

CONTINGENCY PLAN **FOR NORTHERN REGIONAL GRID**

The details of specific actions to be taken under different contingent conditions are as follows:

1.0 Outage of Rihand Dadri HVDC Pole / Poles:

Rihand-Dadri HVDC bipole (2x750 MW) is the most important link in evacuating the generation from Singrauli (2000 MW), Rihand (1000 MW) and Anpara (1600) and other Power Stations in UP to the load predominant area in western part of the grid. In the event of non-availability of HVDC Pole / Poles, the transmission capability and level of the system redundancy in the east-west corridor reduces considerably and under such a situation further outage of any other EHV circuit in the said corridor may lead to critical situation. As such, during the outage of HVDC Pole, contingent conditions as detailed below continue to exist in the Grid:

1.1 Monitoring and control of line loading in parallel AC network:

The 400 KV and 220 KV circuits in the parallel AC network evacuating power from Singrauli-Rihand-Anpara-Obra complex to western part of the grid are likely to remain loaded close to stability limits and would require close monitoring of MW flow on them. The details of the 400 KV circuits in this corridor are as follows:

Eastern to Central UP:

- 400 KV Singrauli-Lucknow (POWERGRID)
- 400 KV Singrauli-Allahabad-Kanpur-1 (POWERGRID)
- 400 KV Singrauli-Allahabad-Kanpur-2 (POWERGRID)
- 400 KV Vindhyachal-Kanpur (POWERGRID)
- 400 KV Obra -Panki (UPPCL)
- 400 KV Anpara-Unnao (UPPCL)
- 400 KV Obra-Sultanpur-Lucknow (UPPCL)

Central to Western UP:

- 400 KV Kanpur-Ballabgarh (POWERGRID)
- 400 KV Kanpur-Agra (POWERGRID)

- 400 KV Panki-Muradnagar (UPPCL)
- 400 KV Unnao-Agra-Muradnagar (UPPCL)
- 400 KV Lucknow-Moradabad (POWERGRID)

The line loading on the above circuits is to be continuously monitored and in the event of loading on any of the circuit approaching towards thermal / stability limits and / or the redundancy reducing below the desired level, immediate measures are to be initiated to control the same.

(Action: NRLDC/UPPCL/POWERGRID/CPCC
Kanpur /NTPC & UPPCL stations in UP)

1.2 Exporting Power to Western / Eastern Region:

In case the loading of the AC tie-lines in the said corridor exceeds beyond the desired level, power may be exported to Western / Eastern Region through Vindhyachal / Sasaram Back to Back link if possible, and/or backing down may have to be resorted to in Singrauli-Rihand-Anpara-Obra complex even during high demand period. Backing down at Unahchar and Tanda would also give valuable relief. This may, however, lead to low frequency conditions in the Northern Grid, for which adequate demand side management shall have to be initiated.

(Action: NRLDC/other Regions /
Generating stations in UP and of NTPC)

1.3 Reducing Generation in Eastern side and increasing in Western side:

The load on the 400 KV trunk lines on parallel AC network can be reduced by restricting the generation in Singrauli-Rihand-Anpara-Obra-Unchahar-Tanda complex and increasing generation in Western side of the Grid i.e. in BBMB complex and / or at Chamera and Ranjit Sagar Dam Hydro stations.

(Action: NRLDC / different Generating Station on
Eastern and Western sides)

1.4 Restricting load in the Western side of the Grid:

The load on the 400 KV trunk lines can be reduced by restricting load in Western side of the Grid viz. in Western UP, Uttranchal, Delhi, Rajasthan, Haryana, Punjab, HP and J & K and reducing equivalent generation in Eastern side of the Grid.

(Action: NRLDC/ other constituents)

1.5 Carrying out Load-shedding in specific areas:

The load on different 400 KV trunk lines can also be reduced by carrying out load shedding in specific areas / pockets. The details pertaining to some of the critical 400 KV trunk lines are given at Annexe-I.

(Action: NRLDC/other constituents)

2.0 Outage of 400 KV circuit (s) in parallel AC network through UP:

Action similar to what has been described in the para 1.0 above may be taken in the event of contingency caused due to outage of 400 KV AC circuit (s) in East to West corridor.

3.0 Outage of Trunk lines between UP-Delhi-Rajasthan (UP) and Punjab-Haryana, HP & J & K (BBMB) systems:

In the Northern Regional Grid out of the total generation available in the region, predominant portion is existing on the Eastern side in the form of pit-head thermal generating stations at Singrauli, Rihand and Anpara as well as at other NTPC and UPPCL stations in UP (hereinafter termed as UP System), while there is a concentration of load in the Western pocket in the states of Haryana, Punjab, HP and J & K (hereinafter termed as BBMB System) Therefore, for most of the period there is considerable flow of power from UP-Delhi-Rajasthan (UP) system to Punjab-Haryana-HP & J & K (BBMB) system.

These two systems are connected by a number of 400 KV and 220 KV circuits. The details of 400 KV trunk circuits between these two systems around Panipat-Hissar axis are as follows:

400 KV Dadri -Panipat
400 KV Dadri-Malerkotla
400 KV Bassi-Hissar
400 KV Bawana-Hissar
400 KV Bawana-Bhiwani-Hissar

Punjab is further connected with Hissar through 400 KV Hissar-Moga D/C. In addition to that there are a number of 220 KV circuits also giving a parallel path to the above circuits.

In the event of tripping of circuit (s) in the above corridor, the flow on the remaining circuits has to be controlled so that in the event of outage of any other circuit (s) in the said corridor, the security of the Grid is not jeopardised.

(Action: NRLDC/other constituents)

3.1 The following actions may be taken in the event of above contingency:

- i) Generation in UP system may be reduced and in BBMB system may be increased in order to reduce the flow from UP to BBMB system.
- ii) Load reduction to be carried out in BBMB system and in case of high frequency conditions power may be exported to WR / ER, if possible and / or generation be got restricted in UP system.
- iii) Support from Hydro units at BBMB, Chamera and RSD may be taken and equivalent reduction in generation may be got done in UP system.

(Action : NRLDC/ other constituents)

4.0 Measures to be taken in case of critically low System Frequency conditions (frequency below 49.0 Hz.):

All possible measures must be taken to maintain the system frequency within normal band (49.0 Hz. to 50.5 Hz.) by taking following additional steps:

4.1 Wherever margins are available the generation may be got stepped- up.
(Action: All constituents)

4.2 Import may be made from the neighbouring regions, if possible.

(Action: NRLDC/other RLDCs)

4.3 Load regulatory measures by all states to reduce their drawals from the Grid /load.

(Action: All States)

4.4 Disconnection of Radial Load / ICTs in the areas of different States (details given at Annexe-2) by issuing codes from NRLDC. While disconnecting Radial Load / ICTs,, the first effort should be to disconnect the load in the areas of the states which are overdrawing from the Grid. However, in case adequate avenues are not there to disconnect

load in the areas of defaulting state and / or the system frequency is excursing to critically low levels even after disconnecting such load, the radial load / ICTs in the areas of other states can also be disconnected in order to save the system. However, as soon as the contingency is over and system parameters become normal, the radial loads in respect of such states shall have to be reconnected back on first priority.

(Action: NRLDC/All constituents)

- 4.3 By providing additional support from hydro units particularly at Chamara, Bhakra Complex and other Reservoir based hydro units during the contingent conditions.

(Action: BBMB & NHPC and other constituents)

5.0 Measures to be taken in case of critically low voltage conditions:

All possible measures be taken to improve the voltages, which shall include:

- 5.1 All possible VAR supporting measures including activation of requisite capacitors and load regulation so as to curtail VAR drawals from the grid.

(Action: All States)

- 5.2 Maximisation of VAR generation by the units particularly at Load Centre locations.

(Action: States and Generating Agencies)

- 5.3 The position of transformer taps be suitably selected to improve the voltage at supergrid level.

(Action: NRLDC/ other constituents)

- 5.4 Since Kanpur is almost the central point in east to west corridor, the voltage at Kanpur be maintained in normal range for system stability (within range 390 KV to 405 KV). In order to achieve this, the optimum utilisation of SVC at 400 KV Kanpur sub-station is of importance. All necessary steps to be taken for the optimum utilisation of SVC.

(Action: POWERGRID NR-I)

- 5.5 Since Rihand-Dadri HVDC bipole is connected with Dadri 400 KV bus and large generation is also available at Dadri complex, it is extremely

important that at Dadri 400 KV bus voltage is maintained at satisfactory level and under no circumstances it should be allowed to fall below 360 KV. In order to maintain proper voltage at Dadri, other than load regulation by the neighbouring States, maximum reactive support should also be provided by Dadri (Thermal), Dadri (Gas) and HVDC station at Dadri.

(Action: NRLDC/NTPC Dadri/
Dadri HVDC/State constituents)

- 5.6 In case the voltages are still persisting in critically low range then the voltage improvement can also be obtained by carrying out load shedding in specific pockets / areas. The details of specific areas to carry out load shedding to improve the voltages at different 400 KV buses are given at Annexe-3.

(Action: NRLDC / other constituents)

6.0 Measures to be taken in case of critical high system frequency conditions (frequency above 50.5 Hz):

The following measures are to be taken in case of critically high frequency conditions;

- 6.1 Export the power to other regions, if possible.

(Action: NRLDC / other RLDCs)

- 6.2 Backing down is to be carried out at the generating stations in central / state sector stations based on frequency linked load despatch guidelines.

(Action: All constituents)

- 6.3 In the event of consistent high frequency conditions some generation units can also be closed down based on the quantum of load crash in specific states/ areas and taking into consideration the possibility of load revival.

(Action: NRLDC / other constituents)

7.0 Measures to be taken in case of high voltage conditions:

The following measures are to be taken in critically high voltage conditions.

- 7.1 Ensure that the bus reactor/switchable line reactors have been taken into service .

(Action : All constituents)

- 7.2 Switchable capacitors banks are taken out wherever possible.

(Action: All constituents)

- 7.3 Generating units absorb VARS to the extent possible.

(Action: All constituents)

- 7.4 The position of transformer taps be suitably selected to control the voltage at supergrid level.

(Action: NRLDC/ other constituents)

- 7.5 In the event of persistent high voltage conditions the lightly loaded redundant lines may be switched off.

(Action: NRLDC/other constituents)

8.0 System Instability / Hunting :

At times the high MW loading of trunk circuits and low voltages on critical 400 KV buses can make the system vulnerable on stability front. It has been observed that high MW load on certain critical 400 KV lines like Singrauli-Lucknow, Kanpur-Ballabgarh, Kanpur-Agra, Lucknow-Moradabad, Panki-Moradnagar and Unnao- Agra-Muradnagar (sometimes in presence of low voltages) leads to system instability in the Grid. Similarly, high MW loading (in the presence of low voltages) on the lines from UP to BBMB System also leads to system instability in the Grid. In order to control the system instability the loading on the trunk lines is to be got reduced and voltages if low are to be improved.

(Action: NRLDC/other constituents)

9.0 Outage of 400 KV Dadri-Mandola Circuits(s):

Since 400 KV ring around Delhi system is incomplete due to non-construction of 400 KV Bamnauli-Samaypur D/C, Delhi is drawing most of its share from grid through 400 KV Dadri-Mandola D/C. Mandola is further connected with Bawana at 400 KV level and HVPN also draws

large power through the circuits from Bawana. It has been observed that many a times the power flow on these 400 KV Dadri-Mandola D/C exceed even to 2400 MW and under such a situation, tripping of even one of the 400 KV Dadri-Mandola circuits can lead the tripping of other circuit and may cause total loss of power supply in Delhi system as well as endanger the security of the Grid. Therefore, the loading on these circuits is to be continuously monitored and kept controlled.

(Action: NRLDC/DTL/HVPN/Rajasthan/Punjab)

9.1 In the event of tripping of even one of the 400 KV Dadri-Mandola circuit, immediate measures must be taken to control the loading on other circuit by taking following measures:

- a) Delhi's load at Bawana / Bamnauli to be shifted to BTPS side / curtailed.
- b) Delhi's load at Mandola / Narela is to be shifted to Panipat side / curtailed.
- c) HVPN load at Abdullapur / Sahabad is to be shifted to Panipat / curtailed.
- d) If required additional load shedding be carried out in Delhi, Haryana, Rajasthan and Punjab area and /or additional generation be carried out at BBMB stations / Chamera /RSD.
- e) If required the out-feed from Dadri be reduced by regulating Rihand-Dadri HVDC flow / generation at Dadri.

(Action: All constituents)

9.2 The above measures are to be further intensified in the event of tripping of both the 400 KV Dadri-Mandola circuits. Furthermore, the flow on all the 400 KV circuits from NTPC-Dadri and to Delhi and BBMB system from Bassi-Hissar side are to be specifically monitored and controlled.

(Action:NRLDC/NTPC, Dadri / other constituents)

10.0 Disturbance / Trippings in J & K System:

Maintenance of uninterrupted supply in J & K system is essential due to strategic and important load persisting in Valley and Jammu areas. It has,

however, been observed that J & K system being available at the tail-end of the Grid and the Valley is connected with the grid through a weak link i.e. only with 220 KV Kishenpur-Pampore D/C, many a times there is interruption in the supply of J & K system. It is, therefore, essential that the transmission corridor connecting J & K / Valley with rest of the Grid should be continuously monitored and all efforts should be made to keep it in good working condition.

10.1 In the event of separation of J & K / Valley from the Grid and having interruption in its power supply, following immediate measures are to be taken:

- a) Self-start the hydro units at Lower Jhelum / Uri and synchronise the same and feed essential load in Valley area.
- b) Extend the power to / from Kishenpur and synchronise Valley with the Grid at the earliest opportunity.

10.2 In the event of separation / tripping of whole J & K system (including Jammu area), the units at Salal should also be self-started and the connected with Valley area/ rest of the Grid at the earliest opportunity.

11.0 Preventive Measures to Maintain Grid in Healthy Condition:

The following preventive measures / proactive actions are to be taken up at regular intervals to keep the Grid in healthy condition:

11.1 Condition Monitoring of critical circuits / ICTs:

Continuous monitoring the health in respect of critical transmission circuits and ICTs etc. shall need to be carried out at regular intervals and as a routine in order to take preventive measures and to avoid undesirable trippings.

(Action: All constituents)

11.2 Operation of underfrequency and df/dt relays:

All the state constituents shall ensure that the requisite quantum of underfrequency and df/dt relays in their system must be kept into service in order to render requisite relief and to act as a defence mechanism in the event of a contingency.

(Action: All states)

11.3 Protection Co-ordination:

The existing settings of overvoltage tripping of various circuits and overload tripping of various ICTs shall have to be examined and reviewed and required steps have to be taken so as to prevent undesirable / spurious tripping of any circuit / ICT. Similarly, single-phase auto-reclosing scheme must be kept under 'enabled' mode.

(Action: All constituents)

11.4 PLCC Channels:

The health of the PLCC channels available on the different circuits shall have to be examined and any preventive / remedial measures required are to be taken immediately so as to ensure their full availability and functioning.

(Action: All constituents)

11.5 Real-Time Data Telemetry:

The real time data telemetry from different generating stations / substations to NRLDC, New Delhi has to be kept in good working conditions, so as to have effective monitoring of the grid. Any steps required to further improve / strengthen the telemetry are also to be taken.

(Action: NRLDC/other constituents)

ANNEX - I

DETAILS OF LOAD SHEDDING IN SPECIFIC AREAS IN ORDER TO REDUCE LOADING ON DIFFERENT CIRCUITS

S. No.	Lines/ICT's	Action by	Action
1.	400 KV Kanpur-Ballabgarh	HVPN RRVPN DTL	Load shedding in and around Ballabgarh Load shedding in Northern Rajasthan Load shedding in South Delhi
2.	400 KV Kanpur-Agra	HVPN RRVPN DTL	Load shedding in and around Ballabgarh Load shedding in Northern Rajasthan Load shedding in South Delhi
3.	400 KV Panki-Muradnagar	UPPCL UPCL	Load shedding in Western UP Load shedding around Rishkesh (Garhwal area)
4.	400 KV Dadri-Muradnagar	UPPCL UPPCL	Load shedding in Western UP area. Load shedding around Rishikesh (Garhwal area)
5.	400 KV Unnao-Agra	UPPCL	Load shedding in Western UP
6.	400 KV Lucknow-Moradabad	UPPCL UPCL	Load shedding in Western UP Load shedding in and around Haldwani and Rishikesh (Garhwal and Kumaon areas)
7.	400 KV Agra-Bassi	RRVPN HVPN	Load shedding in Northern Rajasthan Load shedding in Southern Haryana
8.	400 KV Ballabgarh-Bassi	RRVPN HVPN	Load shedding in Northern Rajasthan Load shedding in Southern Haryana
9.	400 KV Dadri-Panipat	HVPN RRVPN DTL	Load shedding in and around Panipat Load shedding in Northern Rajasthan Load shedding in and around Narela (When Narela being fed from Panipat)
10.	400 KV Dadri-Mandola	DTL HVPN RRVPN	Load shedding in Northern Delhi and Western Delhi Load shedding in Northern Haryana (in and around Abdullapur) Load shedding in Northern Rajasthan
11.	220 KV Ballabgarh-BTPS *	DTL RRVPN	Load shedding in South Delhi and NDMC area Load shedding in and around Alwar
12.	220 KV BTPS-IP Extn.	DTL	Load shedding around UP and in New Delhi area
13.	220 KV Mandola-Patpargarj	DTL	Load shedding in East Delhi area.
14.	220 KV Samaypur-Charkhi-Dadri	HVPN RRVPN	Loading shedding in Southern Haryana Load shedding in Northern Rajasthan
15.	220 KV Ballabgarh-CharkhiDadri	HVPN RRVPN	Load shedding in Southern Haryana Load shedding in Northern Rajasthan
16.	220 KV Kishenpur-Pampore **	J & K	Load shedding in Valley area

* During the time when direction of power flow is from Ballbgarh to BTPS end.

** During the time when direction of power flow is from Kishenpur to Pampore (in the reverse situation i.e. when power flow is from Pampore to Kishenpur and which at times is observed during low load conditions in Valley area, the overloading can be controlled by connecting more load in Valley area.

ANNEX - II

**DETAILS OF RADIAL FEEDERS/ICT S IN DIFFERENT STATES
FOR GETTING LOAD RELIEF IN THE EVENT OF A CONTINGENCY**

STATE	CONTROL- LING STATE/ AGENCY	FEEDER/ICT DETAILS	NORMAL LOAD
DTL	BBMB POWERGRID NTPC UPPCL	D1, D2 and D3 feeders from Rohtak Road 220 kV Mandola-Gopalpur I & Gopalpur-II 220 kV BTPS-Okhla-I and Okhla-II Load to Ghazipur from Noida	100 MW 220 MW 300 MW 50 MW
		Load to Ghazipur from Noida	50 MW
UPCL	UPPCL UPPCL	132 kV Dohna-Kiccha S/C 220 kV C.B.Ganj-Haldwani S/C	40 MW 80 MW
PSEB	BBMB	3 Nos. of 220/66 kV ICTs at Jamalpur	80 MW
	BBMB	2 Nos. of 220/132 kV ICTs at Jamapur	50 MW
	BBMB	2 Nos. of 220/66 kV ICTs at Jullandhar	40 MW
	BBMB	2 Nos. of 220 /132 KV ICTs at Jullandhar	60 MW
	BBMB	3 Nos. of 220/66 KV ICTs at Sangrur	30 MW
HPSEB	BBMB	220 kV Dehar-Kangoo and 132 kV Dehar-Kangoo	100 MW
	BBMB/NHPC	220 kV Pong-Jessore , 220 kV Bairsiul-Jessore & 220 kV RSD -Jessore	80 MW
J&K	PSEB	66 kV Pathankot-Kathua	8 MW
	PSEB	66 kV Sarna-Kathua	6 MW
	NHPC /PSEB	220 kV Salal-Jammu D/C and 220 k V Sarna-Hiranagar	250 MW
	POWERGRID / PSEB	220 kV Kishenpur-Udhampur & 220 kV Sarna-Udhampur	120 MW
	POWERGRID	220 kV Wagoora-Ziankote	140 MW
HVPN	POWERGRID	220 kV Abdullapur-Shabad D/C	120 MW
	BBMB	220 kV Dadri-Narnaul S/C	60 MW
	BBMB	220 kV Dadri-Riwari S/C	80 MW
	BBMB	220 kV Samaypur-Palwal D/C	50 MW
	BBMB	132 kV Panipat-Sonepat & 132 kV Narela-Sonepat	40 MW
	BBMB	132 kV and 33 kV feeders from Panipat	120 MW
	BBMB	132 kV and 33 kV feeders from Kurukshetra	60 MW
	BBMB	220 /132 kV ICT #2 at Dadri (BBMB)	35 MW
	HPSEB	132 kV Giri-Abdullapur	40 MW
	BBMB	220/132 kV ICT# at Hissar	50 MW
	BBMB	220/66 kV ICT-I & ICT-2 at Jagadhari / 66 kV feeders from Jagadhari	80 MW
	BBMB	66 kV feeders from Dhulkote	15 MW
	BBMB	66 kV Rohtak Road-Gurgaon D/C	40 MW
	BBMB	220 kV Samaypur-Badshahpur D/C	120 MW
UT Chandigarh	HVPNL	66 kV Pinjore-Chandigarh (Sector-29) D/C	40 MW

NOTE: Since some of the radial feeders / ICTs contain important loads, it is necessary that

before disconnection or immediately after disconnection of radial load the concerned state is notified about such action in order to facilitate the state to feed that important load from some other source.

ANNEX - III

ACTION DURING LOW VOLTAGE CONDITIONS

Sr. No.	Sub-Station	Min. Bus voltage	Action By	Action
1.	Dadri 400 kV (NTPC)	360 KV	DTL HVPN UPPCL	Load shedding in and around Gopalpur, Subzi Mandi, Narela, Rohtak Road, Rohini, Shalimarbagh, Patparganj, Kashmere Gate, Bawana, Najafgarh, Bamnauli and surrounding areas. Load shedding in and around Panipat and Ballabhgarh. Load shedding in and around Muradnagar, NOIDA, Sahibabad, Meerut, Modipuram, Simbholi, Khurja and surrounding areas.
2.	Panipat 400 kV	360 KV	HVPN DTL	Load shedding in and around Panipat and Ballabhgarh Load shedding in and around Narela (When Narela being fed from Panipat)
3.	Muradnagar 400 kV	360 KV	UPPCL DTL UPCL	Load shedding in and around Muradnagar, NOIDA, Sahibabad, Meerut, Modipuram, Simbholi, Khurja and surrounding areas. Load shedding in and around Patparganj, Ghazipur and surrounding areas (if connected from Sahibabad) Load shedding in and around Rishikesh and Haldwani.
4.	Bassi 400 kV	360 KV	RRVPN HVPN	Load shedding in and around Jaipur and other areas in Northern Rajasthan Load shedding in and around Hissar and Ballabhgarh
5.	Ballabhgarh 400 kV	360 KV	HVPN RRVPN DTL	Load shedding in and around Dadri (BBMB), Badshahpur, Palwal and Ballabhgarh Load shedding in Northern Rajasthan Load shedding in South Delhi
6.	Wagoora 400 kV	360 KV	J & K	Load shedding in Valley area in J&K
7.	NAPS 220 kV	180 KV	UPPCL UPCL	Load shedding in and around Moradabad, Muradnagar Simbholi, Meerut, Modipuram, Khurja, Sahibabad. Load shedding in and around Rishikesh and Barelley
8.	BTPS 220 kV	180 KV	DPSC	Load shedding in and around Okhla, Mehrauli, Patparganj, IP, Rajghat, Lodhi Road and Sarita Vihar
9.	Moga 220 kV	180 KV	PSEB	Load shedding in and around Moga, Ferozpur, Jagraon, Laltokalan.
10.	Jammu 220 kV	180 KV	J & K	Load shedding in Jammu area in J&K

NOTE: In order to minimize/avert the low voltage conditions the following prior actions are to be ensured:

- i) The capacitor banks are kept in service.
- ii) The generating units at Load Centre locations are generating maximum possible VARS.
- iii) Wherever possible the hydro units are operated in synchronous condenser mode and generating VARS.
- iv) The transformer taps are optimally selected.