Agenda Note For 13th Standing Committee Meeting of Northern Region

Item-I **Power evacuation system for RAPP Generating Units No. 5,6 (2x220 MW) and 7,8 (2x700 MW).**

1 Introduction

1.1 The following existing generating units of Nuclear Power Corporation Ltd. (NPCL) are existing at Rawatbhata in Rajasthan:

RAPP – A (Unit 1 & 2) – 2x220 MW
RAPP – B (Unit 3 & 4) – 2x220 MW

The existing evacuation system from RAPP A & B are as follows

RAPP A (2x220 MW) 300 MW Derated Capacity

- RAPP A-Kota 220 kV D/C line
- RAPP A-Nimbahera 220 kV S/C line

RAPP B (2x220 MW)

- RAPP B - Kota 220 kV S/C line
- RAPP B - Udaipur 220 kV S/C line
- RAPP B - Chittorgarh 220 kV D/C line

It may be mentioned that the 220 kV RAPP 'A' and 220 kV RAPP 'B' buses are operating in isolation due to low fault current capacity of RAPP 'A" bus.

1.2 NPCL have now proposed for the construction of four more generating units at Rawatbhata in two stages. The first stage will comprise of two units of 220 MW each (RAPP 5,6) expected to be commissioned by 2007 and the 2nd stage of two larger units of 700 MW, expected by 2009.

The existing system from RAPP 'B" does not have enough redundancy to evacuate power from RAPP unit 5&6.

1.3 With the addition of generation at Kota unit 6 (195 MW), RRVPN have proposed to construct 400 kV, S/C on D/C tower line from Kota to

Kankroli (new 400/220 kV S/S near Udaipur with 2x315 MVA ICT) at Kankroli for evacuation of power from existing Kota unit 5 and proposed Kota unit 6.

1.4 Accordingly, power system studies for evacuation of power from RAPP 5&6 and RAPP 7&8 have been carried out in CEA with additional transmission system. Various transmission alternatives have been considered. Two alternative studies have been carried out considering two stages of RAPP- Stage I (unit 5 & 6) & Stage II (Unit 7 & 8). The studies have been carried out for ultimate capacity and the transmission system has been so staged that the power evacuation system for Stage-I i.e. generation unit No. 5 & 6 could dovetail in the ultimate power evacuation system from generation units 5 to 8.

2. System Studies

Alternative -I Stepping of the power from RAPP unit 5&6 (2x220 MW) to 220 kV and unit 7&8 (2 x700 MW) to 400 kV

Consolidated power evacuation system from RAPP Generation Units

2.1 The proposed unit No. 5 & 6 of RAPP would be stepped up to 220 kV. The generating unit No. 7 & 8 is proposed to be stepped up at 400 kV. The generation of unit no.5&6 would further be stepped up to 400 kV by providing 2x315 MVA, 220/400 kV ICTs. The following transmission system is proposed under Alternate I for evacuation of total generation of power from unit No. 5 to 8

-) RAPP – Kota 400 kV S/C
-) Kota – Kankroli (stringing of 2nd 400 kV line)*
-) RAPP – Jaipur 400 kV D/C
-) RAPP – Kankroli 400 kV D/C
-) Kankroli-Sirohi 400 kV D/C and opening one circuit of 400 kV RAPP-Kankroli D/C line and 400 kV Kankroli-Sirohi D/C line from Kankroli end and connecting them directly, so as to form RAPP-Sirohi line.
-) Sirohi – Jodhpur 400 kV S/C
-) 400/220 kV Sirohi S/S 2x315 MVA (new)
-) 220/400 kV, 2x315 MVA ICTs at RAPP.
-) Kankroli S/S(Aug.). 400/220 kV, 2x315 MVA (3rd & 4th) Trfs.

The result of the studies indicating power flows are given in Exhibit-I-1.

System for RAPP Unit 5 & 6

2.2 Out of the above system, the lines at Sl.No. c) & d) would be constructed under stage I for evacuation of power from RAPP unit 5 & 6 and initially to be operated at 220 kV.i.e.

i) RAPP - Kankroli 400 kV D/C line (initially operated at 220 kV)
i) RAPP - Jaipur 400 kV D/C line (initially operated at 220 kV)

The result of the studies with system under stage I is presented at Exhibit I-2.

The line from RAPP to Jaipur has been considered as it fits in the ultimate stage of RAPP system. Moreover, if RAPP to Kota 400 kV S/C line (operated at 220 kV) is considered instead of RAPP-Jaipur 400 kV D/C line (operated at 220 kV), then under the outage of RAPP-Kankroli 400 kV line (op. at 220 kV), there would be evacuation constraints from RAPP(5 & 6).

Alternative -II Stepping of the power from units 5 to 8 at 400 kV

Consolidated power evacuation system for Generation Unit No.5 & 6 (2x220 MW) and 7,8 (2 x700 MW).

2.3 The proposed transmission system for evacuation of power from the generation of units 5 to 8 are given as under;

) RAPP – Kota 400 kV S/C
) Kota – Kankroli 2nd circuit stringing of 400 kV line*
) RAPP – Jaipur 400 kV D/C
) RAPP-Kankroli 400 kV D/C line
) Kankroli - Sirohi 400 kV D/C and opening one circuit of 400 kV RAPP-Kankroli and 400 kV Kankroli-Sirohi D/C line from Kankroli end and connecting them directly, so as to form RAPP-Sirohi line.
) Sirohi – Jodhpur 400 kV S/C
) 400/220 kV Sirohi S/S 2x315 MVA (new)
) Kankroli S/S(Aug.). 400/220 kV, 2x315 MVA (3rd & 4th) Trfs.

***1st ckt. of Kota-Kankroli 400kV line S/C on D/C tower is proposed to be constructed by M/s. RRVPNL as a part of transmission system for evacuation of power from Kota TPS Stage-IV.**

The result of the studies indicating power flows are given in Exhibit-I-3.

System for RAPP Unit 5 & 6

2.4 Out the above system, the lines at Sl.No. a) & d) would be constructed under stage I for evacuation of power from RAPP unit 5 & 6.i.e.

) RAPP-Kota, 400 kV S/C line
i) RAPP - Kankroli 400 kV D/C line

In addition the transformation capacity of Kankroli S/S is proposed to be augmented by installing the 315 MVA, 3rd ICT.

The result of the studies, indicating power flows are given in Exhibit-I-4.

2. Analysis of alternatives

3.1 The result of the studies with RAPP unit 5to 8 is tabulated as under

Line Loading of the system with ultimate stages at RAPP # Unit 5 to 8

Sl.No.	RAPP-Kankroli 400 kV S/C	RAPP-Sirohi 400 kV S/C	RAPP-Jaipur 400 kV D/C	KTPS-Kankroli 400 kV D/C	RAPP – KTPS 400kV S/C	Kankroli 400/220 kV ICT
	(MW)	(MW)	(MW)	(MW)	(MW)	(MW)
Alt-I	361	306	719	634	270	759
Alt-II	364	307	705	642	278	768

Cost comparison of system with ultimate stages at RAPP # Unit 5 to 8 under Alternative I and II

Alternative	Cost of Transmission line works	Cost of S/S works	Total Cost of Transmission system
	(Rs. Lacs.)	(Rs. Lacs.)	(Rs. Lacs.)
Alternative-I	38200	13500	51700*
Alternative-II	38200	11800	50000*

*** Stringing of 400 Kota-Kankroli 2nd Ckt. would be done by RRVPNL, so cost for the same in not considered**

It is observed that the power flow on various transmission lines under Alternative I are within the normal limits and the system envisaged can easily meet the contingency outage of a 400 kV D/C line. However, in the case of contingency outage of one of the 220 / 400 kV ICT at RAPP, the generation of unit No. 5 & 6, (440 MW) would be restricted to the MVA capacity of the remaining ICT i.e. 315 MVA only. Therefore provision has been made for an additional 220/400 kV ICT at RAPP under Alternative-1 to take care of the contingency conditions.

In case of Alternative -II, the power flows on various lines are within limits. The system proposed is fully capable to take care of any contingency outage of D/C line or any two 400 kV line around RAPP (as per the practice for evolving evacuation system from Nuclear power plant). The transmission losses of Rajasthan as well as of NR in case of Alternative-II are also less than that of Alternative I.

The estimated cost of system under Alternative-II is also less than that of Alternative-I.

3.2 The result of studies with RAPP unit 5&6 is given as under

Line Loading with 2x220 MW unit at RAPP 5 & 6

Sl. No.	**RAPP-Kankroli 400 kV D/C**	**RAPP-Jaipur 400 kV D/C**	**KTPS-Kankroli 400 kV S/C**	**RAPP 'A'–Nimbahera 220kVS/C**	**Kankroli 400/220 kV ICT**
	(MW)	**(MW)**	**(MW)**	**(MW)**	**(MW)**
Alt-I	309 (op. at 220 kV)	86 (op. at 220 kV)	365	167	360
Alt-II	375	20 RAPP-Kota	385	156	754

Cost comparison of system with 2x220 MW unit at RAPP 5 & 6 under Alternative I and II

Alternative	**Cost of Transmission line works**	**Cost of S/S works**	**Total Cost of Transmission system**
	(Rs. Lacs.)	**(Rs. Lacs.)**	**(Rs. Lacs.)**
Alternative-I	24750	900	25650
Alternative-II	12900	1350+ cost of one 315 MVA ICT	14250

From above, it can be seen that line loadings in the system under both the alternatives are within limit. However the system losses in RRVPNL system with Alternative II is less. The cost of the system required under both the alternatives have been calculated and it is seen that Alternative II is less expensive than Alternative I.

3.3 The comparative statement indicating the cost of proposed system with capitalization of losses for different alternative considered for the ultimate stage of RAPP is enclosed at Annexure-I-1. It is seen that with the transmission system developed at 400 kV (Alternative-II), the evacuation of power from ultimate stage of RAPP is techno-economically better solution compared to that of two steps development i.e. 220 kV and 400 kV (Alternative-I).

4. **Contingency Studies**

4.1 As per the above, following contingency studies have also been carried out considering the system evolved with Alternative-II for the ultimate system from RAPP. The results of the following outage studies indicating power flows are given in Exhibits I-3 (a), I-3 (b) & I-3 (c):

- Outage of Kota-Kankroli, 400kV D/C line — Exhibits I-3 (a)
- Outage of RAPP 'C'-Jaipur (PG) 400kV D/C line — Exhibits I-3 (b)
- Outage of RAPP-Kankroli & RAPP-Sirohi, 400kV S/C lines — Exhibits I-3 (c)

The result of the studies indicates that with the contingency outages indicated above, in the system under Alternative- II, no overloading on any of the line is observed.

From the above load flow studies (Exhibits-I-1 toI-4) it is seen that with the establishment of 400/220 kV Kankroli S/S, the underlying 220 kV transmission system emanating from Kankroli needs strengthening for absorption/disposal of power further from Kankroli. Accordingly, the part loads of Udaipur area would need to be shifted to 400/220 kV Kankroli S/S by RRVPNL.Though RRVPNL has proposed strengthening of following system as a part of Kota TPS Stage –IV evacuation system with creation of 400kV Kankroli S/S

- LILO of 220 kV Chittorgarh-Udaipur line at 400 Kankroli GSS
- LILO of 220 kV Bhilwara-Kankroli line at 400 Kankroli GSS
- 220 kV S/C line from Kankroli 220 kV S/S –Kankroli 400 kV S/S

4.2 It may be mentioned that POWERGRID have also carried studies for developing the evacuation system from RAPP 5 to 8. They have suggested for the following evacuation arrangement.

Transmission System with RAPP # 5 to 8

- RAPP-Beawar 220 kV D/C
- RAPP- Nimbahera 220 kV D/C
- RAPP-Jaipur 400 kV D/C
- RAPP-Kota 400 kV D/C
- Kankroli-Sirohi 400 kV S/C
- Kota-Merta 400 kV S/C
- 2x315 MVA ICT at RAPP and Kota
- New S/S at Sirohi with 2x315 MVA ICT

Out the above system, the following lines would be constructed under stage-I for evacuation of power from RAPP unit 5 & 6.

- RAPP-Beawar 220 kV D/C
- RAPP- Nimbahera 220 kV D/C

POWERGRID have indicated a cost of Rs. 738 Crs. for the transmission system with the ultimate Stage and Rs. 112 Crs. (appox.) for the Stage I transmission system.

It is observed that the system proposed by POWERGRID though is less expensive at the initial stage but the cost of the ultimate stage would be high. The ROW requirement from RAPP complex for evacuation of power at 220 kV as well at 400 kV would also be more.

It is observed that in the system suggested by POWERGRID, the 220 kV lines gets overloaded during contingency outage. Considering the lines from RAPP being very old and high ambient temperature of that area and large number of 220 kV lines emanating from RAPP, Kota and Anta complex, it is felt that such loading is not safe from the grid security point of view.

In the study, interconnection between KTPS 400 kV and 220 through 400/220 ICT have been proposed. it may be mentioned that at Kota S/S (Sakatpura bus) has 26 nos. of bays at 220 kV and 23 nos. of bays at 132 kV and there may be constraint of space for accommodating any additional bays. Further in case of outage 400 kV D/C line or two 400 kV lines, as per the general practice considered for evolving the transmission system from nuclear power plant, the system proposed would be inadequate.

4.3 Keeping in view the above limitations, under the system suggested by POWERGRID as well keeping in view of the Security of Grid and Nuclear Power plant, the transmission system proposed as given in Alternative II (under para-2.3 of system studies above) would be required for evacuation of power from RAPP # 5 to 8.

5. Recommendation

Based on the result of the above alternative studies and considering the gap of only 3 years in the commissioning of both the Stages of RAPP (indicated by Sr. ED (T&P), NPCL, copy of the letter enclosed at Annex I-2), the following system can be recommended for evacuation of power from RAPP generating units 5&6 (Stage I) and units 7 & 8 (Stage II).

Stage-I Power evacuation system for RAPP generation Unit No. 5&6 (2x220 MW).

Generation of Unit No. 5,6 (2x220 MW) is proposed to be stepped up to 400 kV and evacuated through following lines:

- RAPP - Kankroli 400 kV D/C line
- RAPP-Kota, 400 kV S/C line
- Augmentation of 400/220 kV Kankroli substation by 1x315 MVA ICT (3^{rd}).

Stage II Additional power evacuation system for total generation of RAPP Unit No. 5 to 8.

- Kota – Kankroli stringing of 2^{nd} 400 kV circuit (By RRVPNL)
- RAPP – Jaipur 400 kV D/C line

- Kankroli - Sirohi 400 kV D/C line and opening one circuit of 400 kV RAPP-Kankroli and 400 kV Kankroli-Sirohi D/C line from Kankroli end and connecting them directly, so as to form RAPP-Sirohi line.
- Sirohi - Jodhpur 400 kV S/C line.
- Establishment of 400/220kV 2x315 MVA Sirohi S/S (new)
- Augmentation of 400/220 kV Kankroli substation by 1x315 MVA ICT (4^{th}).

Members may like to discuss and concur on the above mentioned proposal.

Item II: Evacuation System from Unchahar Stage-III (1x210 MW)

1. NTPC has furnished a project report for expansion of its Unchahar TPS in UP by 1x210 MW to be covered under stage-III of the project. It has been proposed that the generation is expected to be commissioned during 10th plan time frame. NTPC has not yet furnished any specific beneficiaries of power from Unchahar-III, however it has been indicated that all the constituents of the Northern grid are the beneficiary from Unchahar-III. It may be informed that following evacuation system were approved/existing for evacuation of power from Unchahar St- I & II.

i) 220 kV Unchahar (NTPC)-Kanpur D/C line-I
ii) 220 kV Unchahar(NTPC)-Kanpur D/C line-II
iii) LILO of one ckt. of 220 kV D/C Panki-Mainpuri line at Kanpur S/S of POWERGRID
iv) LILO of 220 kV S/C Panki-Nabasta line at Kanpur S/S of POWERGRID
v) 220 kV Unchahar - Fatehpur D/C line (with Moose conductor)
vi) 220 kV Unchahar- Lucknow D/C line (with Moose conductor)

Later on the 220/132 kV Raibareilly S/S was approved as a part of 7th plan transmission works of UPSEB (erstwhile) to be establish by UPSEB by LILO of Unchahar-Lucknow D/C line. However the S/S has not yet come up.

2. For framing the evacuation of power from Unchahar-III, it has been assumed that the redundancy available in the existing system of Unchahar-I & II could be utilized for evacuation of power from Unchahar- III also. As such, no new transmission lines were added from Unchahar Switchyard for evacuation of power from Unchahar-III. Also for the purpose of the instant study, the 220 kV Raibareilly S/S have been considered. The result of the load flow study carried out is given in Exhibit-II-1.

Following outage studies were also carried out on the above base case.

- Outage of 220 kV Unchahar-Panki D/C line(Exhibit- II-2)
- Outage of 220 kV Unchahar-Fatehpur D/C line(Exhibit-II-3)
- Outage of 220 kV Unchahar-Raibareilly D/C line(Exhibit-II-4).

The result of the above cases are tabulated as under

Outage of 220 kV Lines	**Loading on(MW)**		
	Unchahar-Kanpur 2xD/C	Unchahar-Fatehpur D/C	Unchahar-Raibareilly D/C
No Outage (Ex-II-1)	409	237	294
Unchahar-Panki D/C (Ex-II-2)	274 (on the remaining D/C)	308	358
Unchahar-Fatehpur D/C (Ex-II-3)	560	-	380
Unchahar-Raibareilly D/C (Ex-II-4)	588	352	-

Since the 220 kV Unchahar- Fatehpur D/C and 220 kV Unchahar-Raibareilly-Lucknow D/C line is constructed with Moose conductor so the loading of 358 MW and 380 MW respectively during the D/C line outage condition as given above are within limit.

3. The study for evolving the evacuation system from Unchahar -III was also studied by POWERGRID. They have concluded that with the establishment of Raibareilly S/S of UPPCL, there is a problem in meeting the contingency of one circuit between Unchahar and Raibareilly. Hence it is suggested that UPPCL may construct a direct 220 kV D/C line from Unchahar to Raibareilly instead of LILO of Unchahar-Lucknow 220 kV D/C line. As such space provision for two nos. of additional 220 kV bays may be kept in the Unchahar generation switchyard.

Since transmission system of Unchahar TPS Stage-I & II is covered under central sector and the transmission system for evacuation of power from Unchahar-III is to be taken up by POWERGRID so Member of the standing committee may like to deliberate on this issue and give their views.

Item III: **Evacuation System from Dadri-II TPS(1x490 MW)**

1. NTPC vide letter dated 29/1/02 has furnished the project report for Dadri-II TPS (1x490 MW). NTPC have informed that the generation is expected somewhere around 10th plan time frame. Presently at Dadri-I, 4x210 MW of coal fired and 4x130.19 MW+2x150.15 MW CCGT is existing. The generation from both thermal as well as gas generating plant is stepped up to 220 kV. The generation is then stepped up to 400 kV at NCR Dadri switchyard. The further evacuation of power from Dadri-I is taking place through the following 400 kV system.

ii) Dadri-Malerkotla S/C line
iii) Dadri-Muradnagar S/C line
iv) Dadri-Panipat S/C line (2nd circuit approved with Rihand-II TPS)
v) Dadri to Samaypur D/C line with Quad conductor (these circuits to be LILOed at Greater Noida)
vi) Dadri-Mandaula D/C line with Quad conductor

2. It may be mentioned that the fault level study carried out for the Dadri 400 kV bus corresponding to the end of 10th plan time frame under maximum thermal condition indicates that the fault current level is touching nearly 40 kA. Under this circumstance, the addition of generation in the existing bus would increase the fault current level of the existing Dadri switchyard further. Considering the above fact it would be nacessery to separate the two switchyards. Further, to limit the fault current with completion of stage-II, the transmission network from Dadri station would need to be reconfigured. Studies were carried out as per the details given below

- Power flow and the short circuit level with

i) Existing generating capacity at Dadri (Exhibit-III-1).
ii) Addition of Dadri-II generation in the present Switchyard without any extra outlet (Exhibit-III-2).
iii) Addition of Dadri-II generation isolated from existing Dadri-I generation. The 400 kV lines to Malerkotla as well as to Muradnagar shifted to new Dadri-II bus (Exhibit-III-3).
iv) Addition of Dadri-II generation isolated from existing Dadri-I generation. The 400 kV lines to Malerkotla, one circuit of

Panipat and Muradnagar in the existing Dadri-I bus now Shifted to the new Dadri-II bus (Exhibit-III-4).

The result of the above study on the fault current level of the existing Dadri switchyard is given as under.

Cases	**Three Phase fault current**		**Single Phase fault current**		**Malerkotla line loading**		**Muradnagar line loading**	
	Dadri I bus	**Dadri II bus**	**Dadri I bus**	**Dadri II bus**	**Dadri I bus**	**Dadri II bus**	**Dadri I bus**	**Dadri II bus**
	(KA)	(KA)	(KA)	(KA)	(MW)	(MW)	(MW)	(MW)
1. With out Dadri II Generation	40348		36001		695		867	
2. With Dadri II generation but without any extra lines	42514		39950		699		710	
3. Dadri II generation in isolated bus with 400 kV Malerkotla and Muradnagar lines at new bus	35140	17164	31793	14898	-	742	-	-302
4. Dadri II generation in isolated bus with 400 kV Malerkotla, Panipat and Muradnagar lines at new bus	34921	20477	31406	17388	-	708	-	-612
5. System as in **4.** above with outage of 400 kV Malerkotla circuit	34400	18753	30930	16192	Dadri I-Panipat line 257	Dadri II-Panipat line 563	-	-123

From the above result it is seen that

- By 10th plan end the Dadri (existing) bus fault level would be beyond the rating of the switchyard equipments at Dadri.
- Any addition of generation in the existing switchyard would further increase the fault level at Dadri bus.
- The loading on the Dadri - Malerkotla circuit would be beyond SIL loading even under normal condition.
- Fault current contribution from Muradnagar line to Dadri is of the order of about 8000 A.

3. It can be seen that the solution to the above problem lies in identifying the outlets from generation as well as to limit the fault current at Dadri switchyard. From the result tabulated at S.No. 3 & 4 above, it can be seen that with the splitting of Dadri bus (or separate bus) with Dadri II generation and the 400 kV lines to Malerkotla (by LILO of the existing line at the Dadri new bus) and Muradnagar lines shifted from Dadri (existing bus), the fault level at Dadri can be controlled within reasonable limit (about 35000 A). However the loading on the Malerkotla line would be high. The problem of the heavy loading on the Malerkotla bus can be mitigated by constructing the proposed 400 kV Dadri- Panipat (2nd ckt.) approved under Rihand II TPS from the Dadri II TPS new bus instead of at the existing Dadri bus.

With the above arrangement, following outage cases have been carried out to ascertain the adequacy of the evacuation arrangement from Dadri II

- Outage of Dadri II- Malerkotla S/C line (**Exhibit –III-5)**
- Outage of Dadri II - Muradnager S/C line (**Exhibit- III-6**)

It can be seen from the result that the loadings on the other lines from Dadri-II are normal under the above outage conditions.

Physical Location of Dadri-II TPS(1x490MW)

4. The matter regarding the availability of space at Dadri bus for evacuation of power from Dadri-II TPS (490 MW) was discussed in details with NTPC engineers. It was informed that the space for the Dadri-II is

available in between the existing generation at Dadri TPS and Dadri CCGT. As such creating a separate bus with Dadri-II generation along with the line to Muradnagar, Panipat and Malarkotla would be difficult because of its locationaspect due to space constraint at Dadri station and also to minimize the shifting/crossing of lines in the generation switchyard. Accordingly, following alternative arrangement was worked out.

b) Bring the generation of Dadri II generation at the existing Dadri 400 kV bus.

ii) Splitting of the existing 400 kV Dadri bus along D-D (given in the single line diagram enclosed at **Exhibit-III-7**) with thermal machines of 4x210 MW MW along with 2x3x167 MVA ICT and the lines to Muradnagar, Panipat and Malerkotla (New proposed line).

The Load flow as well as short circuit studies carried out with the above arrangement is given in **Exhibit-III-8**. The result of the studies indicates reduction in loading on the 400 kV Malerkotla line and decrease in the short circuit level at the existing Dadri bus from 35.39 KA to 33.83 KA. The loading on the other circuits are within limit.

The result of studies with outage of Malerkotla 400kV line is given in **Exhibit-III-10.**

Incase of outage of ICT at Dadri gas plant, the spare ICT at Dadri would be so interconnected that the power generated from Dadri complex would be evacuated without any constraint. The result of the study is given in **Exhibit-III-9.**

5. **Recomendations**

The following transmission system can be recommended along with Dadri-II TPS (490 MW)

ii) Bring the generation of Dadri II generation at the existing Dadri 400 kV bus.

iii) Splitting of the existing 400 kV Dadri bus along D-D (given in the Single line diagram enclosed in **Exhibit XV**) with thermal machines of 4x210 MW along with 2x3x167 MVA ICT

and the line to Muradnagar, Panipat(existing and 2nd proposed ckt.) and MalerKotla (New proposed line).

) 2nd 400 kV line from Dadri (Split Bus) to Malerkotla

The interconnection between 400 kV Dadri and Dadri split bus would remain normally open. There is a need for providing interlocking arrangement so that in case of outage of Dadri thermal machines, the breaker get closed and Dadri split bus gets connected with 400 kV Dadri bus.

Members of the standing committee may like to discuss and concur with the above proposal.

Item IV: LILO of Tehri-Meerut 765 kV line (charged at 400 kV) at 400 kV Rishikesh S/S of Uttaranchal.

1. CMD, Uttaranchal Power Corporation Ltd.(UPCL), in his letter dated 16th July 2001, has desired that the one circuit of the 400 kV Tehri–Meerut 765 kV line may be LILOed at 400 kV Rishikesh S/S. It was stated that the newly formed Uttaranchal state does not have any direct link with the National grid, so this arrangement would help the state to get supply directly from central sector project.

2. It is mentioned that the proposal of LILO of one ckt. of Tehri-Meerut D/C 765 kV line (initially to be operated at 400 kV) was studied and the results of the studies were circulated along with the agenda of 12th Standing Committee meeting held at Udaipur. The proposal was discussed in detail in the above Standing Committee meeting. From the result of the study it was observed that during high hydro and high thermal condition, the utility of the above proposal by 10th plan for Uttaranchal would be minimal, since most of the power through this interconnection would flow towards Muzaffarnagar of UP.

However, considering the fact that Uttaranchal being a new state and the specific request of UPCL regarding the possibility of load growth in view of the prospective industrialization, it was decided in the 12th standing committee meeting that further study might be carried out taking the 400 kV D/C line from Tehri (pooling point) to Rishikesh.

3. In line with the decision of the standing committee, system studies have been carried out in CEA considering the evacuation arrangement for

Tehri Stage-I and Koteshwar and providing additional 400 kV D/C line from Tehri (pooling point) to Rishikesh. The results of the studies are enclosed in Exhibits (IV-1, VI-2 & VI-3).

4. From the result of studies it was observed that power flow on proposed 400kV D/C Tehri (pooling point) – Rishikesh line is about 443 MW and the flow on 400 kV Rishikesh - Muzaffarnagar also is about 460 MW (Exhibit-XV). With the commissioning of the generation at Tehri-II the loading on the proposed 400kV D/C Tehri (pooling point) – Rishikesh increases to 994 MW (Exhibit-XVI) and the flow on 400 kV Rishikesh - Muzaffarnagar also increases to about 669 MW which is on higher side. Whereas the loading on the 765 kV Tehri-Meerut 2xS/C line is only 1367 MW, which is much below the SIL loading of 765 kV line. As such the line is underutilized. Further heavy flow towards the Rishikesh 400/220 kV S/S also creates heavy over loading of the 220 kV lines of Uttaranchal particularly Rishikesh-Roorkee 220 kV S/C line(331 MW). Further, it was observed that in the event of outage of one ckt. of 765kV Tehri (pooling point) – Meerut 2xS/C line, the load on this proposed 400kV D/C Tehri (pooling point) – Rishikesh line and the flow on 400 kV Rishikesh - Muzaffarnagar increases to about 1145 MW and 728 MW respectively(Exhibit-VI-3).

5. Thus the results of studies indicates that the proposal for connection of Tehri(pooling point) to Rishikesh by a 400 kV line will over load the nearby transmission system during 10^{th} plan conditions. As such the proposal does not appears to be feasible. However considering the specific request of UPCL for direct touch point from the Northern Grid, another alternate transmission proposal was studied by providing a 400 kV D/C line from Meerut(POWERGRID) to Muzaffarnagar and reconfiguring the existing 400 kV Rishikesh-Muradnagar line so as to make the network as under.

- Rishikesh-Meerut 400 kV S/C line
- Meerut-Muzaffarnagar 400 kV S/C line
- Muzaffarnagar-Muradnagar 400 kV S/C line

The result of the load flow studies considering the above arrangement (Exhibit-VI-4) indicates no overloading on any of the 400 kV line. This proposal would meet the requirement of UPCL as they could transmit the power to Uttaranchal during winter conditions. However, the overloading on

the 220 kV Rishikesh – Roorkee S/C line of UPCL under high hydro conditions still persists.

5. This issue was discussed in detail with UPCL authority during the visit of CEA officers on 8th and 9th April 2002 to Uttaranchal. Considering the future prospect of heavy load growth around Roorkee area and the overloading in the 220 kV Rishikesh-Roorkee S/C line, two alternatives emerged.

Alt-I Providing additional 220 kV Rishikesh-Roorkee D/C line.

Alt-II Creating 400/220 kV S/S at Roorkee by LILO of the proposed Rishikesh-Meerut 400 kV S/C line at Roorkee.

The results of the load flow studies with the above two alternatives are given in Exhibit-VI-5 & VI-6. From the result of the study it has been observed that the loading on the 400 kV as well as in the 220 kV lines around Rishikesh are within permissible limits.

Since the above matter concerning the rearrangement of the 400 Rishikesh- Muzaffarnagar line and 400 kV S/S in Uttaranchal. As such it requires the concurrence of the Northern Regional constituents so the matter is put up for discussion.

Member of the committee may like to discuss and concur on the proposal.

Item V: Strengthening of Bhakra Transmission System

1. A DPR has been received from BBMB for renovation, modernisation and uprating (RM&U) of 5 units of Bhakra Left Bank Power House from 5x108 MW to 5x126 MW with an effective increase of 90 MW in generation.

The Bhakra Right Bank units was already uprated from 5x132 MW to 5x157 MW with an increase of 125 MW in generation. Thus with the uprating of the machines at Bhakra left, the generation capacity at Bhakra complex would increase by 215 MW.

2. Presently the generation from Bhakra complex is being evacuated through the following transmission system

- Bhakra (right)- Mahilpur 220 kV D/C line
- Bhakra (right)- Ludhiana 220 kV D/C line
- Bhakra (right)- Ganguwal 220 kV D/C line
- Bhakra (left)-Ganguwal 220 kV T/C line

Further the evacuation from Ganguwal is being taking place through the following lines

- Ganguwal-Ludhiana 220 kV D/C line
- Ganguwal-Ambala 220 kV D/C line
- Ganguwal-Govindgarh 220 kV D/C line
- Ganguwal-Mohali 220 kV S/C on D/C line
- Ganguwal-Abdullapur 220 kV D/C line

Beside this, part of the generation from Dehar HEP also comes to Ganguwal at 220 kV through Dehar-Ganguwal D/C line. In addition to the above system there is a bay provision at Bhakra (right) for taking 220 kV line from Bhakra (right)- Panchkula.

1 Considering the existing transmission system, load flow studies have been carried out corresponding to 10^{th} plan condition with the uprated generation at Bhakra complex. The result of the load flow is given in Exhibit V-1. From the result of the load flow studies, it can be seen that most of the lines from Bhakra/Ganguwal complex are critically loaded. The 220kV Bhakra (L) – Gangwal T/C line (2x .3 + 1x .4 conductor size) carries about 575 MW after meeting the local loads of Bhakra (L) at 66 kV. The 220kV Bhakra (R) – Mahilpur D/C line (2x .4 conductor size) carries about 185 MW per circuit. Since the lines from Bhakra/Ganguwal complex are very old lines and are constructed with lower rating conductor so any contingency outage of D/C line in this complex would not be sustainable. As such the existing transmission system from Bhakra needs to be strengthen to cater to the increased generation at Bhakra left. Further the 220 kV bay at Bhakra (right) is still lying vacant and CE HVPNL (plg.) vide letter No. Ch-126/HSS-135 dated 25/04/00 has intimated that HVPN has decided to drop the construction of 220 Bhakra (right) - Panchkula line (copy enclosed in Annex V-I). So under this circumstance, the bay at Bhakra (right) would fall

vacant and the same could be gainfully be utalised by PSEB for construction of line from Bkakra(right) to their load center like Jallandhar. Studies have also been carried out considering the additional line from Bkakra(right) to Jallandhar and reconductoring of the existing lines from Bhakra complex with 420 mm. AAAC conductor. The result of the studies is given in Exhibit V-2**.** The studies have also been carried out with outage of following lines.

- Bhakra-Mahilpur 220 kV D/C line (Exhibit V-3)
- Ganguwal-Ludhiana 220 kV D/C line (Exhibit V-4)
- Bhakra(right)l-Ludhiana 220 kV D/C line (Exhibit V-5)
- Bhakra(right)l-Ludhiana 220 kV D/C line with out the proposed line from Bhakra(right)-Jallandhar S/C line (Exhibit V-6)

From the result of the studies, it can be seen that with the proposed strenghtning and additional circuit from Bkakra(right) to Jallandhar, the problem of overloading of lines from Bhakra complex can be mitigated.

4. The modifications/additions in the existing transmission system are proposed as under:

. **Reconductoriing of the following 220kV lines from Bhakra with AAAC, 420 Sq.mm. size conductor**.

i) Bhakra(L) – Ganguwal T/C line
ii) Bhakra(R) – Mahilpur D/C line
) Bhakra(R) – Ludhiana D/C line
) Ganguwal- Ludhiana D/C line
) Ganguwal- Ludhiana D/C line

. **Addition of 220 kV Bhakra (R) – Jullunder (Pb) S/C line.**

Constituent members are requested to discuss and concur on the issue.

CENTRAL ELECTRICITY AUTHORITY
SYSTEM PLANING AND PROJECT APRAISAL DIVISION

No.1/9/01-SP&PA/ **Dated : /05/02**

-As per List enclosed-

Sub: 13th meeting of the Standing Committee on Power System Planning of Northern Region.

Sir,

Please find enclosed the agenda note for 13th meeting of the Standing committee on Power System Planning of Northern Region. The date, venue & time of the meeting shall be intimated in due course.

Yours faithfully,

(A.K.AGGARWAL)
DIRECTOR(SP&PA)

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