission inadequacy. Evacuation of Paricha generation was through 220 kV Paricha-Mainpuri via Saifai S/C and 220 kV Paricha-Mainpuri via Orai. Frequent trippings are observed on this line.

UPPCL informed they have also planned 400 kV system from Paricha. In addition, 400 kV substations have also been planned at Orai and Mainpuri. UPPCL informed that frequent trippings were due to malfunctioning of protection at Paricha and this has now been rectified

15.4 Overloading of 2x315 MVA, 400/220 kV ICTs at Bassi as well as Bhiwadi

Member (PS) informed that load growth in Rajasthan is resulting in overloading of ICTs at Bassi and Bhiwadi during winters. Further, parallel operation of 220 kV Bhiwadi-Rewari line is also getting delayed due to anticipated overloading of 2x315 MVA, 400/220 kV ICT at Bhiwadi. The third 315 MVA ICT at Bhiwadi was approved in the 26th Standing Committee Meeting on Power System Planning of Northern Region. It was further stated that NRLDC has requested that transformer needs to be in place by 31st October 2009.

Powergrid informed that the scheme was agreed only during the last Standing Committee meeting, feasibility report for the scheme was under preparation and it would take about 30 months to implement. CEA suggested that possibility of diversion of some ICT to Bhiwadi should be explored for early commissioning. The overloading of ICTs at Bassi would be contained with commissioning of Jaipur (south) 765/400 kV S/S.

15.5 Network Constraints in Uttarakhand

It was pointed out by NRLDC that connectivity of Uttarakhand power systems with ISTS at 400 kV level is through 400 kV Moradabad-Kashipur and 400 kV Muzaffarnagar-Rishikesh system. Outage of any one of these circuits would result in severe constraints in Uttarakhand system.

POWERGRID clarified with the strengthening scheme proposed above during this meeting, additional connectivity shall be provided to Uttarakhand. Member (PS) stated that Uttarakhand also should take up the strengthening of sub-transmission network in their state.

16. Evacuation of power from generation projects coming up in Sikkim and Bhutan

Member (PS) informed that a lot of hydro generation was coming up Sikkim, NER and Bhutan. It was further informed that about 4000 MW generation is coming up in NER, about 2400 MW generation was coming up in Sikkim (considering priority projects) and about 1200 MW (Punatsangchu-I HEP) was coming in Bhutan. The other future projects in Bhutan like Mangdechu (670MW) and Punatsangchu-II (990 MW) are expected to be commissioned by 2016. The Lower Subansiri HEP and Kameng HEP projects in NER are expected to be commissioned in 2012-13. In order to evacuate the power from the generation projects in NER, Sikkim and Bhutan, a comprehensive transmission scheme had been evolved which consisted of Bishwanath Chariyali(NER) - Agra(NR), +/-800kV, 6000MW HVDC bipole line with 3000MW HVDC converter stations at Bishwanath Chariyali and Agra proposed under "NER – NR/WR Interconnector-I" initially which has already been concurred by the constituents of NR and WR. The balance portion of the scheme consisted of 3000MW converter station each at a suitable location near Alipurduar and Agra along with loop-in & loop-out of 6000MW HVDC bipole line at Alipurduar.

Power from generation projects coming up during 2011-13 in Sikkim was to be brought to Kishanganj, a pooling substation in the north of West Bengal/Bihar, through substations at Melli & Rangpo in Sikkim. From Kishanganj substation power would be further transferred through AC lines like LILO of Siliguri-Purnea 400kV D/c lines at Kishanganj and Kishanganj-Patna 400kV D/c lines. It was also explained that the HVDC station was proposed at a pooling station near Alipurduar in North of West Bengal so as to pool power from Punatsangchu-I HEP in Bhutan as well as from generation projects in Sikkim, thereby optimizing the utilization of Right-of-Way.

The transmission system for evacuation of the above projects has been divided into three parts. The first part is for evacuation of power from the first two projects in Sikkim i.e. Chuzachen (99 MW) and Teesta-III (1200 MW). The 2nd part would be for evacuation of the next 1100MW of power i.e. total 2400MW from Sikkim generation projects. The 3rd part would provide the corridor towards NR/WR with adequate reliability and security for the above generation projects in Sikkim as well as help in evacuation of power from Phunatsangchu-I generation project in Bhutan and also initial evacuation of future generation projects in Bhutan like Punatsangchu-II, Mangdechu etc.

The details of the transmission system are given below.

(i) By 2011-12, for evacuation of 1300 MW from Sikkim

Part-A: Transmission System for development of pooling station at Kishanganj in Northern part of West Bengal/Bihar

- Establishment of new 2x315 MVA, 400/220kV sub-station at Kishanganj
- LILO of Siliguri (Existing) – Purnea 400kV D/c line(quad) at new pooling station Kishanganj
- LILO of Siliguri (Existing) – Purnea 400kV D/c line(on which reconductoring is being carried out) at Kishanganj with the higher capacity(HTLS) conductor
- LILO of Siliguri – Dalkhola 220kV D/c line at new pooling station at Kishanganj
- LILO of Gangtok-Melli 132kV S/c line upto Rangpo, where Chuzachen-Rangpo 132kV D/c would be connected so as to form Chuzachen-Gangtok and Chuzachen-Melli 132kV S/c lines.

(ii) By 2012-13, when additional 1100 MW materializes in Sikkim

Part-B: Transmission System for development of pooling substations within Sikkim and transfer of power to a new pooling station Kishanganj in northern Part of West Bengal/Bihar

- Establishment of 220/132kV, 3x100MVA Gas Insulated Substation at Rangpo
- Establishment of 10x167MVA, 1 phase, 400/220kV Gas Insulated substation at New Melli
- LILO of Teesta III – Kishanganj 400kV D/c line at New Melli
- Rangpo – New Melli 220kV D/c line (with twin Moose conductor)
- LILO of Gangtok-Rangit 132kV S/c line at Rangpo and termination of Gangtok-Rangpo and Melli – Rangpo 132kV lines (constructed under part-A through LILO of Gangtok-Melli 132kV S/c line upto Rangpo) at Rangpo
- LILO of Teesta V – Siliguri 400kV D/c line at New Melli
- Kishanganj – Patna 400kV D/c (quad) line

(iii) By 2014-15, when Punatsangchu-I (1200 MW) comes up in Bhutan

Part-C: Transmission System for development of pooling station in Northern part of West Bengal and transfer of power from Sikkim/Bhutan to NR/WR.

- New 400kV AC & HVDC sub-station with \pm 800kV, 3000MW converter module at new pooling station in Alipurduar
- Extension of \pm 800 kV HVDC station with 3000 MW inverter module at Agra
- LILO of Bishwanath Chariali – Agra HVDC line at new pooling station in Alipurduar for parallel operation of the HVDC station
- LILO of Bongaigaon – Siliguri 400kV D/c line at new pooling station in Alipurduar
- LILO of Tala-Siliguri 400kV D/c line at new pooling station in Alipurduar
- LILO of Birpara-Salakati 220 kV D/C line at New Pooling station in Alipurduar
- Punatsangchu-I (generation project in Bhutan)-Alipurduar 400 kV D/C with quad conductor (Indian portion)

It was further explained that transmission charges for Part 'A' & 'B' of the above transmission scheme shall be initially borne by the generation developers. It was also proposed that transmission charges for Part 'C' of the transmission scheme shall be borne by beneficiaries of Bhutan power. RVPN enquired that as the confirmation of beneficiary was not there it may not be possible to agree for the transmission charges. After detailed

deliberations Northern Region Constituents agreed to share the transmission charges of Part-C of the scheme subject to the allocation of power from Bhutan projects to Northern Region.

Member (PS) stated that proposal to set up Sankosh (4060 MW) and Wangthoo (900 MW) in Bhutan was in pipeline. To evacuate power from these projects, separate HVDC line would be required. The proposal would be taken up after getting the firm schedule from Bhutan authorities.

17. Proposed Evacuation System of various thermal projects in Rajasthan – Agenda by RRVPNL

Member (PS) explained that RRVPNL had proposed the transmission system for proposed Super Critical Thermal Power Stations at Chhabra (2x660 MW), Kewai (2x330 MW), Banswara (3x660 MW) and Suratgarh (3x660 MW). The proposal broadly included 765 kV transmission lines from Chhabra pooling station to Jaipur (South), Suratgarh to Neemrana 765 kV transmission lines, Banswara to Bhilwara 765 kV lines and Bhilwara – Jaipur (south) 765 kV interconnection. They intend to construct 765 kV substations at Chhabra, Jaipur (South) and Bhilwara. The detailed proposal of Rajasthan was furnished along with Additional agenda-2 and the same is again placed at **Annex-IV**.

Member (PS) stated that 765 kV transmission should be planned only if the flow on each circuit is of the order of 1000-1500 MW as otherwise one would face substantial reactive power management problem. He suggested that the transmission lines from Chhabra pooling point to Jaipur, Bhilwara-Jaipur and Jaipur-Neemrana should be operated at 400 kV keeping in view the flows on these lines indicated in the studies of RRVPNL

RRVPNL stated that generation at Chhabra TPS would come in 2013-14 when 765 kV link at inter state level would be adequate. Chhabra and Suratgarh power stations were being developed by the state generating company and Banswara power station was proposed to be developed through Case-II bidding. For Chhabra TPS, the orders had already been placed on BHEL. He further stated that power procurement through Case-I bidding has been floated and the final outcome would be known in July 2009.

Rajasthan ERC has approved procurement of 1000 MW of power round the clock under Case-I.

Member (PS) stated that Powergrid had also planned a 765/400 kV Jaipur (S) substation and there should be only one station catering to the requirement of RVPN also. Powergrid informed that land for Jaipur (South) has been identified & feasibility report is under preparation. RVPN enquired about the time frame of Jaipur (South) 765 kV substation incase it is to be constructed by Powergrid. Powergrid informed that Jaipur (South) 765 kV substation could be ready by 2012 and expressed that it should meet the requirement of RVPN.

Member (PS) stated that incase Rajasthan was coming up with such generation expansion plan, then adequate transmission system need to be planned beyond Jaipur. Powergrid clarified that considering this aspect Jaipur (South) – Bhiwani 765 kV S/c line has been proposed under Rihand-III.

Member (PS) stated that 765 kV transmission system proposed in Rajasthan has implication on ISTS development and therefore requested Powergrid to carry out load flow study incorporating Rajasthan proposal and inform the outcome in a week's time so that RRVPNL could be informed accordingly.

18. HPPTCL's proposal for additional 220 kV bays

CEA informed that HPPTCL has requested for following 220 kV bays for their utilization:

- (i) 2 nos. of bays at Banala i.e. 400 kV Parbati Pooling Station for termination of 220 kV D/C Allain Duhangan – Nalagarh line at Banala
- (ii) 2 nos. of bays for termination of proposed 220 kV D/C line from 220/132 kV Bajora S/S at Banala

HPPTCL has also informed that above 4 nos. of 220 kV bays are in addition to 4 nos. of 220 kV bays required for termination of 2x220 kV (Quad) D/C line from Chenab Basin, as per CEA's Master Plan.

Member (PS) informed that neither CEA nor CTU have received any proposal from AD Hydro for termination of their line at Parbati Pooling station and they are

constructing 220 kV D/C line upto Nalagarh. He also informed that 400 kV station at Banala was a 400 kV switching station and incase HP requires the ICTs can be provided for which transmission charges would have to be exclusively borne by HP.

HP stated that they would revert back on the issue.

Minutes for Long term Open Access Meeting with Northern Region Constituents held on 30.05.2009 at Nainital

1. Evacuation of Power from Allain Dhungan located in HP

Powergrid informed that the case of long term open access of AD Hydro was discussed and agreed with NR constituents in various meetings and following system was finally agreed in long term open access meeting held on 25.04.2007

- Allain Dhungan HEP – Nalagarh 220 kV D/c line (to be constructed by AD Hydro at their cost as dedicated system)

Accordingly, the long term open access to M/s AD Hydro was granted for transfer of power to Haryana and intimation for the same was issued to them subject to the signing of BPTA for payment of regional transmission charges. Presently, the above 220 kV D/c line & 220 kV bays at Nalagarh are under construction.

It was further informed that the issue of signing of BPTA was taken up with M/s A D Hydro during April 2008 & during December 2008, with Haryana as a beneficiary. Recently, M/s A D Hydro vide their letter dated 07.01.2009 have stated that they wanted to change the beneficiary as “Any Utility in Northern Region” instead of Haryana.

Member (PS) enquired about the status of the generation project from the representative of AD Hydro. AD Hydro Representative informed that Allain would be coming up in April 2010 and Dhungan would be coming up in November 2010. Member (PS) stated that LTOA to M/s AD Hydro could be granted for Northern Region. All the Members agreed for the same. It was agreed that AD Hydro would sign the BPTA for payment of Northern Regional Transmission Charges within one month after issuance of the Minutes.

2. Long term open access to M/s Nuziveedu Seeds Ltd. for transfer of 100 MW from their Tidong-I HEP at Kinnaur Distt., H.P. to Haryana, Punjab, and Delhi

Powergrid informed that they have received an application dated 4/6/08 from M/s Nuziveedu Seeds Ltd. seeking long-term open access to transfer 100 MW from Tidong-I, located at Kinnaur Distt., HP to various NR constituents. Out of 100 MW, 88 MW power is proposed as distribution among three states- Haryana, Punjab & Delhi and 12MW (12% free power) has been allocated to HP. The commissioning schedule as indicated by Tidong-I are 31.12.2011 & 31.03.2012 for unit 1 & 2 respectively. Expected date of commencement of long term open access is indicated as 31/03/2012 and the duration is for 25 years. However, the date of commencement of Long Term Open Access would be 31/12/2011, as first unit is expected by that time frame.

It was further informed that CEA had developed a Master Plan for evacuation of power from the various hydro projects located in Satluj valley in Himachal Pradesh. As per the Master Plan, Tidong-I HEP (100 MW) was proposed to be connected to 400/220 kV Jangi Pooling Station by a 220 kV D/c line and the 400 kV system was planned from Jangi to Abdullapur via intermediate substations for evacuation of power from Sutluj Basin Projects including Tidong-I HEP. Tidong is the first project being developed in the vicinity and development of Jangi, Powari & Sherpa colony 400/220 kV pooling stations alongwith the 400 kV lines may not be techno-economical solution for evacuation of power from such small sized generation project.

It was explained that the issue was deliberated at a meeting taken by Member (PS) CEA on 22/12/08 wherein the developers of the project, Powergrid, HPSEB were present. During the meeting it was discussed & agreed that the power from Tidong-I could be evacuated via Kashang, Bhabha, Kotla, Kunihar 220 kV D/C lines of HPSEB. It was also informed by HPSEB that the 220 kV D/c line from Kashang to a location near Bhabha HEP would be ready by March 2009. HPSEB is required to construct a 220 kV D/c line from Tidong-I to a location near Kashang-I project site

and also 220 kV D/c line from Bhabha to Kunihar. It was also agreed that, as and when the 400 kV S/s at Jangi and pooling station at Sherpa colony would be commissioned, the Tidong power could be injected at Jangi Pooling Station and be evacuated as envisaged in the Master Plan for Sutluj Basin Project. All the constituents agreed for the same.

Member (PS) requested HPSEB (now HPPTCL) to complete the system upto Tidong-I generation project so that power is not bottled up.

Concluding the discussions following was agreed:

After the discussions, it was agreed that Long-term Open Access can be granted to Tidong-I HEP of M/s Nuziveedu Seeds Limited, subject to following:

- Power to Haryana, Punjab and Delhi shall be through displacement.
- It was agreed that LTOA to M/s Nuziveedu Seeds (P) Ltd. shall be granted for transfer of power to Haryana, Punjab and Delhi subject to the signing of the BPTA for Northern region transmission charges for 88 MW.
- It was also informed that at present no constraints were envisaged in ISTS system for the above target power allocation, however some constraints, during special dispatch/loading conditions or in a particular operating situation, however, cannot be totally ruled out, which cannot be foreseen today.
- As the power was being injected into the STU network, the ISTS charges for free power would not be applicable until Jhangi pooling point was not commissioned by CTU.
- HPSEB to complete the implementation of 220 kV system required for evacuation of power from Tidong-I HEP.
- Later when 400/220 kV substations at Jangi & Sherpa colony alongwith the other 400 kV lines are established, power from Tidong-I can be injected at Jangi pooling station.

3. Long Term Open Access Application for transfer of 514 MW from Tapovan Vishnugadh HEP of NTPC Ltd.

Powergrid informed that NTPC Ltd., has proposed to develop Tapovan Vishnugadh Hydro Electric Project (520MW) as run of river scheme in the state of Uttarakhand. It was further informed that power from the generation project would be injected at Kashipur via Kuwanri Pass & Srinagar. It was also informed the project is a merchant plant and NTPC have also informed target beneficiaries in Northern Region.

CEA enquired about the latest commissioning schedule of the generation project. NTPC informed that project is on schedule and likely to be commissioned by Sept 2011. CEA further enquired about the status of transmission system being implemented in Uttarakhand by PTCUL. PTCUL informed that the 400 kV substation at Srinagar and Srinagar - Kashipur 400 kV line shall be available by March 2012. However for evacuation of power from Kunwari Pass they would LILO one ckt of Vishnu Prayag – Muzaffarnagar 400 kV D/c line at Kuwanri Pass. Member (PS) informed that there would be constraints under the outage of one 400 kV line.

For transfer of power beyond Kashipur, Powergrid informed that in the same corridor a strengthening scheme and Lucknow – Bareilly – Meerut 765 kV system (under NKSTPP) has been planned and power from this project could be transferred after the availability of above transmission lines. Therefore LTOA to Tapovan Vishnugadh HEP can be granted subject to availability of above transmission system.

NTPC and CEA requested that Kashipur – Bareilly – Roorkee – Saharanpur line may be expedited.

Concluding the discussions it was agreed that the Long Term Open Access to NTPC Ltd. may be granted for 25 years subject to the following:

- The Long Term Open Access shall be granted for the Target beneficiaries as indicated by NTPC.

- LTOA shall be applicable after the commissioning of following transmission system:
 - One ckt of Lucknow – Bareilly 765 kV line
 - Bareilly – Meerut 765 kV S/c
 - Bareilly-Kashipur–Roorkee–Saharanpur 400 kV D/c (Quad conductor)

- NTPC agreeing to pay the regional transmission charges and sign the BPTA. The transmission charges applicable shall be equivalent to the plant capacity minus the power allocated to Uttarakhand.

- NTPC would coordinate with PTCUL for implementation of transmission system within the state of Uttarakhand

4.0 & 5.0 Long Term Open Access to Lanco Hydro Energies Private Limited for transfer of 76 MW each from their Rambara & Phata Byung HEPs located in Uttarakhand

Powergrid informed that applications have been received from M/s Lanco Hydro Energies Private Limited seeking long-term open access to transfer 76 MW each from Rambara HEP and Phata Byung, located in Uttarakhand. The power (entire saleable energy after releasing free power to Uttarakhand towards their royalty) from these projects is proposed to be sold to the constituents of Northern Region. The 1st unit of Rambara is expected to come by April 2012 and 1st unit of Phata Byung is expected to come up by April 2011.

Member (PS) enquired from PTCUL about the evacuation plan for these projects within the state of Uttarakhand. PTCUL informed that it has been planned to pool the power of Rambara and Phata Byung at Brarmwari and from Baramwari power would be transferred to Kashipur via Srinagar. It was further informed by PTCUL that the transmission system is scheduled to be commissioned by March 2012. Member (PS) expressed his concern over the mismatch of the transmission system with respect to

the commissioning of Phata Byung generation project and requested to expedite the transmission system so that generation is not bottled up.

The injection point for the above two generations is also at Kashipur. Powergrid explained that while carrying out the studies generation from above projects was also considered and LTOA to above projects can be granted after the commissioning of the strengthening scheme i.e. Bareilly–Kashipur-Roorkee-Saharanpur 400 kV D/c (Quad) line and one ckt of Lucknow – Bareilly – Meerut 765 kV system (under NKSTPP).

Concluding the discussions following was agreed

LTOA to M/s Lanco Hydro Energies Private Limited may be granted for transfer of 76 MW power (after releasing free power to Uttarakhand towards their royalty) each from Rambara and Phata Byung HEPs for Northern Regional Constituents for 25 years.

- M/s Lanco Hydro Energies Private Limited would sign the requisite BPTA for Northern regional Transmission system charges for 76 MW (minus power allocation to Uttarakhand) for Northern Regional Transmission Charges.
- Considering the quantum of power flow requirement, prima facie it appears that in general there would not be any constraint in transfer of power to any NR constituent. Some constraints during special dispatch/loading conditions or in a particular operating situation, however, cannot be totally ruled out, which cannot be foreseen today.
- The transmission charges applicable shall be equivalent to the plant capacity minus the power allocated to Uttarakhand.
- Long Term Open Access shall be granted after the commissioning of following scheme:
 - One ckt of Lucknow – Bareilly 765 kV line
 - Bareilly – Meerut 765 kV S/c

- Bareilly-Kashipur-Roorkee-Saharanpur 400 kV D/c (Quad conductor)
- Lanco Hydro Energies Private Limited would coordinate with PTCUL for implementation of transmission system within the state of Uttarakhand.

6. Long Term Open Access to Rosa Power Supply Company Limited for transfer of 600 MW from their Rosa Thermal Power Project (Stage II) located at Shahjahanpur, Uttar Pradesh

Powergrid stated that an application dated 26/08/2008 has been received from M/s Rosa Power Supply Company Limited seeking Long-term Open Access for transfer of 300 MW power from Stage-II (2x300 MW) of Rosa Power Project located at Shahjahanpur, U.P. Out of 600 MW power, 300 MW power is allocated to Uttar Pradesh and balance 300 MW is to be distributed between Delhi(150 MW) and Haryana(150 MW). The Long Term Open Access has been sought for the power which is to be transmitted outside the state for 25 years.

Member (PS) enquired about the commissioning schedule of the Rosa generation project. Representative from Rosa Power Company informed that Unit-1 of Rosa stage-II is scheduled to be commissioned by December 2011 and Unit-2 by March 2012.

Powergrid informed that the margins available in Lucknow – Shajahanpur – Bareilly – Mandaula 400 kV (Quad) corridor and Lucknow – Bareilly – Meerut 765 kV transmission corridor would be adequate for transfer of additional 300 MW power.

RRVFN submitted that the LTOA of Tapovan Vishnugadh, Rambara, Phatabyung and Rosa all are being linked to this strengthening and 765 kV system of North Karanpura and wanted to reconfirm about the requirement of strengthening scheme. Powergrid explained that the total power transfer due to LTOA would be about 800-900 MW and margins available in Lucknow– Shajahanpur – Bareilly – Mandaula 400 kV (Quad) corridor and Lucknow – Bareilly – Meerut 765 kV transmission line shall be adequate for transfer of this power.

Member (PS) enquired about the time frame of Shahjahanpur 400 kV substation of Powergrid. Powergrid informed that land for the substation has already been identified the feasibility report is under preparation. Member (PS) stated that Powergrid should expedite the works to complete the Sahajahanpur substation by the time frame of the generation.

Concluding the discussions following was agreed:

Long-term Open Access can be granted for 25 years subject to following:

- Long Term Open Access to Rosa Power Company shall be granted after the commissioning of following strengthening scheme:
 - One ckt of Lucknow – Bareilly 765 kV line
 - Bareilly – Meerut 765 kV S/c
 - Bareilly-Kashipur–Roorkee–Saharanpur 400 kV D/c (Quad conductor)

- For connectivity of Rosa Power Plant with the grid the following was agreed :
 - Rosa- Shahjahanpur 400 kV D/c

- For supply of power to Uttar Pradesh, Rosa Power Company shall provide 400/220 kV ICTs of adequate capacity at Rosa switchyard, therefore ISTS charges for supply of power to Uttar Pradesh would not be applicable.

- M/s Rosa Power Company would sign the requisite BPTA for Northern regional Transmission system charges for 300 MW (150 MW for Delhi & 150 MW for Haryana).

7. Long-Term Open Access to Shri Bajrang Power & Ispat Ltd. for transfer of 22.5 MW power from Rupin HEP (45 MW) located in Himachal Pradesh

Powergrid informed that Shri Bajrang Power & Ispat Ltd. vide letter dated 18.12.2008 has applied for long term Open Access in inter-state transmission system for transfer 22.5 MW of power from the proposed Rupin hydro power plant to be set up in Himachal

Pradesh by M/s Shri Bajrang Power & Ispat Ltd. The commissioning schedule for generation project as indicated in the application is Unit I, II & III – June 2014. The Long Term Open Access is desired from June 2014. It was further informed that as per the application power from the project is to be injected at Gosangu 132 kV substation of STU of Himachal Pradesh and point of injection into CTU grid was mentioned as 220 kV interconnection points of STU-CTU grid. Constituents enquired about the details of exact injection point of power into the CTU grid. Powergrid informed that this has not been mentioned in the application. Constituents were of the opinion that matter may be taken up with STU and the developer and be discussed again in the next meeting.

8. Long term open access to M/s Himachal Sorang Power Private Limited for transfer of 85 MW to NDPL from their Sorang HEP (100 MW) at Kinnaur, H.P.

Powergrid informed that Himachal Sorang had applied for long-term open access for transfer of 85 MW power from Sorang HEP (100 MW), located in Himachal Pradesh to NDPL (remaining 15 MW by Open Trading). It was further informed that The Sorang HEP 400 kV power was earlier planned to be evacuated through LILO of the Baspa-Jhakri 400 kV line. During the CEA meeting held at New Delhi on 15.01.2009, it was decided that Sorang power is to be evacuated through the LILO of one circuit of Karcham Wangtoo-Abdullapur 400 kV D/c (Quad) Line instead of Baspa-Jhakri line.

Member (PS), CEA enquired about the time frame of the generation project. It was informed by the project developer that Unit-1 is expected to be commissioned by Nov'2010 and unit-2 by Feb'2011. Powergrid informed that Himachal Sorang was requested to upgrade their switchyard to the equivalent capacity of Quad line and they have confirmed the same and accordingly LTOA to Himachal Sorang may be granted with the revised configuration. Constituents agreed for the same.

Concluding the discussions following was agreed:

Long-term Open Access can be granted subject to the following:

- M/s Himachal Sorang Power Private Limited has applied for Long term Open Access for 85 MW to NDPL for 25 years and LTOA shall granted. For the remaining 15 MW by Open Trading, LTOA shall be granted for Northern Region for 25 years.
- M/s Himachal Sorang Power Private Limited shall take up the matter with Jaypee Powergrid Ltd. for commissioning of the 400 kV D/c quad line from Karcham Wangtoo to Abdullapur for facilitating evacuation of power from Sorang HEP.
- M/s Himachal Power Sorang Limited will have to construct the LILO portion from their switchyard to a suitable location near Karcham Wangtoo- Abdullapur line.
- The sharing of the transmission charges of the Karcham Wangtoo- Abdullapur line for evacuation of the Sorang power would be as per the CERC regulations.
- M/s Himachal Sorang Power (P) Ltd. would sign the requisite BPTA for 100 MW for Northern regional Transmission system charges.
- Date of commencement of above open access is from the date of commissioning of the generation at Sorang HEP.

9. Long term open access to M/s Adani Power Limited for transfer of 342 MW from their Mundra TPS at Mundra, Gujarat to Punjab and/or Rajasthan in Northern Region.

Powergrid stated that M/s. Adani Power Ltd. (APL) had applied long term open access for transfer of 342 MW power from their Mohindergarh HVDC station to Punjab and/or Rajasthan in Northern Region. The power was sourced from Adani Mundra TPS and brought to Northern Region through their dedicated \pm 500 KV HVDC Mundra – Mohindergarh line. From Mohindergarh, APL was also to supply 1424 MW power to Haryana which would be directly injected into Haryana Grid.

In the 26th Standing Committee Meeting of Northern Region Transmission Planning, following connectivity with Mohindergarh HVDC station was agreed:

- LILO of the one circuit of Bhiwadi – Moga 400 kV D/c line at Mohindergarh HVPNL and LILO of other circuit of Bhiwadi – Moga 400 kV D/c line at Mohindergarh HVDC terminal of Adani
- Mohindergarh HVDC Terminal – Mohindergarh HVPNL 400 kV D/c (Triple)

The network configuration was revisited as with the above arrangement, 2 HVDC terminals i.e. Bhiwadi and Mohindergarh would get into direct connectivity which may cause interaction and control problem as any fault in one HVDC system/connected AC system may trigger problem in other HVDC system. In order to avoid direct connectivity, instead of LILO of Bhiwadi – Moga line, a 400 KV DC line could be constructed from Mohindergarh to Bhiwani where Powergrid was establishing a new 765/400 KV substation. Member (PS) stated that instead triple conductor line, Adani Power Limited should have Mohindergarh HVDC – Mohindergarh HVPNL line as quad considering the power flow requirement to Haryana

The Standing Committee in 27th meeting held on the same day immediately prior to long term open access meeting has approved the following revised transmission system:

- Mohindergarh HVDC Terminal – Mohindergarh HVPNL 400 kV D/c (Quad conductor) – by Adani Power
- Mohindergarh HVDC Terminal – Bhiwani (new) 400 kV D/c – by Adani Power
- Mohindergarh HVPNL – Jhajjar Stage-II (2x660 MW) 400 kV D/c – by HVPNL

APL representative stated that the commissioning schedule of HVDC station was April, 2011 and the connectivity was required by that time. As Bhiwani 765/400 KV was a new substation, suitable arrangement for providing connectivity ahead of commissioning of Bhiwani substation would be required.

Powergrid stated that investment approval & award of Bhiwani S/S was in process and it would take around 3 years for the new S/S. Member (PS) stated that Bhiwani (new) S/S of Powergrid is also to be connected through LILO of Bahadurgarh –

Hissar 400 KV line. It was suggested that Powergrid should take up the works on their LILO line on priority so as to provide connectivity to Moindergarh – Bhiwani line of APL directly by connecting to the LILO line. With this arrangement, M/s Adani would get reliable connectivity to the grid for safe operation of their HVDC line in the event of outage of Mohindergarh-Mohindergarh (HVDC) line. Subsequently, when Powergrid's Bhiwani substation was completed, the arrangement as per the planned system may be implemented.

APL representative stated that the basic requirement of APL was to get connectivity with CTU grid in NR so as to facilitate sale of balance power in short-term / medium term arrangements. However, as long term open access was the only available route for obtaining connectivity, they have applied for long-term open access. Powergrid stated that LTOA to APL may be granted for 342 MW in equal proportion to Rajasthan and Punjab.

APL further stated that CERC had circulated draft regulation in which provision for connectivity independent of long term open access had been proposed and APL would review quantum of long term open access. However, as the time frame for implementation of connectivity was to match with the target of April, 2011, the connectivity may be approved so that works could be taken up for implementation by the required time. He further stated that APL was also to participate in future case 1 bids of Punjab and in case successful, they would like to extend the Mohindergarh – Bhiwani line to suitable location in Punjab from where power could be delivered directly into Punjab Grid while retaining the activity with CTU network at Bhiwani. APL representative stated that extending their Mohindergarh – Bhiwani line to Punjab and directly injecting into PSEB network would be a cost effective solution. Member (PS) stated that the above proposal could be considered at an appropriate stage.

PSEB stated that purchase of power was not envisaged at this stage and in future when they invite bids the award would depend on merit of bids.

Powergrid clarified that based on new regulation M/s APL would need to apply for connectivity and efforts would be made to match the connectivity with the commissioning schedule of HVDC terminal.

After discussions, the above proposed system was agreed and it was decided that long term open access can be granted to APL subject to following:

Concluding the discussions following was agreed:

Long-term Open Access can be granted for 25 years subject to following:

- The following system being built by Adani Power would be required for transfer of power to Punjab and/or Rajasthan and to Haryana
 - a) Mohindergarh HVDC Terminal – Mohindergarh (HVPNL) 400 kV D/c (Quad)
 - b) Mohindergarh HVDC Terminal – Bhiwani (new) 400 kV D/c

The line at (a) shall be for transfer of power to Haryana and line at (b) shall be for connectivity with the regional grid for transfer of power to Punjab/Rajasthan.

- LTOA to M/s Adani may be granted with equal proportion for Punjab and Rajasthan subject to the signing of the BPTA for Northern region transmission charges for 342 MW.
- Mohindergarh HVDC Terminal – Bhiwani 400 kV D/c line shall be built, owned, operated and maintained by M/s Adani Power Limited to interconnect with NR grid.

10. Long term open access to NTPC Limited for transfer of 600 MW from their Lohari Nagpala HEP in Uttarakhand to various states in Northern Region

Powergrid informed that NTPC had sought Long Term Open Access for transfer of power from their Lohari Nagpala hydro Power Station (600 MW) located at Uttaranchal to the states of Uttaranchal (102MW), Uttar Pradesh (153 MW), Punjab (74 MW), DTL (102MW), Haryana (44MW), Rajasthan(74MW) and Jammu & Kashmir(51MW) for a period of 25 years on Merchant basis.

It was further informed that the Long Term Open Access Application for transfer of power from Lohari Nagpala was discussed during the long term open access meeting held on 03.11.2006 and subsequently on 16.02.2008, wherein it was agreed that Power from Loharinag Pala would be pooled at Tehri Pooling station being established by POWERGRID by a 400kV D/c triple conductor line. The line and associated bays at both ends would be part of dedicated system and shall be made available by NTPC. (*Presently under construction by PTCUL.*) NTPC would sign the requisite BPTA for Northern regional transmission system as well as for the dedicated system corresponding to full capacity of 600MW for a period of 25 years.

It was also discussed that NTPC was to bear the full transmission charges of Tehri PSP transmission system till the time Tehri PSP is commissioned for reliable evacuation of power.

Powergrid enquired about the date of commissioning of the generation project. NTPC informed that 1st unit of the Lohari Nagpala is expected by September 2012 and subsequent at a gap of one month for each unit.

Regarding sharing of transmission charges for preponement of Tehri Transmission system, NTPC informed that they would not like to share the transmission charges for preponement and would prefer to utilize the present margins available in the Tehri System. Member (PS), CEA stated that there would be constraints during the outage of one ckt of Tehri – Meerut 765 kV (op at 400 kV) line. NTPC confirmed that they would back down the generation under such scenario.

Concluding the discussions following was agreed

LTOA to NTPC for transfer of power from Lohari Nagpala may be granted for 25 years subject to the following:

- i. LTOA shall be granted after the commissioning of Tehri Transmission system i.e. 765 kV operation of Tehri – Meerut lines.

- ii. It was noted that some constraints may arise under certain operating conditions under which NTPC would back down the generation at Lohari Nagpala till the grant of LTOA.
- iii. The Long Term Open Access shall be granted for the Target beneficiaries as indicated by NTPC. It may be noted that no constraints are envisaged in ISTS system for the above target power allocation, however some constraints, during special dispatch/loading conditions or in a particular operating situation, however, cannot be totally ruled out, which cannot be foreseen today.
- iv. NTPC agreeing to pay the regional transmission charges and sign the BPTA. The transmission charges applicable for 600 MW.
- v. LTOA charges shall be applicable from the commissioning of generation project.
- vi. NTPC would coordinate with PTCUL for implementation of transmission system within the state of Uttarakhand
- vii. PTCUL has desired for construction of 2 nos. of 400 kV GIS bays at Tehri Pooling station for termination of 400 kV D/c line from Loharinagpala on deposit works basis. The work towards the implementation of these works shall be taken up by Powergrid and time frame for the same shall be discussed mutually.

11. Open Access Applications pertaining to New Generation Projects in Western Region with target beneficiaries in Northern Region

Powergrid informed that the following applications seeking access to ISTS for new generation projects in Western region with target beneficiaries in Northern region were discussed and in WR in a meeting held on 06.12.2008.

	Generation Project	Gen MW	LTOA quantum (figures in MW)			Date of commencement of LTOA Sought
			SR	WR	NR	
1	Jaiprakash Associates	1320	-	840 (to WR)	480 (to NR)	Dec., 2011
2	Aryan Coal Benefication -III	1200	-	900 (Gujarat -200), (Maharashtra - 300), (MP-400)	300 (Rajasthan -300)	March 2012
3	Dheeru +PTC	1050	-	668 (MPPTCL-300), (Chhattisgarh - 368)	382 (PSEB - 300MW), (Merchant sale to NR - 82)	Jan. 2012
4	Maruti CCPL	300	-	222 (to WR)	78 (to NR)	June 2011
	Total	3870	-	2630	1240	

It was further informed that formal agreement for procurement of power by the NR beneficiaries from these generation projects is yet to take place. Therefore, identification of strengthening of NR grid/inter-regional links to NR would be carried out only after firming of the beneficiaries within the NR. In the meantime it was proposed that Access to the ISTS in NR may be permitted subject to the provision that strengthening NR grid / interregional capacity shall be identified once the actual beneficiaries and quantum are tied up by the applicant. Further, the open access applicants shall share the transmission charges in proportion to its utilization as indicated above.

The connectivity to the above generation projects shall be as agreed in WR meeting. Members agreed to the proposal.

12. Long Term Open Access Applications pertaining to New Generation Projects in Southern Region with target beneficiaries in Northern Region

Powergrid stated that in Southern region Open Access meeting held on 13th June, 2008 and 3rd March, 2009, following applications seeking access to ISTS for new generation projects in Southern region with target beneficiaries in Northern region were discussed.

	Generation Project	Gen MW	LTOA quantum (figures in MW)			Date of start of LTOA Sought
			SR	WR	NR	
1	LANCO Kondapalli	375	-	200	150 (Punjab – 100 MW) (Haryana – 50 MW)	June, 2009
2	Meenakshi	540	205	165	170	September, 2010
3	Gautami	1150	300	400	550 (Punjab – 150 MW) (Haryana–150 MW) (Delhi – 100 MW) (Rajasthan–150 MW)	1 st Qtr, 2011
4	Krishnapatnam (Navayugaa)	1860	360	600	900 (Punjab – 200MW) (Haryana – 100 MW) (Delhi – 200 MW) (Rajasthan –400 MW)	March, 2012
5	Krishnapatnam APPDCL	1600	1425	-	175 (Punjab – 175)	June, 2012
6	JSW Power Trading	600	-	300	300	2009
	Total		2835	1940	2145	

In the above referred meetings of SR, immediate evacuation system as well as system strengthening required in SR grid for the above projects was evolved and open access to the ISTS in Southern region grid was agreed to. Further, it was informed to the open access applicants that they shall have to share transmission charges for the SR grid, intervening regions, and associated inter-regional charges proportional to its utilization by the respective open access applicant.

It was also informed that formal agreement for procurement of power by the NR beneficiaries from these generation projects is yet to take place. Therefore identification of strengthening of NR grid/inter-regional links to NR would be carried out only after firming of the beneficiaries within the NR. In the meantime it is proposed that Access to the ISTS in NR may be permitted subject to the availability of margins in the system and provision of strengthening NR grid that shall be identified once the actual beneficiaries and quantum are tied up by the applicant. Further, the open access applicants shall share the transmission charges in proportion to its utilization. The connectivity to the above generation projects shall be as agreed in SR meeting. Members agreed to the proposal.

At the end of the meeting, Powergrid informed that the following have been granted LTOA in various LTOA meetings, and they have not signed BPTA inspite of follow up:

S.No.	Applicant	Generation Project	Draft BPTA sent
1	Jindal Stainless Ltd.	Jindal Stainless, Orissa	16.06.08
2	PTC	Malana-II	15.10. 08
3	PTC	Pathadi stage-II	15.10. 08
4	PTC	Bhilangana HEP	16.02.09
5	NDPL	DVC	15.10. 08

It was proposed by Powergrid that a final communication may be forwarded to the above applicants for signing of the BPTA within 30 days and incase they do not sign BPTA within 30 days, without justified/satisfactory reason, the LTOA already granted may be cancelled and be advised to make fresh application if required. The Committee agreed and observed that before taking action provisions of CERC Regulations should be taken into consideration.

Meeting ended with a vote of thanks.

Annex-I

List of participants for the 27th meeting of Standing Committee on Power System Planning in Northern Region, held on 30.05.2009 at Nainital, Uttarakhand

		Designation
CEA		
1.	Sh V Ramakrishna	Member (PS)
2.	Sh. Naresh Bhandari	Director (SP&PA)
PGCIL		
1.	Sh. Sh. I.S. Jha	ED (Engg)
2.	Sh. Umesh Chandra	ED (Comml.)
3.	Sh. P.C. Pankaj	ED (NR-I)
4.	Sh. Pankaj Kumar	GM (Engg.)
5.	Sh. S.C. Singh	GM (Projects)
6.	Sh. U.K. Tyagi	AGM (Comml)
7.	Sh. S.K. Nagpal	DGM (Engg., NR-I)
8.	Sh. T.C. Sharma	DGM (PESM)
9.	Sh. Mukesh Khanna	CDE (Engg)
NTPC		
1.	Sh. A.K. Gupta	GM (Engg.)
2.	Sh. A. Basu Roy	DGM (Comml.)
3.	Sh. L.K. Jain	DGM (OS-NCR)
4.	Sh. S.O. Katiyar	DGM (O&M)
NHPC		
1.	Sh. Y.K. Khanduja	DM (T&RE)
PTCUL		
1.	Sh. D.N. Joshi	GM (Projects)
2.	Sh. S. Bhatnagar	DGM (Engg.)
3.	Sh. Ashok Kumar	EE (Design)
DTL		
1.	Sh. Ved Mitra	DGM (Comml.)
2.	Sh. M.K. Sharma	DGM (Plg.-I)

RRVPNL

1. Sh. Y.K. Raizada Director (Tech)
2. Sh. B.N. Saini Chief Engineer (PPM &R)
3. Sh. L.N. Nimawat Addl. SE (Protection)

HVPNL

1. Sh. S.K. Mittal Director (Projects)
2. Sh. T.K. Dhingra CE (Planning)

HPSEB

1. Sh. N.S. Bal CE (Planning)

PSEB

1. Sh. I.S. Anand CE (Planning)
2. Sh. K.S. Jolly Advisor/SO&C

UPPCL

1. Smt. A. Guha Roy SE
2. Sh. V.P. Tiwari EE

THDC

1. Sh. H.M. Kothari GM (EM-D)
2. Sh. P.K. Srivastava AGM (EM-D)

BBMB

1. Sh. K.K. Vohra CE/SO

STATUS OF TRANSMISSION SCHEMES IN NORTHERN REGION

	Name of the Scheme	Elements	SCM approval	Date of FR	Cost (Rs.)	Approval of Board/PIB	Target now	Status
1.	Northern Regional System Strengthening Scheme-V	<ul style="list-style-type: none"> ➤ LILO of Hissar – Jaipur 400 kV s/c at Bhiwadi ➤ Bhiwadi – Agra 400 kV D/c ➤ Bhiwadi – Moga 400 kV D/c 	15 th SCM held on May 30, 2003	December, 2004	Rs. 605.53 Crores incl. IDC of Rs. 30.96 Crores (Q4, 2004, PL)	PIB-March 08, 2006 CCEA-July 31, 2006	Commissioned September, 2009	Advanced stage of completion.
2.	Tr. system for Sewa-II (120MW)	<ul style="list-style-type: none"> ➤ Sewa II – Hiranagar 132 kV D/c ➤ Sewa II – Kathua via Mahanpur 132 kV D/c 	16 th SCM held on March 24, 2004	June, 2004	Rs. 85.76 Crores incl. IDC of Rs. 4.36 Crores (Q2, 2004, PL)	June 14, 2005	June, 2009	Ready for Commissioning
3.	Transmission system for Koldam HEP	<ul style="list-style-type: none"> ➤ Koldam – Nalagarh 400 kV D/c (Quad) ➤ Koldam - Ludhiana 400 kV D/c 	16 th SCM held on March 24, 2004	-	-	PIB-June 01, 2005 CCEA-August 25, 2005	June, 2009	Koldam-Ludhiana 400 kV D/c under JV (December, 2012).
4.	Transmission system for Parbati-II HEP (800MW)	<ul style="list-style-type: none"> ➤ Parbati-II – Koldam 400 kV (Quad) Two S/c ➤ Realignment works at Koldam 	16 th SCM held on March 24, 2004	June, 2004	Rs. 322.57 Crores incl. IDC of Rs. 27.34 Crores (Q2, 2004, PL)	December 20, 2005	December, 2012	Under Implementation.
5.	Transmission system for Koteswar (400 MW)	<ul style="list-style-type: none"> ➤ Koteswar – Pooling Point 400 D/c ➤ LILO of Tehri-Meerut lines at pooling point ➤ Creation of GIS pooling station ➤ 50% series compensation of Tehri-Meerut 2x S/c 	16 th SCM held on March 24, 2004	July, 2004	Rs. 231.87 Crores incl. IDC of Rs. 10.67 Crores (Q2, 2004, PL)	April 29, 2005	December, 2009 September, 2010	Under Implementation.
6.	System strengthening in South West part of Northern region(Part-B)	<ul style="list-style-type: none"> ➤ Kankroli-Jodhpur 400kV S/c 	16 th SCM held on March 24, 2004	December, 2005	Rs. 147.86 Crores incl. IDC of Rs. 8.89 Crores (Q4, 2005, PL)	September 21, 2006	October, 2009	Under Implementation.
7.	Transmission system for Parbati-III	<ul style="list-style-type: none"> ➤ LILO of both the circuits of Parbati-II - Koldam at Parbati Pooling Point ➤ LILO of one circuit of Parbati-II - Pooling Point at Parbati-III. ➤ Parbati Pooling point - Amritsar 400 kV D/c. ➤ Establishment of 400kV Parbati pooling stn (GIS) with 80 MVAR Bus Reactor. 	16 th SCM held on March 24, 2004	December, 2004	Rs. 487.91 Crores incl. IDC of Rs. 32.58 Crores (Q2, 2004, PL)	PIB-March 08, 2006 CCEA-July 31, 2006	May, 2010 November, 2010	Under Implementation.
8.	Transmission system for Barh (1980 MW)	<ul style="list-style-type: none"> ➤ LILO of both ckts of Kahalgaon-Patna 400kV D/c at Barh TPS ➤ Barh- Balia 400kV D/c ➤ Balia – Bhiwadi ± 500kV HVDC bi pole ➤ Seoni-Bina 765kV S/c at 400kV operation 	16 th SCM held on March 24, 2004	March, 2004	Rs. 3532.73 Crores incl. IDC of Rs. Crores (Q4, 2003, PL)	PIB-June 08, 2005 CCEA-December 12, 2005	September, 2009	Under Implementation.
9.	Establishment of Pooling station near Chamera-II	<ul style="list-style-type: none"> ➤ Chamera-II – Pooling point 400kV S/c. ➤ Establishment of 220/400 kV 2x 315 MVA pooling station near by Chamera-II. 	18 th SCM held on June 06, 2005	October, 2006	Rs. 269.9 Crores incl. IDC of Rs. 11.11 Crores (Q2, 2006, PL)	August 14, 2007	March, 2010	Under Implementation.
10.	Transmission system for Chamera-III	<ul style="list-style-type: none"> ➤ Chamera-III – Pooling Station 220 kV D/c ➤ Pooling Station – Jullandhar 400 kV D/c 	18 th SCM held on June 06, 2005	March, 2007		January 31, 2008	August, 2010	Under Implementation.
11.	Transmission system for Uri-II	<ul style="list-style-type: none"> ➤ Uri-II – Uri – I 400kV S/c ➤ Uri-II – Wagoora 400kV S/c 	18 th SCM held on June 06, 2005	December, 2005	Rs. 226.15 Crores incl. IDC of Rs. 19.79 Crores (Q4, 2005, PL)	September 21, 2006	August, 2010	Under Implementation.
12.	Transmission system for Kishen Ganga	<ul style="list-style-type: none"> ➤ Kishenganga – Alistang 220 kV 2* D/c ➤ Alistang – New Wampoh 220 kV D/c 	18 th SCM held on June 06, 2005	-	-	2014		

	Name of the Scheme	Elements	SCM approval	Date of FR	Cost (Rs.)	Approval of Board/PIB	Target now	Status
		➤ Kishenganga- Amargarh 220kV D/c						
13.	Transmission System Associated with Rampur	➤ Patiala – Ludhiana 400 kV D/c ➤ LILO of Nathpa Jhakri – Nalagarh 400 kV D/c (Triple) line at Rampur ➤ LILO of Patiala –Hissar 400kV line (Triple) at Kaithal	18 th SCM held on June 06, 2005	September, 2008	Rs. 184.19 Crores including IDC of Rs. 14.16 Crores (Q4,2008,PL)	February 11, 2009	July, 2011	Under Implementation.
14.	Northern Region System Strengthening Scheme-VI	➤ Establishment of 400/220 kV, 2x315 MVA substation at Gurgaon (GIS) ➤ LILO of Ballabgarh – Bhiwadi 400 kV S/c line at Gurgaon	18 th SCM held on June 06, 2005	December, 2005	Rs. 170.84 Crores including IDC of Rs. 8.69 Crores (Q4,2005,PL)	January 04, 2007	December, 2010	Under Implementation.
15.	Northern Region System Strengthening Scheme-VII (2008-09)	➤ 3rd 400/220 kV 315 MVA ICT at Ludhiana ➤ 4th 400/220 kV 315 MVA ICT at Wagoora	18 th SCM held on June 06, 2005	April, 2006	Rs. 57.24 Crores incl. IDC of Rs. 2.84 Crores (Q4, 2005, PL)	September 21, 2006	May, 2010	Under Implementation.
16.	Enhancement of Transmission Capacity in East-West corridor of Northern Region	➤ 30% Fixed series compensation on Gorakhpur-Lucknow 400kV D/c at Lucknow end. ➤ 30% Fixed series compensation on Bareilly – Mandaula 400kV D/c at Bareilly end. ➤ 45 % Fixed series compensation on Unnao-Bareilly 400kV D/c at Unnao end	19 th SCM held on October 1, 2005	March, 2006	Rs. 119.56 Crores including IDC of Rs. 4.23 Crores (Q4,2005,PL)	June 23, 2006	July, 2009	Under Implementation.
17.	NR System Strengthening Scheme-IX	➤ Kanpur-Ballabgarh 400kV D/c with 40% series compensation ➤ 80 MVAR Line Reactor at both ends on both circuits.	21 st SCM held on November 3, 2006	January, 2007	Rs. 522.59 Crores including IDC of Rs. 34.28 Crores (Q4,2006,PL)	PIB-July 4, 2007	July, 2010	Under Implementation.
18.	NR System Strengthening Scheme-X	➤ Gorakhpur-Lucknow 400kV D/c with 30% series compensation:	21 st SCM held on November 3, 2006	December, 2006	Rs. 399.76 Crores including IDC of Rs. 22.47 Crores (Q4,2006,PL)	November 30, 2007	March, 2010	Under Implementation.
19.	NR System Strengthening Scheme-XI	➤ Meerut-Kaithal 400kV D/c	21 st SCM held on November 3, 2006	January, 2007	Rs. 404.47 Crores including IDC of Rs. 22.73 Crores (Q4,2006,PL)	November 30, 2007	December, 2010	Under Implementation.
20.	NR System Strengthening Scheme-XII	➤ Bahadurgarh-Sonapat 400kV D/c(Triple) ➤ Establishment of 400/220kV substation with 2x315 MVA transformation capacity at Sonapat.	21 st SCM held on November 3, 2006	April, 2007	Rs. 247.25 Crores including IDC of Rs. 13.9 Crores (Q4,2006,PL)	January 30, 2008	November, 2010	Under Implementation.
21.	System strengthening in Northern Region for Sasan & Mundra UMPP's	➤ Agra-Sikar 400kV D/c (Quad). ➤ Sikar-Jaipur (POWERGRID) 400kV D/c. ➤ Sikar-Ratangarh 400kV D/c ➤ LILO of both circuits of Sikar(RVPNL)-Ratangarh(RVPNL) 220 kV D/c line at Sikar(POWERGRID) ➤ LILO of both Ckts of NathpaJhakri-Abdullahpur 400kV D/c at Panchkula- ➤ Establishment of new 400/220kV substation with 2x315 MVA transformation capacity at Sikar. ➤ Establishment of new 400/220kV substation with 2x315 MVA transformation capacity at Panchkula.	21 st SCM held on November 3, 2006	August, 2007	Rs. 4091.88 Crores including IDC of Rs. 226.53 Crores (Q4,2005,PL)		March, 2012	Under Implementation.
22.	System strengthening in	➤ Abdullapur–Sonapat 400kV D/c (Triple)	21 st SCM held on	February,	Rs. 328.97 Crores incl.	November 18, 2008	July, 2010	Under Implementation.

	Name of the Scheme	Elements	SCM approval	Date of FR	Cost (Rs.)	Approval of Board/PIB	Target now	Status
	Northern Region for Karcham Wangtoo HEP		November 3, 2006	2007	IDC of Rs. 22.15 Crores (Q2, 2008, PL)			
23.	765 kV System for Central Part of Northern Grid – PART - I	<ul style="list-style-type: none"> ➤ Agra - Meerut 765 kV S/c – 260 km ➤ Agra - Jhatikra 765 kV S/c – 240 km ➤ Jhatikra - Bhiwani 765 kV S/c – 80 km ➤ Bhiwani – Moga 765 kV S/c – 275 km ➤ LILO of both circuits of Mundka/Bawana – Bamnoli at Jhatikra – 5km 	22 nd SCM held on March 12, 2007	February, 2009	Rs. 1347.32 Crores incl. IDC of Rs. 102.70 Crores (Q4, 2008, PL)	February 11, 2009	February, 2012	Under Implementation.
24.	765 kV System for Central Part of Northern Grid – PART - II	<ul style="list-style-type: none"> ➤ Agra Substation extension ➤ Establishment of 765/400/220 kV substation at Jhatikra with 4x1500MVA 765/400 kV ➤ Augmentation of Moga & Meerut 400/220 kV substation to 765/400/220 kV substation with 2x1500MVA transformation capacity 	22 nd SCM held on March 12, 2007 & 26 th SCM held on October 13, 2008	FR under preparation	-	-	-	FR under Preparation.
25.	765 kV System for Central Part of Northern Grid – PART - III	<ul style="list-style-type: none"> ➤ Establishment of 765/400/220 kV substation at Bhiwani with 2x1000MVA 765/400 kV and 2x500 MVA 400/220 kV ➤ Augmentation of Moga & Meerut 400/220 kV substation to 765/400/220 kV substation with 2x1500MVA transformation capacity ➤ LILO of both circuits of Bawana/Bahadurgarh-Hissar 400 kV D/c at Bhiwani ➤ LILO of both circuits of Bareilly-Mandaula 400 kV D/c at Meerut ➤ Mandaula Bus split ➤ Ballabgarh Bus split 	22 nd SCM held on March 12, 2007 & 26 th SCM held on October 13, 2008	FR under preparation	-	-	-	FR under Preparation.
26.	Transmission Scheme for transfer of power from DVC projects & Maithon-RB	<ul style="list-style-type: none"> ➤ Maithon - Gaya 400kV quad D/C line ➤ Gaya - Sasaram 765kV S/C line ➤ Gaya-Balia 765kV S/C ➤ Balia-Lucknow 765kV S/C ➤ LILO of both circuits of Allahabad - Mainpuri 400kV D/C line at Fatehpur 765/400kV sub-station of POWERGRID ➤ Ranchi-WR Pooling 765kV 2xS/C ➤ 40% Series compensation of Barh-Balia 400kV quad D/C line at Balia end ➤ 40% Series compensation of Biharsharif-Balia 400kV quad D/C line at Biharsharif /Balia end ➤ Lucknow 765/400kV new sub-station – Lucknow 400/220kV existing sub-station 400 kV quad 2xD/c line ➤ Bareilly 765/400kV new sub-station – Bareilly 400/220kV existing sub-station 400 kV quad 2xD/c line (to match with NKSTPP System) ➤ Ranchi 765/400kV new sub-station – Ranchi 400/220kV existing sub-station 400 kV quad 2xD/c ➤ 765kV substations like Gaya, Sasaram, Fatehpur, Agra, Balia, Lucknow, Bareilly (matching with NKSTPP system) and Ranchi(1200 or 765kV) alongwith suitable 	22 nd SCM held on March 12, 2007	September, 2007	Rs. 8138.23 Crores incl. IDC of Rs. 677.25 Crores (Q1, 2007, PL)		December, 2009 to September, 2010	Under Implementation.

	Name of the Scheme	Elements	SCM approval	Date of FR	Cost (Rs.)	Approval of Board/PIB	Target now	Status
		interconnection with its downstream system at 400kV level.						
27.	NR System Strengthening Scheme-XIII	<ul style="list-style-type: none"> ➤ Gurgaon (PG Sec 72) – Manesar 400 kV D/c(Quad) – 18 km. ➤ Establishment of 400/220kV substation with 2x500 MVA transformation capacity at Manesar ➤ Delinking Agra-Samaypur and Samaypur-Gurgaon (PG Sec-72) 400 kV lines from Samaypur and making a direct line from Agra to Gurgaon (PG Sec-72) 400 kV S/c circuit – 1.5 km. ➤ 2 nos. of 220 kV bays at Fatehabad 400/220 kV substation. ➤ 125 MVAR Bus Reactor at Manesar 	23 rd SCM held on February 16, 2008	September, 2008	Rs. 317.69 Crores incl. IDC of Rs. 24.32 Crores (Q4, 2008, PL)	January 21, 2009	November, 2011	Under Implementation.
28.	NR System Strengthening Scheme-XIV	<ul style="list-style-type: none"> ➤ LILO of Nallagarh-Kaithal 400 kV circuit (Triple Snowbird second ckt of Nalagarh-Hissar 400 kV D/c line) at Patiala (first ckt is already LILoed) – 11 km. ➤ Additional 500 MVA 400/220 kV ICT at Patiala so as to increase transformation capacity from 2x315 MVA to 2x315+1x500 MVA ➤ Additional 500 MVA 400/220 kV ICT at Malerkotla so as to increase transformation capacity from 2x315 MVA to 2x315+1x500 MVA ➤ 125 MVAR Bus Reactor at Patiala 	23 rd SCM held on February 16, 2008	September, 2008	Rs. 132.19 Crores incl. IDC of Rs. 8.93 Crores (Q4, 2008, PL)	January 21, 2009	August, 2011	Under Implementation.
29.	NR System Strengthening Scheme-XV	<ul style="list-style-type: none"> ➤ Manesar - Neemrana 400 kV D/c ➤ Bhiwadi - Neemrana 400 kV D/c ➤ LILO of Bhiwadi – Jaipur 400 kV S/c to establish new 400/220 kV S/s at Kotputli. ➤ Establishment of 400/220kV substation with 2x315 MVA transformation capacity at Neemrana and Kotputli 	23 rd SCM held on February 16, 2008	September, 2008	Rs 520.48 Crores incl. IDC of Rs. 34.45 Crores (Q4, 2008, PL)	February 11, 2009	November, 2011	Under Implementation.
30.	NR System Strengthening Scheme-XVI	<ul style="list-style-type: none"> ➤ LILO of both circuits of Kishenpur – Wagoora 400 kV D/c to create new 400/220 kV S/s at New Wanpoh ➤ Kishenpur – New Wanpoh 400 kV D/c ➤ Establishment of 400/220kV substation with 2x315 MVA transformation capacity at New Wanpoh 	23 rd SCM held on February 16, 2008	FR under Preparation	-	-	-	FR under Preparation
31.	NR System Strengthening Scheme-XVII	<ul style="list-style-type: none"> ➤ Neemrana – Sikar 400 kV D/c 	23 rd SCM held on February 16, 2008	September, 2008	Rs. 210.79 Crores incl. IDC of 13.77 Crores (Q4, 2008, PL)	January 21, 2009	July, 2011	Under Implementation.
32.	NR System Strengthening Scheme-XVIII	<ul style="list-style-type: none"> ➤ Baghpat – Dehradun 400 kV D/c (Quad) ➤ Establishment of 400/220kV substation with 2x315 MVA transformation capacity at Dehradun 	23 rd SCM held on February 16, 2008	September, 2008	Rs. 509.66 Crores incl. IDC of Rs. 36.67 Crores (Q4, 2008, PL)	February 11, 2009	November, 2011	Under Implementation.
33.	NR System Strengthening Scheme-XIX	<ul style="list-style-type: none"> ➤ LILO of both circuits of Meerut – Kaithal 400 kV D/c (Quad HSIL) to create new 400/220 kV S/s at Bagpat ➤ Bagpat 400/220 kV GIS s/s with 2x500 MVA transformation capacity 	23 rd SCM held on February 16, 2008	September, 2008	Rs. 410.29 Crores incl. IDC of Rs. 31.55 Crores (Q4, 2008, PL)	January 21, 2009	December, 2011	Under Implementation.

	Name of the Scheme	Elements	SCM approval	Date of FR	Cost (Rs.)	Approval of Board/PIB	Target now	Status
		<ul style="list-style-type: none"> ➤ 80 MVAR Bus Reactor at Kaithal ➤ 125 MVAR Bus Reactor at Bagpat 						
34.	NR System Strengthening Scheme-XX	<ul style="list-style-type: none"> ➤ LILO of one circuit of Parbati PS – Amritsar 400 kV D/c to create new 400/220 kV S/s at Hamirpur ➤ Hamirpur 400/220 kV s/s with 2x315 MVA transformation capacity 	23 rd SCM held on February 16, 2008	September, 2008	Rs. 244.21 Crores incl. IDC of Rs. 21.50 Crores (Q2, 2008, PL)	Under Investment Approval	2011-12	Under Investment Approval
35.	Kameng (600 MW) & Lower Subansiri HEP (2000 MW) Transmission system : Part-A : North East – Northern / Western Interconnector – I	<ul style="list-style-type: none"> ➤ Biswanath Chariyali – Agra +800 kV, 6000 MW HVDC bi-pole line ➤ Balipara – Bishwanath Chariyali 400kV D/C ➤ LILO of Ranganadi – Balipara 400kV D/C line at Biswanath Chariyali (Pooling Point) ➤ Biswanath Chariyali – Biswanath Chariyali (AEGCL) 132 kV D/c ➤ Establishment of 400/132 kV Pooling Station at Biswanath Chariyali with 2x200MVA, 400/132/33 kV transformers alongwith associated bays. ➤ HVDC rectifier module of 3,000 MW at Biswanath Chariyali and inverter module of 3,000 MW capacity at Agra. ➤ Augmentation of 400 kV Agra substation by 4x105 MVA, 400/220/33 kV transformer alongwith associated bays. 	23 rd SCM held on February 16, 2008		Rs. 11,130.19 Crores incl. IDC of Rs. 1066.05 Crores(Q4, 2008,PL)	February 27, 2009	August, 2013	Under Implementation.
36.	Kameng (600 MW) & Lower Subansiri HEP (2000 MW) Transmission system : Part-B : Transmission Sytem for immediate evacuation of power from Kameng HEP	<ul style="list-style-type: none"> ➤ 2nd 315 MVA, 400/220 kV ICT at Misa ➤ Extension fo 400 kV line bays at Bongaigaon and Balipara substations. 	23 rd SCM held on February 16, 2008	-	-	February 27, 2009	February, 2013	Under Implementation.
37.	Kameng (600 MW) & Lower Subansiri HEP (2000 MW) Transmission system : Part-C : Transmission Sytem for immediate evacuation of power from Lower Subansiri HEP	<ul style="list-style-type: none"> ➤ 400 kV Line bay extensions at Biswanath Chariyali Pooling staction. 	23 rd SCM held on February 16, 2008	-	-	February 27, 2009	February, 2013	Under Implementation.
38.	System Strengthening in Northern Region	<ul style="list-style-type: none"> ➤ 1x315 MVA, 400/220 kV ICT (3rd) at Bhiwadi alongwith associated bays and two nos. of 220 kV line bays ➤ Two nos. of additional bays 220 kV at Panchkula, Sonipat and Gurgaon sec-72 s/s as per the decision taken in 23rd SCM to have 6 nos. 220 kV line bays with first two 315 MVA ICTs. These bays are to be utilized by HVPNL. ➤ Bhiwani – Jind 400 kV D/c ➤ Establishment of new 400/220 kV, 2x315 MVA substation at Jind ➤ Establishment of new 400/220 kV, 2x315 MVA substation at Sohawal ➤ LILO of both the ckts of Balia – Lucknow 400 kV D/c line at Sohawal ➤ Establishment of new 400/220 kV, 2x315 MVA substation at Saharanpur 	26 th SCM held on October 28, 2008	FR under Preparation				

	Name of the Scheme	Elements	SCM approval	Date of FR	Cost (Rs.)	Approval of Board/PIB	Target now	Status
		<ul style="list-style-type: none"> ➤ LILO of both the ckts of Dehradun – Bagpat 400 kV D/c Quad line at Saharanpur ➤ Establishment of new 400/220 kV, 2x315 MVA substation at Shajahanpur ➤ LILO of both the ckts of Lucknow (PG) – Bareilly 400 kV D/c line at Shajahanpur ➤ Establishment of new 400/220 kV, 2x500 MVA substation at Jaipur (South) ➤ LILO of both the ckts of Agra – Jaipur 400 kV D/c line at Jaipur (South) 						

PROPOSED TRANSMISSION SYSTEM

Tilaiya UMPP (4000MW) – To be shared by constituents in proportion to allocation

1. Tilaiya UMPP – Balia 765kV 2xS/C line
2. Tilaiya UMPP – Gaya, 765kV S/C line

Note : Earlier Tillaiya – Balia 765 kV S/c and Tillaiya – Sasaram 765 kV lines were proposed. However, considering the space constraints Tillaiya – Balia 765 kV 2xS/s lines are proposed.

Nabinagar (1000MW)

1. Nabinagar-Sasaram 400kV D/C line

Barh-II (1320MW)

1. Barh – Gorakhpur 400kV quad D/C line

System Strengthening in NR for Tillaiya, Nabinagar and Barh-II –Proposed to be shared by NR Constituents

- Balia – Lucknow, 765kV (Second)S/C line
- Meerut – Moga, 765kV S/C line

Generation Specific Transmission System for other ER projects:

For pooling of power from proposed power projects in Orissa, following three (3) nos. of 765/400kV pooling substation are proposed to be established in Orissa :

- a. Pooling Station at Jharsuguda**
- b. Pooling Station at Dhenkanal**
- c. Pooling Station at Angul**

These substations are planned to be interconnected with each other through following 765kV 2xS/c ring network:

- Dhenkanal Pooling Station – Angul Pooling Station 765kV 2xS/c
- Angul Pooling Station – Jharsuguda Pooling Station 765kV 2xS/c

- Jharsuguda Pooling Station – Dhenkenal Pooling Station 765kV 2xS/c

For onward transfer of power to WR/NR, the pooled power from different generating stations in Orissa at three pooling stations mentioned above is proposed to be injected at new pooling station near Dharamjaygarh in Chhattisgarh through **Jharsuguda – Pooling Station – Dharamjaygarh 765kV 2xD/c lines**. This pooling station near Dharamjaygarh is proposed to be established by LILO of Ranchi – WR Pooling Point 765 kV S/c line and a separate Ranchi-Dharamjaygarh-WR Pooling 765 kV 2nd S/c line which will also be utilized for transfer of power from Jharkhand projects.

Generation specific transmission system is given below:

Essar(1800MW), Electrosteel(1200MW) and Corporate(800MW):

These three IPPs in Jharkhad would connect at 400kV to Ranchi 765/400kV substation through dedicated/common 400kV transmission lines

Adunik (1000MW) and DumkaCESC (1200MW) :

These two IPPs in Jharkhand would connect to ER grid at Jamshedpur/Maithon/Gaya

Sterlite(2400MW), GMR (1050MW), Monet (1005MW), Jindal (1200MW), Essar(1200MW) and Lanco (2640MW)

These IPPs in Orissa would connect to 765kV and 400kV system specifically proposed in ER for Orissa IPPs. Three 765/400kV pooling stations at Jharsuguda, Angul and Denkenal have been proposed together with Jarsuguda-Angul-Denkenal-Jharsuguda 2xS/C 765kV lines. This system is proposed to be connected to WR system through following provision:

1. LILO of all four circuits of Rourkela-Raigarh 2xD/C 400kV lines at Jharsuguda.
2. Jarsuguda-Dharmjaygarh 4xS/c or 2xD/C 765kV lines.

WBPDCL projects

To be connected to West Bengal and ER grid

Generation Specific Transmission System for WR projects:

Details for the Generation specific transmission system for the projects located in WR and which have already been discussed in Western region is given below:

Maruti Clean Coal & Power Ltd.

- Maruti – WR Pooling Station near Sipat 400kV D/c

Dheeru Powergen Pvt. Ltd.

- Dheeru – WR Pooling Station near Sipat 400kV D/c[Triple/Twin Lapwing]

Jaiprakash Associates Ltd.

- JAL – Satna(PG) 400kV D/c (Quad)

Aryan Coal Benefication Pvt. Ltd. (MP)

- Aryan – VSTPP Pooling Station 400kV D/c (Triple)

Transmission charges for immediate evacuation of power from various projects are to be shared in proportion to the allocation of power from the generation project. Alternatively, dedicated transmission lines from the generating stations which would be constructed by the generators at their own cost, can be recovered by them through their generation tariff and when a group of generators would have common dedicated lines, they would share the cost between themselves and recover their respective investment through their respective generation tariff.

OTHER COMMON TRANSMISSION SYSTEM

Strengthening Scheme for NR (common for Jharkhand IPPs and import by NR from ER or from NER/SR/WR via ER)

- Gaya-Balia 765 kV S/C(2nd line)
- New 765/400kv S/s at Varanasi and Kanpur
- LILO of Tillaya –Balia 765kV S/C at Varanasi
- Varanasi - Kanpur 2xS/C 765kV lines
- Kanpur – Bareilly 765kV S/C line
- Kanpur – Jhatikalan 765kV S/C line
- 400kV connectivity for new 765/400kV S/S at Varanasi and Kanpur.

ER-NR HVDC Corridor

For transfer of power from the generation projects located in Orissa and southern part of ER, 6000MW, \pm 800kV HVDC bipole has been planned from Angul Pooling Point (ER-Orissa) to Barnala(NR) for transfer of power from ER to NR.

- Angul Pooling Point– Barnala (NR) 6000MW, \pm 800kV HVDC Bipole
- Barnala – Malerkotla 400 kV D/c (quad)
- Barnala – Amritsar 400kV D/c (quad)
- Barnala – Jullandhar 400kV D/c (quad) (one circuit via Nakodar)
- Barnala – Dhuri 400kV D/c (quad)

The transmission charges for the above transmission system shall be initially borne by the generation developers till the time beneficiaries are firmed up.

Part of ER-WR-NR Corridor - Common for WR-NR

- Establishment of 765/400kV substation at Dharamjaygarh
- Jharsuguda Pooling Station – Dharamjaygarh 765kV 2xD/c
- LILO of Ranchi – WR Pooling 765kV S/c line at Dharamjaygarh
- Ranchi - Dharamjaygarh 765kV S/C line
- Dharamjaygarh – WR Pooling station 765 kV S/c line
- Dharamjaygarh-Jabalpur Pooling station 765kV 2xD/C 765kV lines
- Pooling station at Jabalpur with 2x1500MVA 765/400kV
- Jabalpur Pooling station – Bina 765kV one D/c & one S/c
- Bina – Gwalior 765kV S/c (3rd)

The transmission charges for the above transmission system shall be initially borne by the generation developers till the time beneficiaries are firmed up.

NR Strengthening – For import of power from WR / Via WR

- Gwalior – Jaipur 765kV S/c
- Jaipur – Bhiwani 765 kV S/c
- Bhiwani – Moga 765 kV S/c
- Charging of Kishenpur – Moga 2x765 kV line at 765 kV level
- Augmentation of Kishenpur substation to 765 kV level with 2x1500 MVA transformation capacity

The transmission charges for the above transmission system shall be initially borne by the generation developers till the time beneficiaries are firmed up.

The above transmission schemes were agreed by the NR constituents.

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Jaipur, Dt: 20/5/09

No. RVPN/SE(P&P)/PSS/D. 180

Shri V. Ramakrishna
Member Secretary (PS)
Central Electricity Authority,
Sewa Bhawan,
R.K. Puram,
New Delhi - 110056.

Sub: Agenda Item of RVPNL to be included in 27th meeting of the Standing
Committee on Transmission System Planning of NR


Dear Sir,

As per discussion of RVPNL Engineers with CEA officers on dated 15-5-09 at Sewa Bhawan, New Delhi, the revised Load Flow Studies have been conducted for the condition corresponding to 2016-17 for Evacuation System of the newly proposed Super Critical Thermal Power Stations at Chhabra (2*660 MW), Kewal (2*330 MW), Banwara (3*660 MW) and Suratgarh (3*660 MW).

Detailed proposal along with load flow study results is enclosed for inclusion in the 27th meeting of the Standing Committee on Transmission System Planning of NR for discussion.

With regards

Your's faithfully,


(B.N. Saini)

CHIEF ENGINEER (PPM&R)

O/c A.T.

Encl:

1. Appendix-1: Justification Note
2. Appendix-2: Cost Estimate
3. Appendix-3: Load Generation Balance Report

5/2
20/5/09

Proposed Evacuation System of Chhabra Super Critical TPS (2*660 MW) & Kawai TPS (2*330MW)

Background

In Baran district of Rajasthan at Chhabra TPS, there are 2 units of 250 MW (under Stage I- Phase I) at commissioning stage and additional 2 units of 250 MW (under Stage I- Phase II) are under construction. RVUN has further stipulated 2x660MW at Chhabra TPS under Stage II and 4x330 MW Power Plant at Kawai TPS (a Generating Plant which would be very close to Chhabra TPS) under IPP sector is also in advance stage of finalization.

Existing/Approved Transmission System at Chhabra TPS

The approved 2xD/C 400 kV line from Chhabra TPS to 400/220 kV GSS at Dahra, Bhilwara and Hindaun are sufficient for evacuation of 4x250 MW power even under various contingencies. Further, for evacuation of power of approx. 1980 MW i.e. Chhabra TPS (2x660 MW) + Kawai TPS (2x330 MW- allocation to Rajasthan) would require new Transmission system.

Planning Criteria

- For evacuation of power of approx. 1980 MW from Chhabra TPS (2x660 MW) and Kawai TPS (2x330 MW- allocation to Rajasthan) at least 3 Nos. of 400 kV D/C lines on Twin Moose would be required. Laying of 3xD/C 400 kV lines on Twin Moose would pose serious Right Of Way problem, therefore, in order to reduce the environmental impact and land use, we have designed the Evacuation System with minimum number of transmission lines i.e. 2xS/C 765 kV.
- The tentative Cost Estimates of the Evacuation System at 765 kV voltage level on Quad Bersimis and 400 kV voltage level on Quad Moose indicate that the cost estimates are comparable, hence 765 kV option has been recommended for evacuation of generation from both Chhabra TPS (2x660 MW) and Kawai TPS (2x330 MW). Tentative Cost Estimates for Evacuation System at 765 kV voltage level and Evacuation System at 400 kV voltage level are placed at **Annexure I(A) and I(B)** respectively.
- Further, under future generation expansion at Chhabra TPS or/and Kawai TPS 2xS/C 765 kV lines would continue to suffice, hence the proposal of 765 kV would become more economical as compared to 400 kV proposal.
- The step up generation at Chhabra TPS and Kawai TPS would be 400 kV voltage level. Both the generators would be connected through 400 kV D/C lines to the proposed 400/765 kV Pooling Station at Chhabra (a location in between Chhabra TPS and Kawai TPS).

- The length of the interconnecting transmission lines involved would be of the order of 350 kms from the generating stations at Chhabra and Kawai in Baran district to major load centers at Jaipur. Therefore, in the Evacuation System on 765 kV voltage level, 400 kV transmission lines from the 765/400 kV GSS at Jaipur(South-PG) would involve laying down of shorter 400 kV transmission lines vis-à-vis in the Evacuation System on 400 kV voltage level. This proposal would reduce the transmission losses in the system.
- 765 kV 2xS/C transmission lines have been proposed to provide sufficient redundancy and reliability under N-1 contingencies of transmission lines.
- As the development of generation projects would take place in phased manner, it is expected that during initial years of operation, 765 kV transmission line may be lightly loaded. Thus in order to obviate the onerous task of reactive power management, 765 kV transmission line would be charged on 400 kV voltage level till the generators would generate 750 – 1000 MW.
- 765 kV transmission line would be generating large capacitive charging MVAR and, therefore, to limit over voltages under lightly loaded condition and also to limit switching over voltages, 3x80/110 MVAR, 765 kV line/bus type shunt reactors have been proposed.
- Keeping the above facts in mind, it is felt that there is a need to increase the AC transmission voltage beyond 400 kV and explore the possibility of establishing 765 kV network in Rajasthan. Now a days evacuation and transfer of bulk power over 765 kV transmission line is considered to be better option by PowerGrid in India and other countries.

Proposed Evacuation for Chhabra TPS(2x660 MW) & Kawai TPS(3x 330 MW)

SNo.	Transmission System	Line Length/ No.	Transf. Capacity
A	Chhabra TPS (2*660 MW)		
1	400 kV 2xD/C (Quad Moose) Chhabra TPS - Chhabra Pooling Station line	10 kms, 2xD/C	
2	LILO of one ckt of 400 kV D/C+S/C Chhabra TPS - Dahra line at Chhabra Pooling Station	10 kms, D/C	
3	LILO of one ckt of 400 kV D/C Kalisindh TPS - Dahra line at Chhabra Pooling Station	50 kms, D/C	
4	1*1500 MVA,765/400 kV GSS at Chhabra Pooling Station (RVPN)	1 No.	1500 MVA
5	765 kV 2xS/C Chhabra TPS - Jaipur(South) line	330 kms 2xS/C	
6	1*1500 MVA,765/400 kV GSS at Jaipur(South)	1 No.	1500 MVA
7	3*80 MVAR (Single Phase) Line Reactors at both ends of 765 kV 2xS/C Chhabra PP - Jaipur(South) lines	4 Sets	
8	3*110 MVAR (Single Phase), 765 kV Bus Reactors at Jaipur(South)	1 Sets	
9	10 km LILO of 400 kV S/C Hindaun-Heerapura line at Jaipur(South)	10 kms, D/C	
10	10 km LILO of one circuit of 400 kV D/C Chhabra TPS-Heerapura line at Jaipur(South)	10 kms, D/C	
11	10 km LILO of one circuit of 400 kV D/C Ajmer-Heerapura line at Jaipur(South)	10 kms, D/C	
12	220 kV D/C interconnections at Jaipur (South)	50 kms, D/C	
	TOTAL(A)		
B	Kawai TPS (2*330 MW)		
1	400 kV D/C (Quad Moose) Kawai TPS - Chhabra Pooling Station line	20 kms, D/C	

Evacuation System of Suratgarh Super Critical Thermal Power Station (3*660 MW)

Introduction

The State Govt. has accorded 'in principle' approval for 2*660 MW at Suratgarh TPS under Extension Stage V (Unit 7 & 8) in Sriganganagar district to be set up by Rajasthan Rajya Vidyut Utpadan Nigam Ltd. (RVUNL). Furthermore, an additional 1*660 MW is also anticipated by RVUNL. Therefore, RVPNL have to design the Evacuation System for 3 * 660 MW at Suratgarh TPS.

Existing Transmission System at STPS

At Suratgarh TPS, there are 5 units of 250 MW under Stage I- III and one unit of 250 MW under Stage IV has been synchronized on 31st March '2009. The existing Evacuation System at STPS is as under:

SNo	Generator	Transmission System
A	STPS Stage I-III (5*250 MW)	2*S/C 400 kV STPS – Ratangarh line
		3*315 MVA, 400/220 kV GSS at Ratangarh
		2*S/C 220 kV STPS – Suratgarh line
		1*D/C 220 kV STPS – Ratangarh line
		1* S/C 220 kV STPS – Bikaner line
B	STPS Stage IV (1*250 MW)	1*S/C 400 kV STPS – Bikaner line (to be initially charged on 220 kV)..... works under progress
		1* S/C 220 kV STPS – Bhadra line

Now RVUN has further stipulated 3x660 MW at Suratgarh Super Critical TPS and the quantum of power to be evacuated would be 1980 MW. Since the existing 3 Nos. of 400 kV lines and 6 Nos. of 220 kV do not have sufficient spare capacity to evacuate additional 1980 MW, hence new lines would have to be laid.

Criteria for selecting the voltage level for new evacuation system

The tentative Cost Estimates for the evacuation on 765 kV voltage level (**Annexure II(A)**) and the evacuation on 400 kV voltage level (**Annexure II(B)**) indicate that the evacuation proposal on 765 kV voltage level would be more economical as compared to 400 kV voltage level on Quad Moose.

Assumptions for designing the evacuation system

1. The step-up generator voltage at Suratgarh TPS would be 765 kV.
2. 1x1500 MVA, 400/765 kV ICT has been proposed at Suratgarh TPS.
3. For ensuring the stability of the proposed Power Evacuation System under N-1 outage of transmission line, 2 Nos. S/C of 765 kV lines have been proposed.
4. 2xS/C 765 kV Suratgarh TPS – Neemrana lines with 1x1500 MVA, 765/400 GSS at Neemrana have been proposed, which would benefit the growing load centers at NCR (Alwar district).

Proposed Evacuation System for Suratgarh TPS (3x660 MW)

SNo.	Transmission System	Line Length/No	Transf. Capacity
1	1*1500 MVA,765/400 kV ICT at Suratgarh TPS	1 No.	1500 MVA
2	765 kV 2xS/C Suratgarh TPS - Neemrana line	350 kms 2xS/C	
3	1*1500 MVA,765/400 kV GSS at Neemrana	1 No.	1500 MVA
4	3*80 MVAR (Single Phase) Line Reactors at both ends of 765 kV 2xS/C Suratgarh TPS-Neemrana lines	4 Sets	
5	3x110 MVAR (Single Phase), 765 kV Bus Reactors at Neemrana	1 Sets	
6	400 kV D/C (Twin Moose) Neemrana– Jhunjhunu line	120 kms, D/C	
7	2x315 MVA, 400/220 kV GSS at Jhunjhunu	1 No.	630 MVA
8	220 kV interconnections at 400/220 kV GSS at Jhunjhunu	60 kms, D/C	

Evacuation System of Banswara Super Critical Thermal Power Station (3*660 MW)

Background

The State Govt. has announced the implementation of 2*660 MW at Banswara TPS in Banswara district in the XII Plan period. This Generating Project would be set up under “Case-2” Projects.

Planning Criteria

- The proposed Evacuation System for Banswara TPS would have to pass through reserved forest and Wildlife sanctuary, which may call for laying of high capacity transmission corridor.
- It is anticipated that there could be addition of 1 to 2 units of 660 MW at Banswara TPS, therefore the proposed Evacuation System have been designed for 3x660 MW.
- The tentative Cost Estimates for the evacuation on 765 kV voltage level is at **Annexure III**

Proposed Evacuation System

SNo	Transmission System	Line Length/No	Transf. Capacity
1	765 kV 2xS/C Banswara TPS - Bhilwara(New) line	240 kms 2xS/C	
2	765 kV S/C Bhilwara(New) - Jaipur (South) line	250 kms	
3	1*1500 MVA, 765/400 kV GSS at Bhilwara(New)		1500 MVA
4	765 kV S/C Jaipur (South) - Neemrana line	160 kms	
5	3x80 MVAR (Single Phase) Line Reactors at both ends of 765 kV 2xS/C Banswara TPS - Bhilwara(New) ,Bhilwara(New) - Jaipur (South) & Jaipur(South) - Neemrana lines	8 SETS	
6	3x110 MVAR (Single Phase), 765 kV Bus Reactors at Bhilwara(New)	1 SETS	
7	400 kV inter-connections at 765/400 kV Bhilwara (New)		
(i)	400 kV D/C Bhilwara(New) - Ajmer line with one circuit LILO at existing 400 kV GSS Bhilwara	150 kms, D/C	
(ii)	10 kM LILO of 400 kV S/C Bhilwara - Dahra line at Bhilwara (new)	10 kms, D/C	
(iii)	400 kV D/C Bhilwara(New) - Udaipur line	160 kms, D/C	
(iv)	2*315 MVA, 400/220 kV ICTs at Bhilwara(New) & associated bay works		630 MVA
(v)	220 kV interconnections at Bhilwara(New)	60 kms, D/C	
(vi)	2*315 MVA, 400/220 kV GSS at Udaipur		630 MVA
(vii)	220 kV interconnections at Udaipur	60 kms, D/C	

Load Flow Studies

It is anticipated that there would be increase in peak demand due to the impact of supply to Agriculture consumers from 3 blocks to 2 blocks. Also, higher growth rate has been anticipated in Industrial Sector due to development of Special Economic Zone in important cities of Rajasthan as well as fast urbanization. In view of these assumptions, it has been anticipated that Total System Peak Load of Rajasthan would be 16050MW in 2016-17 condition.

The load flow studies have been conducted for the following scenario:

System Condition	Exhibit No.	Table No.
The system condition corresponding to 2016-17 for the revised Total System Peak Load of 16050 MW: <ul style="list-style-type: none">• Commissioning of 2x660 MW Units at Chhabra TPS, 2x330 MW at Kawai TPS, 3x660 MW each at Suratgarh TPS and Banswara TPS• Charging of 2x765 kV lines on 765 kV voltage level	1	1
The system condition corresponding to 2016-17 under Low Load of 12000 MW:	2	2

Observations:

1. The proposal of 400/765 kV pooling station at Chhabra would enable to optimize the number to EHV lines which should emanate for evacuation of power from Chhabra TPS and Kawai TPS.
2. 2 Nos of 765 kV lines from each of the Super Critical Generating Station would help to provide the system stability under N-1 contingency.
3. Sufficient shunt line/bus type reactors have been proposed in order to limit the over voltage problems under low load conditions.

Conclusion:

Proposed Evacuation System for Chhabra/Kawai TPS

1. Step up generation at Chhabra TPS (2x660 MW) and Kawai TPS (3x330 MW) at 400 kV voltage level
2. 400 kV interconnections between Chhabra TPS/ Kawai TPS and Chhabra Pooling Station (RVPN)
3. 1*1500 MVA, 400/765 kV GSS at Chhabra Pooling Station (RVPN)
4. 765 kV 2xS/C Chhabra TPS - Jaipur(South) line (330 kms)

5. 1*1500 MVA, 765/400 kV GSS at Jaipur(South)
6. 3*80 MVAR (Single Phase) Line Reactors at both ends of 765 kV 2xS/C Chhabra PP - Jaipur(South) lines
7. 3*110 MVAR (Single Phase), 765 kV Bus Reactors at Jaipur(South)

Since 2x S/C 765 kV lines are proposed towards Jaipur(South), thus it is very essential that the commissioning of 765/400 kV GSS at Jaipur (South) is firm in the same time frame in which the Units at Chhabra/Kawai TPS would commission. Secondly, due to the availability of sufficient number of the existing/approved 400 kV lines of RVPN in the southern part of Jaipur, hence dispersal of 1980 MW at Jaipur could be facilitated without any constraint. Therefore, it is proposed that 765/400 kV GSS at Jaipur (South) be constructed by RVPN vis-à-vis PGCIL.

Proposed Evacuation System for Suratgarh TPS

1. The step-up generator voltage at Suratgarh TPS would be 765 kV.
2. 1x1500 MVA, 400/765 kV ICT has been proposed at Suratgarh TPS.
3. 765 kV 2xS/C Suratgarh TPS - Neemrana line (350 kms)
4. 3*80 MVAR (Single Phase) Line Reactors at both ends of 765 kV 2xS/C Suratgarh TPS - Neemrana lines
5. 3*110 MVAR (Single Phase), 765 kV Bus Reactors at Neemrana

Since PGCIL has already initiated the identification of suitable land at Neemrana for construction of 400/220 kV GSS and with the availability of sufficient number of proposed 400 kV regional lines at Neemrana, It is proposed that 765/400 kV GSS at Neemrana be constructed by PGCIL and accordingly PGCIL may consider up-gradation of their 400/220 kV GSS at Neemrana to 765 kV voltage level.

Proposed Evacuation System for Banswara TPS

1. 765 kV 2xS/C Banswara TPS - Bhilwara(New) line (240 kms)
2. 765 kV S/C Bhilwara(New) - Jaipur (South) line (250 kms)
3. 1*1500 MVA, 765/400 kV GSS at Bhilwara(New)
4. 765 kV S/C Jaipur (South) - Neemrana line (160 kms)
5. 3x80 MVAR (Single Phase) Line Reactors at both ends of 765 kV 2xS/C Banswara TPS - Bhilwara(New), Bhilwara(New) - Jaipur (South) & Jaipur(South) - Neemrana lines
6. 3x110 MVAR (Single Phase), 765 kV Bus Reactors at Bhilwara(New)

EXPORT/IMPORT FROM CENTRAL SECTOR PROJECTS AND SHARED PROJECTS CORRESPONDING TO 2016-17 UNDER LOW HYDRO (30% IC) SCENARIO			
	NAME OF STATION	INSTALLED CAPACITY	Allocation to Rajasthan
A	SHARED PROJECTS		
1	SHARED PROJECTS OUTSIDE RAJASTHAN(Excl. GS HEP & Satpura Thermal)		200.58
2	SHARED PROJECTS INSIDE RAJASTHAN (30% IC)	81.30	40.65
	TOTAL(A) (30% IC)		241.23
	IMPORT ON NREB_ HYDRO BUS		159.93
B	CENTRAL SECTOR PROJECTS		
1	PROJECTS OUTSIDE RAJASTHAN		
	NTPC, NLC		1539.12
	NPC		144.00
	NHPC & OTHERS (30% IC)		361.48
	TOTAL (B1)		2044.60
2	PROJECTS INSIDE RAJASTHAN		
	Anta Gas	419.33	83.07
	Barsingsar (NLC)	250.00	250.00
	RAPP-UNIT 2 to4	640.00	325.00
	RAPP-UNIT 5 & 6	440.00	88.00
	RAPP-UNIT 7 & 8	1400.00	280.00
	TOTAL (B2)	3149.33	1026.07
	TOTAL(B)		3070.67
C	ULTRA MEGA POWER PROJECTS		800.00
	IMPORT ON NREB_ THERMAL BUS		721.34
	TOTAL (SHARED/ALLOCATION)		4111.90
	TOTAL GENERATION INSIDE RAJASTHAN	3230.63	
	NET POWER IMPORT ON TIE LINES		881.27
	PEAKING CAPABILITY AT 70%		616.89

EXPORT/IMPORT FROM CENTRAL SECTOR PROJECTS AND SHARED PROJECTS CORRESPONDING TO 2016-17 UNDER LOW THERMAL (70% IC) SCENARIO			
	NAME OF STATION	INSTALLED CAPACITY	Allocation to Rajasthan
A	SHARED PROJECTS		
1	SHARED PROJECTS OUTSIDE RAJASTHAN(Excl. GS HEP & Satpura Thermal)		668.61
2	SHARED PROJECTS INSIDE RAJASTHAN	271.00	135.50
	TOTAL(A)		804.11
	IMPORT ON NREB_HYDRO BUS		533.11
B	CENTRAL SECTOR PROJECTS		
1	PROJECTS OUTSIDE RAJASTHAN		
	NTPC, NLC (70% IC)		-233.15
	NPC (70% IC)		-289.10
	NHPC & OTHERS		1204.92
	TOTAL (B1)		682.67
2	PROJECTS INSIDE RAJASTHAN		
	Anta Gas	419.33	83.07
	Barsingsar (NLC)	250.00	250.00
	RAPP-UNIT 2 to4	640.00	325.00
	RAPP-UNIT 5 & 6	440.00	88.00
	RAPP-UNIT 7 & 8	1400.00	280.00
	TOTAL (B2) (70% IC)	2204.53	718.25
	TOTAL(B)		1400.92
C	ULTRA MEGA POWER PROJECTS		800.00
	TOTAL (SHARED/ALLOCATION)		3005.03
	IMPORT ON NREB_THERMAL BUS		-3.61
	TOTAL GENERATION INSIDE RAJASTHAN	2475.53	
	NET POWER IMPORT ON TIE LINES		529.50
	PEAKING CAPABILITY AT 70%		370.65

TABLE-1 : Power flow for the system condition corresponding to 2016-17 for 16050 MW system load		
SNo.	Transmission System	POWER FLOW(MW)
		Exhibit -2
A	765 kV Transmission Lines	
	2* S/C Chhabra (PP) - Jaipur(South) line	1348 MW
	2* S/C STPS - Neemrana line	1240 MW
	2* S/C Banswara TPS - Bhilwara(New) lines	1970 MW
	1* S/C Bhilwara (New)- Jaipur (South) line	713 MW
	1* S/C Jaipur(South) - Neemrana line	424 MW
B	765/400 kV ICT	
	1*1500 MVA, 765/400 kV Bhilwara (New)	1247 MW
	2*1500 MVA, 765/400 kV Jaipur (South)	1629 MW
	2*1500 MVA, 765/400 kV Neemrana	1659 MW
	2*1500 MVA, 400/765 kV Chhabra (PP)	1351 MW
	*1500 MVA, 765/400 kV Suratgarh TPS	729 MW
C	400 kV Transmission Lines	
I	At 765/400 kV Jaipur(South)	
	3*S/C Jaipur (South) - Heerapura line	1224 MW
	1*S/C Jaipur (South) - Ajmer line	-19 MW
	1*S/C Jaipur (South) - Dahra line	-338 MW
	1*S/C Jaipur (South) - Hindaun line	133 MW
II	At 400/220 kV Jaipur(North)	
	1*S/C Jaipur (North) - Heerapura line	-428 MW
	1*S/C Jaipur (North) - Merta line	99 MW
	2*S/C Jaipur (North) - Bassi(PG) line	336 MW
	1*S/C Jaipur (North) - Sikar(PG) line	24 MW
	1*S/C Jaipur (North) - Kotputli(PG) line	168 MW
III	At 765/400 kV Neemrana	
	D/C Neemrana(PG) - Alwar line	331 MW
	D/C Alwar - Hindaun line	-101 MW
	D/C Neemrana(PG) - Sikar(PG) line	115 MW
	D/C Neemrana(PG) - Hissar(PG-NR) line	-17 MW
	D/C Neemrana(PG) - Jhunjhunu line	632 MW
	D/C Neemrana(PG) - Manesar(PG-NR) line	0 MW
IV	At 765/400 kV Bhilwara (New)	
	D/C Bhilwara - Ajmer line	231 MW
	S/C Bhilwara - Dahra line	-341 MW
	D/C Bhilwara - Udaipur line	466 MW
V	At STPS	
	2*S/C STPS - Ratangarh line	740 MW
	S/C STPS - Bikaner line	443 MW

TABLE-2 : Power flow for the system condition corresponding to 2016-17 for 12000 MW system load		
SNo.	Transmission System	POWER FLOW(MW)
		Exhibit -3
A	765 kV Transmission Lines	
	2* S/C Chhabra (PP) - Jaipur(South) line	1098 MW
	2* S/C STPS - Neemrana line	852 MW
	2* S/C Banswara TPS - Bhilwara(New) lines	1312 MW
	1* S/C Bhilwara (New)- Jaipur (South) line	385 MW
	1* S/C Jaipur(South) - Neemrana line	270 MW
B	765/400 kV ICT	
	1*1500 MVA, 765/400 kV Bhilwara (New)	923 MW
	2*1500 MVA, 765/400 kV Jaipur (South)	1210 MW
	2*1500 MVA, 765/400 kV Neemrana	1120 MW
	2*1500 MVA, 400/765 kV Chhabra (PP)	1101 MW
	*1500 MVA, 765/400 kV Suratgarh TPS	463 MW
C	400 kV Transmission Lines	
I	At 765/400 kV Jaipur(South)	
	3*S/C Jaipur (South) - Heerapura line	914 MW
	1*S/C Jaipur (South) - Ajmer line	-6 MW
	1*S/C Jaipur (South) - Dahra line	-268 MW
	1*S/C Jaipur (South) - Hindaun line	73 MW
II	At 400/220 kV Jaipur(North)	
	1*S/C Jaipur (North) - Heerapura line	-313 MW
	1*S/C Jaipur (North) - Merta line	114 MW
	2*S/C Jaipur (North) - Bassi(PG) line	-259 MW
	1*S/C Jaipur (North) - Sikar(PG) line	-8 MW
	1*S/C Jaipur (North) - Kotputli(PG) line	101 MW
III	At 765/400 kV Neemrana	
	D/C Neemrana(PG) - Alwar line	243 MW
	D/C Alwar - Hindaun line	-73 MW
	D/C Neemrana(PG) - Sikar(PG) line	108 MW
	D/C Neemrana(PG) - Hissar(PG-NR) line	-61 MW
	D/C Neemrana(PG) - Jhunjhunu line	446 MW
	D/C Neemrana(PG) - Manesar(PG-NR) line	0 MW
IV	At 765/400 kV Bhilwara (New)	
	D/C Bhilwara - Ajmer line	72 MW
	S/C Bhilwara - Dahra line	-329 MW
	D/C Bhilwara - Udaipur line	397 MW
V	At STPS	
	2*S/C STPS - Ratangarh line	554 MW
	S/C STPS - Bikaner line	337 MW

TENTATIVE COST ESTIMATES		
SNo.	Transmission System	Unit Cost (Rs. Crores)
1	765 kV S/C line	1.45
2	765/400 kV GSS without ICT	261.30
3	1*1500 MVA. 765/400 kV ICT (Banks of 4 Single Phase Transformers)	51.00
4	3*80 MVAR, 765 kV Line Reactors	28.00
5	3*110 MVAR, 765 kV Bus Reactors	32.00
6	2x315 MVA, 400/220 kV GSS	79.41
7	1*315 MVA, 400/220 kV ICT	11.50
8	400 kV D/C line (Twin Moose)	0.80
9	400 kV D/C line (Quad Moose)	1.95
10	50 MVAR, 400 kV Line Reactors	3.50
11	63 MVAR, 400 kV Line Reactors	4.75
12	80 MVAR, 400 kV Line Reactors	5.00
13	125 MVAR, 400 kV Bus Reactors	5.50
14	40 % Series Compensation on 400 kV D/C (Quad Moose) lines	30.00
15	220 kV D/C line (Zebra)	0.37

Annexure - III(a)

Cost of Proposed Evacuation System at 765 kV voltage level for Super Critical Thermal Power Stations at Banswara TPS (3x660 MW)				
SNo	Transmission System	Line Length/ sets	Transformation Capacity	Cost (In Cr.)
1	765 kV 2xS/C Banswara TPS - Bhilwara(New) line	240 kms 2xS/C		696.00
2	765 kV S/C Bhilwara(New) - Jaipur (South) line	250 kms		362.50
3	1*1500 MVA, 765/400 kV GSS at Bhilwara(New)		1500 MVA	312.30
4	765 kV S/C Jaipur (South) - Neemrana line	160 kms		232.00
5	3x80 MVAR (Single Phase) Line Reactors at both ends of 765 kV 2xS/C Banswara TPS - Bhilwara(New) ,Bhilwara(New) - Jaipur (South) & Jaipur(South) - Neemrana lines	8 SETS		224.00
6	3x110 MVAR (Single Phase), 765 kV Bus Reactors at Bhilwara(New)	1 SETS		32.00
7	400 kV inter-connections at 765/400 kV Bhilwara (New)			
(i)	400 kV D/C Bhilwara(New) - Ajmer line with one circuit LILO at existing 400 kV GSS Bhilwara	150 kms, D/C		119.70
(ii)	10 kM LILO of 400 kV S/C Bhilwara - Dahra line at Bhilwara (new)	10 kms, D/C		7.98
(iii)	400 kV D/C Bhilwara(New) - Udaipur line	160 kms, D/C		127.68
(iv)	2*315 MVA, 400/220 kV ICTs at Bhilwara(New) & associated bay works		630 MVA	79.41
(v)	220 kV interconnections at Bhilwara(New)	60 kms, D/C		22.20
(vi)	2*315 MVA, 400/220 kV GSS at Udaipur		630 MVA	79.41
(vii)	220 kV interconnections at Udaipur	60 kms, D/C		22.20
	Total Cost of Power Evacuation System of Banswara TPS (3x660 MW)			2317.38

Annexure - III(b)

Cost of Proposed Evacuation System at 400 kV voltage level for Super Critical Thermal Power Stations at Banswara TPS (3x660 MW)				
SNo	Transmission System	Line Length/ sets	Transformation Capacity	Cost (In Cr.)
1	400 kV 2xD/C (Quad Moose) Banswara TPS - Bhilwara(New) line	240 kms 2xD/C		936.00
2	400 kV D/C (Quad Moose) Bhilwara(New) - Jaipur (South) line	250 kms, D/C		487.50
3	400 kV D/C (Quad Moose) Bhilwara(New) - Jodhpur (New) line	230 kms, D/C		448.50
3	3*315 MVA, 400/220 kV GSS at Bhilwara(New)		945 MVA	90.91
4	400 kV D/C (Quad Moose) Jaipur (South) - Neemrana line	160 kms, D/C		312.00
5	40 % Series Compensation on 400 kV 2xD/C (Quad Moose) Banswara TPS - Bhilwara(New) , D/C Bhilwara(New) - Jaipur (South), D/C Bhilwara(New) - Jodhpur (New) & D/C Jaipur (South) - Neemrana lines	5 Sets		150.00
6	2*80 MVAR Line Reactors at both ends of 400 kV 2xD/C (Quad Moose) Banswara TPS - Bhilwara(New) , D/C Bhilwara(New) - Jaipur (South), D/C Bhilwara(New) - Jodhpur (New) & D/C Jaipur (South) - Neemrana lines	20 Sets		100.00
7	125 MVAR , 400 kV Bus Reactors at Bhilwara(New) and Jodhpur(New)	2 SETS		11.00
8	400 kV D/C Bhilwara(New) - Ajmer line with one circuit LILO at existing 400 kV GSS Bhilwara	150 kms, D/C		119.70
9	10 KM LILO of 400 kV S/C Bhilwara - Dahra line at Bhilwara (new)	10 kms, D/C		7.98
10	400 kV D/C Bhilwara(New) - Udaipur line	160 kms, D/C		127.68
11	2*315 MVA, 400/220 kV ICTs at Bhilwara(New) & associated bay works		630 MVA	79.41
12	220 kV interconnections at Bhilwara(New)	60 kms, D/C		22.20
13	2*315 MVA, 400/220 kV ICTs at Jodhpur (New) & associated bay works		630 MVA	79.41
14	220 kV interconnections at Jodhpur (New)	60 kms, D/C		22.20
15	2*315 MVA, 400/220 kV GSS at Udaipur		630 MVA	79.41
16	220 kV interconnections at Udaipur	60 kms, D/C		22.20
Total Cost of Power Evacuation System of Banswara TPS (3x660 MW)				3096.10

TENTATIVE COST ESTIMATES		
SNo.	Transmission System	Unit Cost (Rs. Crores)
1	765 kV S/C line	1.45
2	765/400 kV GSS without ICT	261.30
3	1*1500 MVA. 765/400 kV ICT (Banks of 4 Single Phase Transformers)	51.00
4	3*80 MVAR, 765 kV Line Reactors	28.00
5	3*110 MVAR, 765 kV Bus Reactors	32.00
6	2x315 MVA, 400/220 kV GSS	79.41
7	1*315 MVA, 400/220 kV ICT	11.50
8	400 kV Switching Station	57.00
9	400 kV D/C line (Twin Moose)	0.80
10	400 kV D/C line (Quad Moose)	1.95
11	50 MVAR, 400 kV Line Reactors	3.50
12	63 MVAR, 400 kV Line Reactors	4.75
13	80 MVAR, 400 kV Line Reactors	5.00
14	125 MVAR, 400 kV Bus Reactors	5.50
15	40 % Series Compensation on 400 kV D/C (Quad Moose) lines	30.00
16	220 kV D/C line (Zebra)	0.37

Annexure -I(A)

765 kV PROPOSAL : Total Estimated Cost for Evacuation System of Chhabra TPS (2*660 MW) & Kewai TPS (2*330 MW)

SNo.	Transmission System	Line Length/Set	Transf. Capacity	Estimated Cost (Rs. Cr)
A	Chhabra TPS (2*660 MW)			
1	400 kV 2xD/C (Quad Moose) Chhabra TPS - Chhabra Pooling Station line	10 kms, 2xD/C		39.00
2	LILO of one ckt of 400 kV D/C+S/C Chhabra TPS - Dahra line at Chhabra Pooling Station	10 kms, D/C		7.98
3	LILO of one ckt of 400 kV D/C Kalisindh TPS - Dahra line at Chhabra Pooling Station	50 kms, D/C		39.90
4	1*1500 MVA,765/400 kV GSS at Chhabra Pooling Station (RVPN)	1 No.	1500 MVA	312.30
5	765 kV 2xS/C Chhabra TPS - Jaipur(South) line	330 kms 2xS/C		957.00
6	1*1500 MVA,765/400 kV GSS at Jaipur(South)	1 No.	1500 MVA	312.30
7	3*80 MVAR (Single Phase) Line Reactors at both ends of 765 kV 2xS/C Chhabra PP - Jaipur(South) lines	4 Sets		112.00
8	3*110 MVAR (Single Phase), 765 kV Bus Reactors at Jaipur(South)	1 Sets		32.00
9	10 km LILO of 400 kV S/C Hindaun-Heerapura line at Jaipur(South)	10 kms, D/C		7.98
10	10 km LILO of one circuit of 400 kV D/C Chhabra TPS-Heerapura line at Jaipur(South)	10 kms, D/C		7.98
11	10 km LILO of one circuit of 400 kV D/C Ajmer-Heerapura line at Jaipur(South)	10 kms, D/C		7.98
12	220 kV D/C interconnections at Jaipur (South)	50 kms, D/C		18.50
	TOTAL(A)			1854.92
B	Kewai TPS (2*330 MW)			
1	400 kV D/C (Quad Moose) Kewai TPS - Chhabra Pooling Station line	20 kms, D/C		39.00
	TOTAL(B)			39.00
	Total Estimated Cost for Evacuation System of Chhabra TPS (2*660 MW) & Kewai TPS (2*330 MW)			1893.92

Annexure -I(B)				
400 kV (QUAD MOOSE) PROPOSAL: Total Estimated Cost for Evacuation System of Chhabra TPS (2*660 MW) & Kewai TPS (2*330 MW)				
SNo	Transmission System	Line Length/set	Transf. Capacity	Estimated Cost (Rs. Cr)
A	Chhabra TPS (2*660 MW)			
1	400 kV Pooling Station at Chhabra			57.00
2	400 kV 2xD/C (Quad Moose) Chhabra TPS - Chhabra Pooling Station line	10 kms, 2xD/C		39.00
3	LILO of one ckt of 400 kV D/C+S/C Chhabra TPS - Dahra line at Chhabra Pooling Station	10 kms, D/C		7.98
4	LILO of one ckt of 400 kV D/C Kalisindh TPS - Dahra line at Chhabra Pooling Station	50 kms, D/C		39.90
5	400 kV D/C (Quad Moose) Chhabra TPS - Jaipur(South) line	330 kms, D/C		643.50
6	400 kV D/C (Quad Moose) Chhabra TPS - Alwar line	360 kms, D/C		702.00
7	400 kV D/C (Quad Moose) Neemrana - Alwar line	80 kms, D/C		63.84
8	40 % Series Compensation on 400 kV D/C (Quad Moose) Chhabra TPS - Jaipur(South) , Chhabra TPS - Alwar & Neemrana - Alwar lines	3 Sets		90.00
9	2*80 MVAR Line Reactors at both ends of 400 kV D/C Chhabra TPS - Jaipur(South) ,Chhabra TPS-Alwar & Neemrana - Alwar lines	12 Sets		60.00
10	125 MVAR, 400 kV Bus Reactors at 400/220 kV GSS Jaipur(South-PG), Alwar & Neemrana	3 Sets		16.50
11	10 KM LILO of 400 kV S/C Hindaun-Heerapura line at Jaipur(South)	10 kms, D/C		7.98
12	10 KM LILO of one circuit of 400 kV D/C Chhabra TPS-Heerapura line at Jaipur(South)	10 kms, D/C		7.98
13	10 KM LILO of one circuit of 400 kV D/C Ajmer-Heerapura line at Jaipur(South)	10 kms, D/C		7.98
14	220 kV D/C interconnections at Jaipur (South), Alwar and Neemrana	100 kms, D/C		37.00
	TOTAL(A)			1780.66
B	Kewai TPS (2*330 MW)			
1	400 kV D/C Kewai TPS – Chhabra Pooling Station (Quad Moose) line	20 kms, D/C		78.00
	TOTAL(B)			78.00
	Total Estimated Cost for Evacuation System of Chhabra TPS (2*660 MW) & Kewai TPS (2*330 MW)			1858.66

TENTATIVE COST ESTIMATES		
SNo.	Transmission System	Unit Cost (Rs. Crores)
1	765 kV S/C line	1.45
2	765/400 kV GSS without ICT	261.30
3	1*1500 MVA. 765/400 kV ICT (Banks of 4 Single Phase Transformers)	51.00
4	3*80 MVAR, 765 kV Line Reactors	28.00
5	3*110 MVAR, 765 kV Bus Reactors	32.00
6	2x315 MVA, 400/220 kV GSS	79.41
7	1*315 MVA, 400/220 kV ICT	11.50
8	400 kV D/C line (Twin Moose)	0.80
9	400 kV D/C line (Quad Moose)	1.95
10	50 MVAR, 400 kV Line Reactors	3.50
11	63 MVAR, 400 kV Line Reactors	4.75
12	80 MVAR, 400 kV Line Reactors	5.00
13	125 MVAR, 400 kV Bus Reactors	5.50
14	40 % Series Compensation on 400 kV D/C (Quad Moose) lines	30.00
15	220 kV D/C line (Zebra)	0.37

Annexure - II(B)

Total Estimated Cost for Evacuation System of Suratgarh TPS (3*660 MW) with 400 kV D/C line on Quad Moose

SNo	Transmission System	Line Length/Set	Transf. Capacity	Estimated Cost (Rs. Cr)
1	400 kV D/C (Quad Moose) Suratgarh TPS – Jhunjhunu line	230 kms, D/C		448.50
2	400 kV D/C (Quad Moose) Suratgarh TPS – Nagaur line	270 kms, D/C		526.50
4	400 kV D/C (Quad Moose) Jhunjhunu - Sikar(PG) line	75 kms, D/C		146.25
5	400 kV D/C (Quad Moose) Nagaur - Jodhpur(New) line	150 kms, D/C		292.50
6	2x315 MVA, 400/220 kV GSS at Jhunjhunu	1 No.	630 MVA	79.41
7	220 kV interconnections at 400/220 kV GSS at Jhunjhunu	60 kms, D/C		22.20
8	2x315 MVA, 400/220 kV GSS at Nagaur	1 No.	630 MVA	79.41
9	220 kV interconnections at 400/220 kV GSS at Nagaur	60 kms, D/C		22.20
10	2*80 MVAR Line Reactors at both ends of 400 kV D/C Suratgarh TPS - Jhunjhunu-Sikar(PG) line	8 Sets		40.00
11	2*80 MVAR Line Reactors at both ends of 400 kV D/C Suratgarh TPS - Nagaur & Nagaur – Jodhpur(New) lines	8 Sets		40.00
12	125 MVAR, 400 kV Bus Reactors at Jhunjhunu & Nagaur	2 Sets		11.00
13	40 % Series Compensation on 400 kV D/C Suratgarh TPS – Jhunjhunu , Suratgarh TPS – Nagaur, Jhunjhunu - Sikar & Nagaur - Jodhpur lines	4 Sets		120.00
	Total Estimated Cost for Evacuation System of Suratgarh TPS (3*660 MW)			1827.97

Annexure - II(A)

Total Estimated Cost for Evacuation System of Suratgarh TPS (3*660 MW) with evacuation on 765 kV lines

SNo.	Transmission System	Line Length/No	Transf. Capacity	Estimated Cost (Rs. Cr)
1	1*1500 MVA,765/400 kV ICT at Suratgarh TPS	1 No.	1500 MVA	
2	765 kV 2xS/C Suratgarh TPS - Neemrana line	350 kms 2xS/C		1015.00
3	1*1500 MVA,765/400 kV GSS at Neemrana	1 No.	1500 MVA	312.30
4	3*80 MVAR (Single Phase) Line Reactors at both ends of 765 kV 2xS/C Suratgarh TPS-Neemrana lines	4 Sets		112.00
5	3x110 MVAR (Single Phase), 765 kV Bus Reactors at Neemrana	1 Sets		32.00
6	400 kV D/C (Twin Moose) Neemrana– Jhunjhunu line	120 kms, D/C		95.76
7	2x315 MVA, 400/220 kV GSS at Jhunjhunu	1 No.	630 MVA	79.41
8	220 kV interconnections at 400/220 kV GSS at Jhunjhunu	60 kms, D/C		22.20
	Total Estimated Cost for Evacuation System of Suratgarh TPS (3*660 MW)			1668.67

TABLE-3(400 KV PROPOSAL) : Power flow for the system condition corresponding to 2016-17 for 16050 MW system load		
SNo.	Transmission System	POWER FLOW(MW)
		Exhibit -5
A	400 kV Transmission Lines (Quad Moose)	
	D/C Chhabra (PP) - Jaipur(South) line	770 MW
	D/C Chhabra (PP) - Alwar line	750 MW
	D/C STPS -Jhunjhunu line	774 MW
	D/C STPS -Nagaur line	496 MW
	2xD/C Banswara TPS - Bhilwara(New) lines	1970 MW
	D/C Bhilwara (New)- Jaipur (South) line	347 MW
	D/C Bhilwara (New)- Jodhpur line	315 MW
	D/C Jaipur(South) - Neemrana line	197 MW
	D/C Nagaur-Jodhpur(New) line	30 MW
	D/C Jhunjhunu-Sikar line	48 MW
C	400 kV Transmission Lines	
I	At 400 kV Jaipur(South)	
	3*S/C Jaipur (South) - Heerapura line	756 MW
	1*S/C Jaipur (South) - Ajmer line	-94 MW
	1*S/C Jaipur (South) - Dahra line	-352 MW
	1*S/C Jaipur (South) - Hindaun line	49 MW
II	At 400/220 kV Jaipur(North)	
	1*S/C Jaipur (North) - Heerapura line	-266 MW
	1*S/C Jaipur (North) - Merta line	-59 MW
	2*S/C Jaipur (North) - Bassi(PG) line	306 MW
	1*S/C Jaipur (North) - Sikar(PG) line	-17 MW
	1*S/C Jaipur (North) - Kotputli(PG) line	170 MW
III	At 400 kV Neemrana	
	D/C Neemrana(PG) - Alwar line	225 MW
	D/C Alwar - Hindaun line	46 MW
	D/C Neemrana(PG) - Sikar(PG) line	-9 MW
	D/C Neemrana(PG) - Hissar(PG-NR) line	-16 MW
	D/C Neemrana(PG) - Manesar(PG-NR) line	0 MW
IV	At 400 kV Bhilwara (New)	
	D/C Bhilwara - Ajmer line	292 MW
	S/C Bhilwara - Dahra line	-273 MW
	D/C Bhilwara - Udaipur line	432 MW
V	At STPS	
	2*S/C STPS - Ratangarh line	766 MW
	S/C STPS - Bikaner line	411 MW

TABLE-4 (OUTAGE OF 765/400 KV ICT AT STPS) : Power flow for the system condition corresponding to 2016-17 for 16050 MW system load

SNo.	Transmission System	POWER FLOW(MW)
		Exhibit -1
A	765 kV Transmission Lines	
	2* S/C Chhabra (PP) - Jaipur(South) line	1294 MW
	2* S/C STPS - Neemrana line	1970 MW
	2* S/C Banswara TPS - Bhilwara(New) lines	1970 MW
	1* S/C Bhilwara (New)- Jaipur (South) line	655 MW
	1* S/C Jaipur(South) - Neemrana line	113 MW
B	765/400 kV ICT	
	1*1500 MVA, 765/400 kV Bhilwara (New)	1305 MW
	2*1500 MVA, 765/400 kV Jaipur (South)	1822 MW
	2*1500 MVA, 765/400 kV Neemrana	2070 MW
	2*1500 MVA, 400/765 kV Chhabra (PP)	1297 MW
	*1500 MVA, 765/400 kV Suratgarh TPS	OUT
C	400 kV Transmission Lines	
I	At 765/400 kV Jaipur(South)	
	3*S/C Jaipur (South) - Heerapura line	1379 MW
	1*S/C Jaipur (South) - Ajmer line	12 MW
	1*S/C Jaipur (South) - Dahra line	-339 MW
	1*S/C Jaipur (South) - Hindaun line	122 MW
II	At 400/220 kV Jaipur(North)	
	1*S/C Jaipur (North) - Heerapura line	-487 MW
	1*S/C Jaipur (North) - Merta line	140 MW
	2*S/C Jaipur (North) - Bassi(PG) line	363 MW
	1*S/C Jaipur (North) - Sikar(PG) line	96 MW
	1*S/C Jaipur (North) - Kotputli(PG) line	146 MW
III	At 765/400 kV Neemrana	
	D/C Neemrana(PG) - Alwar line	363 MW
	D/C Alwar - Hindaun line	-82 MW
	D/C Neemrana(PG) - Sikar(PG) line	321 MW
	D/C Neemrana(PG) - Hissar(PG-NR) line	0 MW
	D/C Neemrana(PG) - Jhunjhunu line	674 MW
	D/C Neemrana(PG) - Manesar(PG-NR) line	0 MW
IV	At 765/400 kV Bhilwara (New)	
	D/C Bhilwara - Ajmer line	261 MW
	S/C Bhilwara - Dahra line	-353 MW
	D/C Bhilwara - Udaipur line	474 MW
V	At STPS	
	2*S/C STPS - Ratangarh line	282 MW
	S/C STPS - Bikaner line	294 MW

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LOAD FLOW ANALYSIS CONVERGED, ITERATIONS P : 9 Q : 8

CASE NO : 1 CONTINGENCY : 0 SCHEDULE NO : 0

CONTINGENCY NAME : Basecase RATING CONSIDERED : NOMINAL

From	Name	To	Name	From(MW)	From(MVAR)	%Loading	ckts	tap
50	STPS2	52	STPS220G	-448.072	36.413	69.349	2	0.9750
51	STPS4	53	STPS400G	-896.447	-50.745	68.649	4	0.9750
51	STPS4	50	STPS2	441.490	178.140	74.665	2	0.9750
30	RATHNGH4	301	RTNGD42	312.357	12.417	32.809	3	1.0000
65	KTPS2	60	KTPS#1	-197.034	-23.744	78.692	2	1.0000
65	KTPS2	61	KTPS#2	-376.011	-37.563	74.918	2	1.0000
65	KTPS2	62	KTPS#3	-188.006	-18.781	74.918	1	1.0000
417	ANTA2	70	ANTA#1	-238.828	-23.385	79.135	3	1.0000
417	ANTA2	71	ANTA#2	-139.444	-21.835	79.792	1	1.0000
415	RAPPA	80	RAPP#1	-179.109	-13.112	70.929	1	1.0000
416	RAPPB	81	RAPP#2	-397.670	-72.795	81.055	2	1.0000
1510	MAHI_I	92	MAHI#1	-47.624	-17.603	89.511	2	1.0000
1511	MAHI_II	93	MAHI#2	-87.402	-33.012	87.538	2	0.9750
230	DBR1	1230	DEBR1	314.066	29.390	93.689	1	1.0000
1520	RMG132	95	RMGHG	-59.846	8.359	58.478	2	1.0000
312	TINW2	1312	TINWRI1	247.102	45.979	88.970	3	1.0000
160	SKT2	1160	SKT1	429.116	130.469	111.216	4	1.0000
1500	RPS1	97	RPSG	-166.487	7.140	149.678	2	0.9750
1501	JS1	98	JSG	-95.374	2.487	111.563	2	0.9750
210	BHL2	1210	BHIL1	478.812	123.083	100.616	5	1.0000
10	HERPR4	150	HIRAPR2	902.145	354.656	91.012	1	0.9750
43	BASSI4	431	BASSI2	420.112	84.357	67.519	2	1.0000
150	HIRAPR2	1150	HRAPR132	234.106	33.593	80.017	3	1.0000
202	BWR_2	1201	BEAWR1	114.234	25.358	60.478	2	1.0000
311	BIL2	1311	BILARA	101.709	-10.554	53.098	2	1.0000
310	JDP2	1310	JODHPR	364.057	87.955	128.462	3	1.0000
360	BALI2	1360	BALI1	100.644	13.574	103.857	1	1.0000
332	PIND2	1332	PIND1	113.049	13.465	59.103	2	1.0000
330	SRH2	1330	SIROHI1	188.284	21.527	65.448	3	1.0000
350	BALOT2	1350	BALOT1	114.770	-4.927	77.804	1	1.0000
221	NMBR2	1221	NIMBHRA	266.938	75.551	76.847	4	1.0000
154	PHLRA2	1154	PHLRA1	118.512	0.691	84.263	1	1.0000
153	CHMU2	1153	CHMU1	178.890	50.207	95.762	2	1.0000
152	KUKAS2	1152	KUKAS1	191.415	36.181	99.116	2	1.0000
155	SNG2	1155	SANGR1	198.571	44.921	103.365	2	1.0000
120	DAUS2	1120	DAUS1	216.187	-12.806	54.666	4	1.0000
272	RGUS2	1272	RGUS1	319.291	4.499	65.277	5	1.0500
250	KHTRI2	1250	KHTRI1	353.086	79.876	77.084	5	1.0000
101	KOTP2	1101	KOTP1	176.471	38.589	73.479	1	1.0000
100	ALW2	1100	ALW1	230.579	57.021	96.725	1	1.0000
102	BHD2	1102	BHD1	241.908	67.642	84.329	3	1.0000
110	BHT2	2110	BHT21	276.660	-9.536	73.085	4	1.0500
130	HIND2	1130	HIND1	323.108	62.846	83.294	4	1.0000
262	KUCH2	1262	KUCH1	160.356	47.999	87.469	2	0.9500
200	AJM2	1200	AJM1	319.897	-4.227	106.373	2	1.0000
261	NAGR2	1261	NAGR1	210.006	38.930	73.259	3	1.0000
260	MRT2	1460	MRT_1	246.950	13.804	83.968	3	1.0500
271	SIKAR2	1271	SIKAR1	341.942	51.729	69.192	5	0.9500
341	UDYOG2	1341	UDYOG1	128.290	31.680	92.679	1	1.0000
320	HNMNGH	1320	HANUMNG	103.912	8.840	53.982	2	1.0500
340	SURTH2	1340	SURATGH1	269.257	79.150	95.474	3	1.0000
302	RTNGD22	1302	RTNGH1	423.583	-2.260	140.834	3	1.0000
380	BIKNR2	1380	BIKNR1	385.867	4.589	78.125	5	1.0500
251	JJN2	1251	JJN21	164.586	35.665	89.246	2	1.0000
403	HISSR2	1403	HISSR1	0.000	0.000	0.000	1	0.9750
331	BHIN2	1331	BHINML1	201.575	65.604	109.990	2	1.0000
240	KNK2	1240	KANKRLI	180.331	-1.557	59.411	3	1.0000

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220	CHT2	1220	CHTGH	332.110	130.668	96.245	4	1.0000
140	JHLW2	1140	JHALWR1	346.385	43.206	86.409	4	1.0000
141	MODK2	1141	MODAK1	57.009	26.943	41.767	1	1.0000
161	DHR2	1161	DHRA1	116.172	28.907	59.691	2	1.0000
44	NREB_HYD	445	TIE_220	321.694	108.691	32.967	4	1.0000
46	NREB_TH	447	NTIE_220	141.961	16.989	27.762	2	1.0000
159	SWM_2	2159	SAWAIMP	128.570	36.351	136.186	1	1.0000
47	BHWDI4	48	BHWD42	342.606	192.784	61.710	2	0.9750
317	BHOPL2	2319	BHOPL21	120.956	40.062	134.552	1	1.0000
361	PALI_2	2361	PALI_21	120.900	-3.297	63.034	2	1.0000
134	DHOLPR2	1134	DHLPR1	180.867	54.765	126.866	1	1.0000
11	MERTA_4	260	MRT2	438.357	111.493	71.477	2	1.0000
12	JODHPR_4	313	JDHPR_42	464.323	124.630	51.162	3	1.0000
309	SUJNGH2	1309	SUJNGH21	132.088	-10.836	67.442	2	1.0000
231	BANSWR2	1231	BNSR1	73.453	15.501	82.337	1	1.0000
370	JALORE_2	1375	JALOR_21	91.047	21.439	96.976	1	1.0000
65	KTPS2	63	KTPS#4	-348.286	-41.709	69.543	2	1.0000
263	MKRANA2	1263	MKRANA	50.143	-19.541	56.933	1	1.0000
318	PHALOD2	1317	PHALODI	274.391	107.308	75.260	3	1.0000
352	AMSGR2	2352	AMSGR1	-7.390	1.861	3.695	2	1.0000
351	BARMER2	1357	BARMER_1	106.515	4.458	105.623	1	1.0000
343	GLTPS_2	39	GLTPS_G	-240.801	-12.868	79.221	2	1.0000
232	DHAURIMA	2332	DHAURIMN	170.040	33.339	89.081	2	1.0500
270	KHNVS2	1270	KHNVS1	130.936	32.422	71.450	2	1.0000
149	DUNI2	2349	DUNI_1	89.892	14.564	91.904	1	1.0000
94	MADA2	34	MADA_33	-29.976	2.615	12.978	3	1.0000
96	TEMDRIA	35	TEMDRA33	-29.976	6.266	13.183	3	1.0000
2352	AMSGR1	36	AMSGR_33	-19.976	1.569	19.447	4	1.0000
150	HIRAPR2	1142	HPRRING1	111.058	33.391	117.708	1	1.0000
440	DGTPS_2	37	DGTPS_G	-313.615	-17.357	70.118	3	1.0000
375	BLTPS_2	75	BLTPS_G	-224.732	-84.863	81.521	2	1.0000
5	RAPP_CD4	82	RAPP_G	-398.105	3.090	77.965	2	1.0000
7	KNKPG_4	170	KNKPG_2	328.555	124.535	37.565	3	0.9625
127	NEEMR_2	2127	NEMRN132	222.324	53.822	114.665	2	1.0000
128	BHADRA_2	2261	BADRA_21	76.981	-9.062	80.695	1	1.0000
129	SRIDUNG2	1394	SRIDUN21	98.039	29.137	53.243	2	1.0000
131	MANDA2	2123	MANDWR1	91.648	-4.181	46.342	2	1.0000
337	SANCHR2	2333	SANCHR	115.603	24.102	61.690	2	1.0000
8	CHABRA_4	180	CHABRA_2	267.770	24.184	83.248	1	1.0000
8	CHABRA_4	85	CHABRA_G	-996.879	7.705	51.446	6	1.0000
9	BHL_4	142	BHL_42	441.726	63.892	71.146	2	1.0000
143	BARA_2	2174	BARA_21	87.158	6.961	87.585	1	1.0000
13	HIND_4	132	HIND_42	432.299	56.887	69.015	2	1.0000
14	BIKANE_4	381	BIKANE_2	368.125	41.749	58.950	2	1.0000
6	KOTA_PG4	162	KOTA_42	152.722	44.871	24.839	2	1.0000
344	RJWST_2	49	RJWESTG1	-240.806	-24.435	79.864	2	1.0000
432	JAGATPU2	1432	JAGATPU1	117.269	17.918	60.593	2	1.0000
15	BHINM_4	450	BHIN_2	197.251	70.778	69.864	1	0.9625
410	VKIA_2	1105	VKIA_21	116.023	37.897	124.667	1	1.0000
16	RAJWEST4	45	RJWESTG2	-723.048	113.467	80.893	6	1.0000
16	RAJWEST4	344	RJWST_2	81.158	-18.648	26.296	1	1.0000
21	SIKAR_4	273	SIKAR_42	587.254	170.971	96.169	2	0.9750
217	RENWAL_2	1117	RENWL1	135.492	13.285	70.003	2	1.0000
23	JAISWF_4	353	JAISWF_2	-111.471	-50.275	19.007	2	1.0000
31	BARMER_4	351	BARMER2	99.610	-5.249	31.392	1	1.0000
105	KUSHKH_2	2105	KUSHKHR	210.201	81.084	75.735	3	1.0000
199	KISHAN_2	2200	KISHN_21	96.623	57.305	124.303	1	1.0000
374	VSLP_2	74	VSLP_G	-120.383	-15.358	80.343	1	1.0000
147	MANSAR_2	1156	MANSVR1	218.277	44.109	70.693	2	1.0000
181	KAWAI_2	2165	KEWAI	103.345	15.667	104.374	1	1.0000
158	NPH_2	1158	NPH1	204.468	40.163	66.292	2	1.0000
156	BAGRU_2	1123	BAGRU_21	51.418	8.547	54.447	1	1.0000
315	BORNDA_2	1299	BORNDA_!	67.149	38.669	80.005	1	1.0000

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145	SEZ_FIR2	1172	SEZ_21	79.099	46.632	93.420	1	1.0000
253	NMTANA_2	1253	NEEMKT1	0.000	0.000	0.000	1	1.0000
103	MIA_2	2102	MIA	89.043	23.848	93.855	1	1.0000
18	KALISN_4	87	KALINS_G	-1074.951	-68.718	69.414	2	1.0000
26	AJMER_4	203	AJMER_42	321.486	13.165	50.658	2	1.0000
313	JDHPR_42	1397	JDHPR_41	121.637	24.999	127.153	1	1.0000
218	GULABP_2	1218	GULABPR	78.268	20.593	83.776	1	1.0000
233	MADRI_2	1235	MADRI	219.424	18.784	58.122	4	1.0000
277	DHOD_2	1277	DHOD	107.045	-23.785	37.063	3	1.0000
303	KGBAS_2	2103	KSHBAS	69.140	7.484	71.223	1	1.0000
264	NOKHA_2	1386	NOKHA	53.143	26.191	61.630	1	1.0000
255	CHIRAWA2	1255	CHIRAWA	213.862	43.149	58.784	4	1.0000
18	KALISN_4	182	KALISN_2	301.225	66.142	94.639	1	1.0000
308	DEDWANA2	1297	DEDWA_41	91.047	-4.567	92.622	1	1.0000
17	JPR_SOU4	151	JPR_SOU2	624.878	80.025	99.901	2	1.0000
22	NEENR_4	121	NEEM_PG2	405.654	64.600	32.341	4	1.0000
4	JPR_SOU7	17	JPR_SOU4	1629.103	49.352	54.108	2	1.0000
25	NEEMR_7	22	NEENR_4	1659.060	-55.958	54.953	2	1.0000
27	JPR_NOR4	148	JPR_NOR2	472.066	106.311	76.433	2	1.0000
28	DEDWANA4	308	DEDWANA2	495.960	43.483	79.665	2	1.0000
411	PURANA_2	1159	PURNGH1	181.275	20.487	58.298	2	1.0000
157	SHAHPU_2	2107	SHAHPRA1	142.552	19.549	73.730	2	1.0000
24	KOTPUT_4	126	KOTPUT42	392.603	86.705	63.776	2	1.0000
106	BANSUR_2	2106	BANSUR	69.345	9.153	71.765	1	1.0000
104	CHOPANK2	1185	CHOPAN21	68.645	21.030	72.184	1	1.0000
107	NEEMKA2	2363	NEENKA21	70.694	19.169	75.278	1	1.0000
38	BHL_765	3	BHL_74	1246.955	-13.344	83.564	1	1.0000
54	ALWAR_4	108	ALWAR_42	431.075	92.266	69.698	2	1.0000
5	RAPP_CD4	79	RAPP_DG	-1253.806	16.057	72.223	2	1.0000
1	KEWAI_7	90	KEWAI_G	-656.650	96.061	86.358	2	1.0000
269	NWALGAR2	1186	NWALG21	157.514	28.159	85.237	2	1.0000
259	KUCHERA2	1496	KUCHERA1	89.256	20.874	94.694	1	1.0000
55	JODP_74	307	JOD_72	335.511	104.280	56.168	2	1.0000
3	BHL_74	211	BHL_72	443.352	62.022	71.345	2	1.0000
8	CHABRA_4	86	CHABR_G2	-1315.050	207.298	76.380	2	1.0000
2	CHABR_R7	29	CHABR_R4	-1348.394	47.921	43.929	2	1.0000
69	JJN_7	252	JJN_42	627.112	193.614	70.766	3	1.0000
59	STPS_765	88	STPS_G3	-1969.667	160.553	76.145	3	1.0000
59	STPS_765	51	STPS4	729.251	67.271	47.971	1	1.0000
58	NAGAUR_4	265	NAGAUR42	283.998	77.579	47.298	2	1.0000
72	UDAIP_4	234	UDAIP_42	462.768	103.810	76.591	2	1.0000
32	BANS_765	89	BANSWA_G	-1969.467	-185.456	76.880	3	1.0000
109	BUNDI_2	2162	BUNDI	137.265	33.613	47.762	3	1.0000

Number of transformers : 163

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LOAD FLOW ANALYSIS CONVERGED, ITERATIONS P : 7 Q : 6

CASE NO : 1 CONTINGENCY : 0 SCHEDULE NO : 0

CONTINGENCY NAME : Basecase RATING CONSIDERED : NOMINAL

From	Name	To	Name	From(MW)	From(MVAR)	%Loading	ckts	tap
50	STPS2	52	STPS220G	-448.055	79.632	71.417	2	0.9750
51	STPS4	53	STPS400G	-672.375	15.955	68.128	3	0.9750
51	STPS4	50	STPS2	243.920	168.154	46.170	2	0.9750
30	RATHNGH4	301	RTNGD42	213.220	31.500	22.435	3	1.0000
65	KTPS2	60	KTPS#1	-197.014	-32.215	79.495	2	1.0000
65	KTPS2	61	KTPS#2	0.000	0.000	0.000	2	0.0000
65	KTPS2	62	KTPS#3	-187.987	-26.234	75.584	1	1.0000
417	ANTA2	70	ANTA#1	0.000	0.000	0.000	3	0.0000
417	ANTA2	71	ANTA#2	-139.421	-32.296	81.393	1	1.0000
415	RAPPA	80	RAPP#1	-0.000	-0.000	0.000	1	1.0000
416	RAPPB	81	RAPP#2	-397.674	-71.522	80.980	2	1.0000
1510	MAHI_I	92	MAHI#1	-23.617	-8.398	96.267	1	1.0000
1511	MAHI_II	93	MAHI#2	-0.000	0.000	0.000	1	0.9750
230	DBR1	1230	DEBR1	241.171	57.532	74.536	1	1.0000
1520	RMG132	95	RMGHG	-59.846	8.270	58.471	2	1.0000
312	TINW2	1312	TINWRI1	184.886	53.886	66.133	3	1.0000
160	SKT2	1160	SKT1	397.116	152.102	105.914	4	1.0000
1500	RPS1	97	RPSG	-0.000	-0.000	0.000	2	0.9750
1501	JS1	98	JSG	-0.000	0.000	0.000	2	0.9750
210	BHL2	1210	BHIL1	387.330	121.333	82.412	5	1.0000
10	HERPR4	150	HIRAPR2	702.556	339.273	72.681	1	0.9750
43	BASSI4	431	BASSI2	326.154	83.504	52.652	2	1.0000
150	HIRAPR2	1150	HRAPR132	173.630	48.167	60.403	3	1.0000
202	BWR_2	1201	BEAWR1	81.754	40.013	47.101	2	1.0000
311	BIL2	1311	BILARA	73.369	14.433	39.346	2	1.0000
310	JDP2	1310	JODHPR	266.768	84.967	94.122	3	1.0000
360	BALI2	1360	BALI1	74.542	23.549	79.393	1	1.0000
332	PIND2	1332	PIND1	85.214	24.190	45.746	2	1.0000
330	SRH2	1330	SIROHI1	143.672	40.590	51.127	3	1.0000
350	BALOT2	1350	BALOT1	84.865	13.797	57.691	1	1.0000
221	NMBR2	1221	NIMBHRA	213.227	83.167	62.749	4	1.0000
154	PHLRA2	1154	PHLRA1	89.843	17.867	64.122	1	1.0000
153	CHMU2	1153	CHMU1	132.189	58.677	73.991	2	1.0000
152	KUKAS2	1152	KUKAS1	141.242	43.331	74.541	2	1.0000
155	SNG2	1155	SANGR1	150.739	50.490	79.971	2	1.0000
120	DAUS2	1120	DAUS1	154.029	23.494	39.133	4	1.0000
272	RGUS2	1272	RGUS1	235.246	28.894	48.247	5	1.0500
250	KHTRI2	1250	KHTRI1	272.308	82.742	59.143	5	1.0000
101	KOTP2	1101	KOTP1	130.113	43.206	55.187	1	1.0000
100	ALW2	1100	ALW1	169.877	67.039	73.605	1	1.0000
102	BHD2	1102	BHD1	181.374	67.973	64.008	3	1.0000
110	BHT2	2110	BHT21	213.775	12.398	53.487	4	1.0500
130	HIND2	1130	HIND1	234.795	73.278	61.604	4	1.0000
262	KUCH2	1262	KUCH1	118.160	62.351	70.104	2	0.9500
200	AJM2	1200	AJM1	247.819	40.654	84.150	2	1.0000
261	NAGR2	1261	NAGR1	154.763	52.475	55.461	3	1.0000
260	MRT2	1460	MRT_1	185.657	32.929	63.513	3	1.0500
271	SIKAR2	1271	SIKAR1	261.965	101.668	56.069	5	0.9500
341	UDYOG2	1341	UDYOG1	95.030	32.845	69.234	1	1.0000
320	HNMNGH	1320	HANUMNG	75.842	8.266	38.794	2	1.0500
340	SURTH2	1340	SURATGH1	199.559	69.907	70.962	3	1.0000
302	RTNGD22	1302	RTNGH1	315.413	32.740	104.835	3	1.0000
380	BIKNR2	1380	BIKNR1	286.369	30.213	58.045	5	1.0500
251	JJN2	1251	JJN21	124.839	41.910	68.192	2	1.0000
403	HISSR2	1403	HISSR1	0.000	0.000	0.000	1	0.9750
331	BHIN2	1331	BHINML1	150.362	66.389	84.069	2	1.0000
240	KNK2	1240	KANKRLI	143.909	43.955	49.313	3	1.0000

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220	CHT2	1220	CHTGH	258.633	112.823	75.435	4	1.0000
140	JHLW2	1140	JHALWR1	304.762	38.698	77.239	4	1.0000
141	MODK2	1141	MODAK1	26.153	37.239	30.338	1	1.0000
161	DHR2	1161	DHRA1	99.896	33.910	52.912	2	1.0000
44	NREB_HYD	445	TIE_220	269.996	71.101	27.107	4	1.0000
46	NREB_TH	447	NTIE_220	102.195	11.729	19.974	2	1.0000
159	SWM_2	2159	SAWAIMP	96.024	38.351	105.148	1	1.0000
47	BHWDI4	48	BHWD42	264.713	163.009	48.372	2	0.9750
317	BHOPL2	2319	BHOPL21	91.017	47.619	107.381	1	1.0000
361	PALI_2	2361	PALI_21	90.226	10.789	47.494	2	1.0000
134	DHOLPR2	1134	DHLPR1	146.411	46.899	102.136	1	1.0000
11	MERTA_4	260	MRT2	340.986	131.364	57.068	2	1.0000
12	JODHPR_4	313	JDHPR_42	329.667	89.998	35.811	3	1.0000
309	SUJNGH2	1309	SUJNGH21	96.105	4.611	49.144	2	1.0000
231	BANSWR2	1231	BNSR1	81.989	56.193	122.873	1	0.9125
370	JALORE_2	1375	JALOR_21	68.528	24.292	74.630	1	1.0000
65	KTPS2	63	KTPS#4	-348.251	-56.620	70.249	2	1.0000
263	MKRANA2	1263	MKRANA	37.537	-2.325	39.512	1	1.0000
318	PHALOD2	1317	PHALODI	205.167	82.228	53.493	3	1.0000
352	AMSGR2	2352	AMSGR1	-27.476	5.627	13.600	2	1.0000
351	BARMER2	1357	BARMER_1	75.536	12.520	75.450	1	1.0000
343	GLTPS_2	39	GLTPS_G	-120.406	-2.715	78.886	1	1.0000
232	DHAURIMA	2332	DHAURIMN	126.925	29.841	66.063	2	1.0500
270	KHNVS2	1270	KHNVSR	95.946	31.525	52.908	2	1.0000
149	DUNI2	2349	DUNI_1	69.030	18.239	71.779	1	1.0000
94	MADA2	34	MADA_33	-29.976	2.609	12.978	3	1.0000
96	TEMDRIA	35	TEMDRA33	-29.976	4.695	13.072	3	1.0000
2352	AMSGR1	36	AMSGR_33	-19.976	0.524	19.418	4	1.0000
150	HIRAPR2	1142	HPRRING1	83.496	33.636	90.527	1	1.0000
440	DGTPS_2	37	DGTPS_G	-313.648	-17.910	69.423	3	1.0000
375	BLTPS_2	75	BLTPS_G	-112.385	-41.529	81.011	1	1.0000
5	RAPP_CD4	82	RAPP_G	-398.116	20.147	77.745	2	1.0000
7	KNKPG_4	170	KNKPG_2	246.068	169.584	31.637	3	0.9625
127	NEEMR_2	2127	NEMRN132	167.289	53.441	86.822	2	1.0000
128	BHADRA_2	2261	BADRA_21	57.836	2.626	59.295	1	1.0000
129	SRIDUNG2	1394	SRIDUN21	73.917	32.920	41.855	2	1.0000
131	MANDA2	2123	MANDWR1	71.872	12.666	36.622	2	1.0000
337	SANCHR2	2333	SANCHR	88.246	25.784	47.257	2	1.0000
8	CHABRA_4	180	CHABRA_2	238.301	39.608	74.743	1	1.0000
8	CHABRA_4	85	CHABRA_G	-996.883	19.339	51.417	6	1.0000
9	BHL_4	142	BHL_42	388.286	49.110	62.391	2	1.0000
143	BARA_2	2174	BARA_21	69.008	15.675	71.386	1	1.0000
13	HIND_4	132	HIND_42	302.282	67.664	48.453	2	1.0000
14	BIKANE_4	381	BIKANE_2	279.825	52.415	45.015	2	1.0000
6	KOTA_PG4	162	KOTA_42	180.072	96.512	31.729	2	1.0000
344	RJWST_2	49	RJWESTG1	-240.830	-10.623	79.089	2	1.0000
432	JAGATPU2	1432	JAGATPU1	91.010	23.037	47.548	2	1.0000
15	BHINM_4	450	BHIN_2	140.033	71.925	51.758	1	0.9625
410	VKIA_2	1105	VKIA_21	86.448	37.336	95.228	1	1.0000
16	RAJWEST4	45	RJWESTG2	-481.986	123.569	81.852	4	1.0000
16	RAJWEST4	344	RJWST_2	43.432	-10.957	14.035	1	1.0000
21	SIKAR_4	273	SIKAR_42	448.949	196.956	76.493	2	0.9750
217	RENWAL_2	1117	RENWL1	100.467	30.183	53.668	2	1.0000
23	JAISWF_4	353	JAISWF_2	-119.128	-16.209	18.592	2	1.0000
31	BARMER_4	351	BARMER2	70.610	1.591	22.065	1	1.0000
105	KUSHKH_2	2105	KUSHKHR	158.306	65.113	56.597	3	1.0000
199	KISHAN_2	2200	KISHN_21	65.305	40.495	82.625	1	1.0000
374	VSLP_2	74	VSLP_G	-120.390	-12.216	79.896	1	1.0000
147	MANSAR_2	1156	MANSVR1	162.723	51.936	53.724	2	1.0000
181	KAWAI_2	2165	KEWAI	85.231	19.281	87.745	1	1.0000
158	NPH_2	1158	NPH1	153.392	47.847	50.642	2	1.0000
156	BAGRU_2	1123	BAGRU_21	38.802	13.079	42.207	1	1.0000
315	BORNDA_2	1299	BORNDA_!	50.139	27.506	57.857	1	1.0000

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145	SEZ_FIR2	1172	SEZ_21	59.042	32.946	68.124	1 1.0000
253	NMTANA_2	1253	NEEMKT1	0.000	-0.000	0.000	1 1.0000
103	MIA_2	2102	MIA	65.196	27.810	71.459	1 1.0000
18	KALISN_4	87	KALINS_G	-1074.501	227.980	72.428	2 1.0000
26	AJMER_4	203	AJMER_42	248.821	50.486	39.999	2 1.0000
313	JDHPR_42	1397	JDHPR_41	89.246	26.145	93.297	1 1.0000
218	GULABP_2	1218	GULABPR	55.620	24.849	62.995	1 1.0000
233	MADRI_2	1235	MADRI	166.373	32.289	45.790	4 1.0000
277	DHOD_2	1277	DHOD	77.109	-13.311	26.551	3 1.0000
303	KGBAS_2	2103	KSHBAS	49.885	13.768	52.485	1 1.0000
264	NOKHA_2	1386	NOKHA	35.123	33.753	50.178	1 1.0000
255	CHIRAWA2	1255	CHIRAWA	158.867	51.776	43.960	4 1.0000
18	KALISN_4	182	KALISN_2	278.045	42.170	88.303	1 1.0000
308	DEDWANA2	1297	DEDWA_41	65.883	5.720	67.347	1 1.0000
17	JPR_SOU4	151	JPR_SOU2	493.163	68.354	78.347	2 1.0000
22	NEENR_4	121	NEEM_PG2	297.042	51.101	23.456	4 1.0000
4	JPR_SOU7	17	JPR_SOU4	1209.950	28.336	39.901	2 1.0000
25	NEEMR_7	22	NEENR_4	1119.807	-90.621	36.805	2 1.0000
27	JPR_NOR4	148	JPR_NOR2	365.265	104.441	59.513	2 1.0000
28	DEDWANA4	308	DEDWANA2	360.346	68.273	58.563	2 1.0000
411	PURANA_2	1159	PURNGH1	135.658	36.939	44.561	2 1.0000
157	SHAHPU_2	2107	SHAHPRA1	108.118	32.858	57.364	2 1.0000
24	KOTPUT_4	126	KOTPUT42	290.131	88.649	47.621	2 1.0000
106	BANSUR_2	2106	BANSUR	51.481	14.811	54.428	1 1.0000
104	CHOPANK2	1185	CHOPAN21	51.945	19.345	54.868	1 1.0000
107	NEEMKA2	2363	NEENKA21	50.282	18.647	54.416	1 1.0000
38	BHL_765	3	BHL_74	923.291	-58.133	62.175	1 1.0000
54	ALWAR_4	108	ALWAR_42	315.772	102.014	51.817	2 1.0000
5	RAPP_CD4	79	RAPP_DG	-626.921	33.915	72.029	1 1.0000
1	KEWAI_7	90	KEWAI_G	-656.647	100.800	86.387	2 1.0000
269	NWALGAR2	1186	NWALG21	116.617	35.291	63.402	2 1.0000
259	KUCHERA2	1496	KUCHERA1	66.000	25.233	72.176	1 1.0000
55	JODP_74	307	JOD_72	240.443	83.545	40.069	2 1.0000
3	BHL_74	211	BHL_72	390.161	47.096	62.648	2 1.0000
8	CHABRA_4	86	CHABR_G2	-657.440	166.339	77.759	1 1.0000
2	CHABR_R7	29	CHABR_R4	-1098.786	108.922	35.827	2 1.0000
69	JJN_7	252	JJN_42	443.209	174.439	50.401	3 1.0000
59	STPS_765	88	STPS_G3	-1315.377	206.194	50.938	3 1.0000
59	STPS_765	51	STPS4	462.529	83.489	30.568	1 1.0000
58	NAGAUR_4	265	NAGAUR42	205.838	99.978	36.248	2 1.0000
72	UDAIP_4	234	UDAIP_42	394.531	139.810	67.920	2 1.0000
32	BANS_765	89	BANSWA_G	-1312.808	65.942	77.782	2 1.0000
109	BUNDI_2	2162	BUNDI	112.327	38.551	40.113	3 1.0000

Number of transformers : 163
