

POWER GRID CORPORATION OF INDIA LTD.
NORTHERN REGIONAL LOAD DESPATCH CENTRE
NEW DELHI

Date: 24.11.2003

Sub: CONTINGENCY PLAN IN NORTHERN REGIONAL GRID DUE TO SHUTDOWN OF RIHAND- DADRI HVDC POLE-2 w.e.f. 24.11.2003.

Today i.e. on 24.11.2003 at 0922 hrs., Rihand-Dadri HVDC Pole-2 has been declared under shutdown due to tripping of B-Phase converter transformer at Rihand end. Just before tripping the Rihand-Dadri HVDC Bipole was carrying a total load of 1350 MW from Rihand to Dadri and after tripping of Pole-2, the Pole-1 is being loaded to its full capacity i.e. 750 MW. Due to outage of Pole-2 the redundancy in the transmission capacity in east to west corridor has reduced and loading on the balance AC lines in this corridor is to be continuously monitored and kept within safe limits in order to keep the safety and security of the grid intact.

The pole is expected to revive back only after a period of about 10 days i.e. by around 3rd December, 2003. The details of the Contingency Plan in the Northern Regional Grid which would be in force during the outage of HVDC Pole-2 are enclosed herewith. It is requested that all the concerned agencies may please cooperate by taking the requisite measures in order to maintain the safety and security of the Grid during the above period.

With regards,

Encl: As above

(**ALOK ROY**)
General Manager

DISTRIBUTION:

1. Member Secretary, NREB, New Delhi.
2. C.E. (O&M), DVB, New Delhi.
3. CGM (PS), UPPCL, Lucknow.
4. C.E. (SO&LD), RRVPN, Jaipur.
5. C.E. (SO&C), PSEB, Patiala
6. C.E. (Comml), HVPN, Panchkula
7. C.E.(System Planning), HPSEB, Shimla
8. Development Commissioner, PDD, J & K, Jammu
9. C.E. (Elect. Opn), Elec. Deptt. UT Chandigarh
10. ED (NR), NTPC
11. ED (NCR), NTPC
12. GM, SSTPS
13. G.M. Rihand STPS
14. G.M., Anpara STPS
15. G.M., Obra TPS
16. ED (O&M), NHPC
17. C.E.(PR&C), BBMB
18. ED-NR-I, POWERGRID.
19. ED, NR-II, POWERGRID
20. AGM, ERLDC, Kolkatta
21. AGM, WRLDC, Mumbai
22. Vice President (Trading), PTC
23. CMD, Global Energy Ltd.

Copy for kind information to:

1. Director (Opn), POWERGRID
2. ED (OS), POWERGRID
3. ED (SO), POWERGRID
4. Dy. Secy. (EA&OM), MOP

CONTINGENCY PLAN

FOR NORTHERN REGIONAL GRID ON ACCOUNT OF SHUTDOWN OF RIHAND-DADRI HVDC POLE-2

1. BACKGROUND:

On 24.11.2003 at 0922 hrs., Rihand-Dadri HVDC Pole-2 has tripped due to tripping of B-Phase converter transformer at Rihand end. The tripped converter transformer shall be replaced by the spare transformer unit available at Rihand and the pole is expected to revive back by around 3rd December, 2003. During the period of outage of Pole-2, the loading on AC lines in east to west corridor is to be continuously monitored and kept within safe limits at all times.

2. CONTINGENT CONDITIONS DUE TO OUTAGE OF POLE-2:

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) Thermal Power Stations to the load predominant area in western part of the grid. At present one (1) no. of 500MW unit at Anpara and one (1) no. of 500 MW unit at Rihand are under outage and all the 400 KV circuits in the parallel AC network in east to west corridor are in operation. However, both of these units are expected to be revived back within 2 – 3 days time. With enhanced generation in Singrauli-Rihand-Anpara complex, all the lines in east to west corridor would be operated close to their stability limits and further outage of any circuit may lead to critical conditions. As such, during the outage of HVDC Pole-2 certain contingent conditions shall continue to exist which are as enumerated below:

(i) High MW loading of parallel AC network:

The 400 KV circuits of 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. These circuits are:

Eastern to Central UP:

- 400 KV Singrauli-Lucknow (POWERGRID)
- 400 KV Singrauli-Kanpur-1 (POWERGRID)
- 400 KV Singrauli-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)

Eastern to Western UP:

- Rihand-Dadri HVDC Pole-1

The loading on the above circuits becomes critically high during the period when UP resorts to heavy load shedding in eastern UP.

(ii) Lack of Redundancy:

In the event of outage of HVDC Pole-2, the transmission network in the east-west corridor would be devoid of requisite redundancy and the loading on the various circuits in east to west and west to central corridors shall have to be closely monitored. Furthermore, any import of power from Western Grid on Vindhyachal back to back link and from Eastern Grid on Sasaram back to back link shall have to be restricted depending on the line loading conditions.

(iii) System Instability:

Due to high MW loading and in the event of low voltages on 400 KV buses, the system may become vulnerable on stability front. In the past also, high MW load on certain 400 KV critical lines like Singrauli-Lucknow, Kanpur-Ballabgarh, Kanpur-Agra, Lucknow-Moradabad, Panki-Muradnagar and Unnao-Agra-Muradnagar (sometimes in presence of low voltages) has led to system instability/hunting.

(iv) Low Voltage:

Due to high MW loading of the 400 KV AC circuits coupled with an increasing trend of reactive power load, the voltages could go down to low values, particularly in Muradnagar-Dadri-Ballabgarh section.

(v) Low Frequency:

In the event of overloading of the AC tie-lines due to tripping of any further element in the said corridor or any other reason, at times power may have to be exported to Western Region /Eastern Region or backing down may have to be resorted to in Singrauli-Rihand-Anpara complex even during high demand period. This may lead to low frequency conditions in the Northern Grid, unless immediate and adequate demand side management is taken up.

3. CONTINGENT MEASURES:

Though the avenues to fully overcome the above problems caused out of the outage of Pole-2 are not available, some contingent measures so as to tide over the problem to the extent possible are as enumerated below:

(i) Discontinuation / Curtailment of import from Eastern / Western Region:

Presently, following quantum of power is being imported from ER on HVDC Sasaram Back to Back link and from WR on Vindhyachal Back to Back link:

A. Import Quantum through ER (Sasaram):

a)	From ER-NTPC stations to NR States J & K and UT Chandigarh as firm allocation.	Around 25 MW (round the clock)
c)	From ER-NTPC stations to MP (WR) as firm allocation and drawn by MP at 220KV Auraiya-Malanpur (wheeling)	Around 50 MW (round the clock)
c)	From WBPDC to DTL (Through PTC) under bilateral agreement.	140 MW (during evening peak) 100 MW (during rest of the day)
d)	From GRIDCO to DTL (Through PTC) under Bilateral Agreement	150 MW (during evening peak)
e)	From DVC to RRVNPL (Through PTC) under Bilateral Agreement	100 MW (on round the clock except evening peak)
f)	From West Bengal to PDD, J & K (Through PTC) under Bilateral Agreement	100 MW (on round the clock basis)

B. Import Quantum through WR (Vindhyachal):

d)	From Goa to DTL (through GEL)	50 MW (during morning and evening peak)
----	-------------------------------	--

In view of the outage of HVDC Pole-2, the quantum of power imported from ER / WR for NR constituents and MP (WR) and passing through East to West corridor shall have to be discontinued / curtailed depending on the generation in eastern pocket and line loading on other parallel AC lines in east to west corridor.

(ii) Wheeling of power through Western Region on 220 KV Ujjain (Madhya Pradesh) - Kota (Rajasthan) link:

If agreed both by MP and Rajasthan, power in the range of 150-200 MW can be imported from MP (WR) on 220 KV Ujjain-Kota link and equivalent quantum can be exported to Western region on Vindhyachal HVDC back to back link. In the year 2001 during the outage of Pole-2 (during the period 16.1.2001 to 15.4.2001) for some period, power of the order of around 150 MW was wheeled through Western Region on 220 KV Ujjain-Kota circuit.

(Action:NREB/NRLDC/RRVPN/WREB/WRLDC)

(iii) Monitoring and control of the line loading:

Continuous monitoring of the AC tie lines connecting eastern part of the grid with the western part is to be carried out for maintaining the MW and current (Amp) loading on different circuits within reasonable limits. In the event of overloading of a designated line due to tripping or for any other reason, immediate measures would have to be taken to control the situation. The brief details of such measures are as stated below:

a) 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 Unchahar 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)

b) Reducing Generation in Eastern 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)

c) Restricting sudden and large load disconnection in eastern UP:

UPPCL has to avert sudden and large load disconnection in areas in eastern UP which at times UPPCL resorts to in order to restrict its energy drawal.

(Action : UPPCL)

d) 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)

e) By 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 on the western side of the grid.

(Action: NRLDC/other constituents)

(iv) Condition Monitoring of circuits / ICTs:

Thermovision scanning and other condition monitoring aspects in respect of critical transmission circuits and ICTs etc. shall need to be carried out immediately as well as a routine in order to take preventive measures and to avoid undesirable tripping.

(Action:POWERGRID NR-I/ UPPCL/NTPC-NR)

(v) Health monitoring of HVDC Pole-I:

After the outage of HVDC Pole-2, Pole-1 is the single largest element carrying 750 MW power and therefore its uninterrupted operation has become most important. The necessary measures to keep the HVDC Pole-1 in good working condition shall be taken including inspection and preventive maintenance of the electrical and mechanical auxiliaries and other components so as to avoid its malfunction, leading to contingency.

(Action: POWERGRID NR-I)

(vi) 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)

(vii) Review and augmentation of protection and telemetry:

- a) 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: POWERGRID/ UPPCL/NTPC and other constituents of NR)

- b) 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: POWERGRID NR-I/UPPCL/NTPC-NR)

- c) The real time data telemetry from different generating stations / substations to NRLDC, New Delhi and SLDCs, Kanpur 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, POWERGRID-NR-1 & NR-2 (ULDC) and all constituents)

(viii) Measures to be taken in case of critically low system frequency:

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:

- a) Wherever margins are available the generation may be got stepped-up. (Before increasing the generation on the eastern side the loading on the lines in east to west corridor is to be checked).

(Action: All constituents)

- b) Import may be made from the neighbouring regions, if possible. (only when the line loadings in east to west corridor are within control)

(Action: NRLDC/other RLDCs)

- c) Load regulatory measures by all states to reduce their drawals from the Grid /load. (Except in eastern UP area)

(Action: All States)

- d) Disconnection of Radial Load / ICTs in the areas of different States 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)

- e) 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)

(ix) Measures to be taken in case of critically low voltages:

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

- a) 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)

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

(Action: States and Generating Agencies)

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

(Action: NRLDC/ other constituents)

- d) 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)

- e) 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)

- f) 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)