CENTRAL ELECTRICITY REGULATORY COMMISSION
NEW DELHI

Petition No. 167/Suo-Motu/2012

Coram:
Shri V.S.Verma, Member
Shri M. Deena Dayalan, Member

Date of Hearing: 23.04.2013
Date of Order : 22.02.2014

In the matter of

Grid Disturbance on 30.7.2012 and 31.7.2012

And

In the matter of

1. National Load Despatch Centre, New Delhi
2. Northern Regional Load Despatch Centre, New Delhi
3. Western Regional Load Despatch Centre, Mumbai
4. Eastern Regional Load Despatch Centre, Kolkata
5. North Eastern Load Despatch Centre, Shillong
6. Northern Regional Power Committee, New Delhi
7. Western Regional Power Committee, Mumbai
8. Eastern Regional Power Committee, Kolkata
9. North Eastern Regional Power Committee, Shillong
10. Power Grid Corporation of India Limited, Gurgaon
11. NTPC Ltd, New Delhi
12. Central Electricity Authority, New Delhi .....**Respondents**

Parties Present:

Shri V.K Agrawal, POSOCO
Shri S.R. Narasimhan, POSOCO
Ms Jyoti Prasad, POSOCO
Shri Rahul Shukla, POSOCO
Shri S.S. Barpanda, POSOCO
Shri V.V Sharma, NRLDC
Shri Rajiv Porwal, NRLDC
Shri Vivek Pandey, NRLDC
Shri Somara Lakra, NRLDC
Shri Kamaldeep, NRLDC
Shri P.Pentayya, WRLDC
Shri Pushpa Seshadri, WRLDC
Shri G. Chakraborty, ERLDC
Shri Kmurali Krishna, WRLDC
Shri Naresh Kumar, NRPC
Shri D.K. Srivastava, CEA
Shri M.K. Gupta, SLDC, UP
Shri Zahir Ahmad, SLDC, UP
Shri Kamal Sarkar, PGCIL

Shri A.V.S Ramesh, PGCIL
Shri Shashi Bhushan, PGCIL
Shri B.B. Mehta, SLDC, Gujarat
Shri J. Mazumder, PGCIL
Shri R.A. Sharma, SLDC, MPPTCL
Shri M.K. Tomar, RVPNL
Shri Vikas Sharma, PDD J&K
Shri Uday Shankar, NTPC
Shri Shri A. Basu Roy, NTPC
Shri Rohit Chhabra, NTPC
Shri Ajay Dua, NTPC
Shri A.K. Bishoi, NTPC
Ms Shilpa Agrawal, NTPC
Shri S.K. Sharma, NTPC
Ms Suchitra Maggu, NTPC
Shri Darshan Singh, SLDC, Delhi
Shri S.K. Meena, NHPC
Shri Hem Joshi, HUPNL

ORDER

1. The Northern Regional Grid failed on 30.7.2012 at about 2:30 hours and the Northern, Eastern, Western and Northern-Eastern grids failed at about 13:00 hours on 31.7.2012. The grid failures plunged several states into darkness and left the people to fend without electricity for hours together and affected the communication, essential services, industry, economy and the life of the people in a large way. In view of the magnitude and severity of the grid disturbance, the Commission directed the CEO, Power System Operation Corporation Limited (POSOCO) and CEO, Central Transmission Utility (CTU) to investigate into grid failures and submit a report to the Commission. After carrying out a joint detailed investigation by POSOCO and CTU, CEO, POSOCO submitted a report on 9.8.2012. A copy of the report is annexed as Appendix. The report brought out following underlying causes of the aforesaid Grid Disturbances:

   I. Skewed Load Generation Balance across the regional grids

   II. Grid indiscipline

   III. Depleted reliability margins

IV. Failure or inadequate response of Defense Mechanism/ Protection System

V. Insufficient visibility and situational awareness at Load Despatch Centres

VI. Inadequate appreciation of Transfer Capability vis-a-vis Transmission Capacity

VII. Institutional issues

2. Based on the above findings in the report submitted by POSOCO, the Commission came to a prima facie view that the relevant regulations of the Commission namely, Central Electricity Regulatory Commission (Indian Electricity Grid Code) Regulations, 2010 as amended from time to time (hereinafter "Grid Code") and Central Electricity Regulatory Commission (Measures to relieve congestion in real time operation) Regulations, 2009 (hereinafter "Congestion Charges Regulations") were not strictly complied with by various agencies. The Commission, vide order dated 16.11.2012, directed Respondent No. 1 to 11 to submit their responses to the findings in the report on the grid failures on 30.7.2012 and 31.7.2012, with particular reference to their failure to take necessary actions which were expected of them as per the regulations of the Commission. In compliance with the above directions, replies have been filed by NLDC on 10.12.2012 (received at CERC on 19.12.2012) on behalf of Respondent No.1 to 5, NRPC on 26.11.2012, WRPC on 26.11.2012, NERPC on 4.12.2012 and NTPC on 26.11.2012.

3. Hearings in the matter were held on 27.11.2012, 10.1.2013, 20.2.2013 and 23.4.2013. During the hearing on 27.11.2012, the Commission directed POSOCO (NLDC) to file the details of violations, the entities/organizations responsible for such violations. In compliance with our directions, NRLDC,

WRLDC, ERLDC and NERLDC filed their submissions indicating the specific violations of the regulations of the Commission by various entities during the grid disturbance on 30.7.2012 and 31.7.2012. POSOCO has submitted the violations by different entities as under :

Western Region

(i) On 30th July, 2012, the State entities of Maharashtra, Gujarat, Madhya Pradesh, Chhattisgarh and generating entities of LANCO and NTPC failed to comply with IEGC Regulation 6.4.12 and Section 29 of the Electricity Act, 2003.

(ii) On 31st July, 2012 the State entities of Gujarat, Chhattisgarh and Maharashtra and generating entities of NTPC failed to comply with IEGC Regulation 6.4.12 and Section 29 of the Electricity Act, 2003.

(iii) On 30th July as well as on 31st July, 2012 State entities of Western Region namely Gujarat, Madhya Pradesh, Maharashtra, Chhattisgarh and the generating entities of LANCO, JPL and NTPC failed to comply with Regulation 5.2 (f) of the Indian Electricity Grid Code (First Amendment) Regulations, 2012.

Northern Region

(i) Over-drawal of electricity by the State utilities of Haryana and Uttar Pradesh (UP) on 30th July 2012 and Haryana, Punjab and Rajasthan on 31st July, 2012 from the Grid with respect to their schedules and failed to comply the instructions of NRLDC and thereby failed to comply with the Regulations 5.4.2 (g), 5.4.2 (h) and 5.4.2 (i) of IEGC and Section 29 of the Electricity Act, 2003.

(ii) Inadequate response from the all Northern Regional constituents' under frequency and df/dt relays and thereby they failed to comply with Regulation 5.2(n) of IEGC, Regulation 9 of CEA (Grid Standards).

(iii) Insufficient visibility and situational awareness at SLDCs and NRLDC due to non-availability data in real time by :

a. Generating utilities of Northern Region namely JSW (Rajwest), RRVUNL, PDD, J&K, NHPC, NLC, UPPCL and

b. Transmission utilities namely RRVPNL, DTL, PGCIL, PDD, J&K, PTCUL, HPSEB and HVPNL and thereby they failed to comply with regulation 6(3) of CEA (Technical Standards for connectivity to the grid) Regulations, 2007 and Regulation 4.6.2 of the Grid Code.

(iv) Inadequacy of protection system in violation of standard 3(e) of the Grid Standards 5.2 (l) of the Grid Code by POWERGRID

(v) Non-submission of information required for analysis of grid disturbance by various users, STUs/ LDCs and CTU. The information required for analysis of Grid Disturbance on 30th as well as 31st July 2012 by Regional Entity Generating Stations and Inter State transmission licensees was either not submitted or was incomplete. For 30th July 2012 particularly the Regional Entity Generators Singrauli STPS, Rihand STPS, Unchahar STPS, Dadri GPS, Tehri HPS, Koteshwar HPS, NAPS, Jhajjar IGSTPS, Malana-II HPS, Shree Cement have not submitted any information and thus these entities have not complied with regulation 5.9 of Grid Code. The compliance by the Inter State transmission licensees has been partial. With regard to submission of information in respect of 31st July, 2012, particularly the Regional Entity Generators Singrauli STPS, Rihand STPS, Unchahar STPS, Dadri GPS, Tehri HPS, Koteshwar HPS, RAPS-B & C, NAPS, IG STPS, Jhajjar, Malana-II HPS, Shree Cement have not submitted any information and thus these entities have not complied with Regulation 5.9 of the Grid

Code. The compliance by the Inter-State transmission licensees has been partial.

4. During the hearing on 10.1.2013, the Commission issued notices to all State entities and generation entities responsible for non-compliance of the directions of concerned RLDCs which led to the grid failure on 30.7.2012 and 31.7.2012 as brought out in the submissions of NLDC and RLDCs. The Commission further directed POSOCO (NLDC/RLDCs), CTU, NTPC, WRPC, overdrawing/under-drawing entities, the SLDCs and generating stations like LANCO and JPL to submit certain information. After detailed hearing in the matter on 20.2.2013, the Commission directed POSOCO (NLDC/RLDCs), CTU, WRPC, overdrawing/under-drawing entities and the SLDCs to submit certain further information. After hearing the respondents on 23.4.2013, the Commission had directed POSOCO and WRPC to file certain information/clarifications.

5. In response to the notices, the following organizations/entities have filed their replies:

(a) Submission vide affidavit by WRPC dated 22.11.12
(b) Submission vide affidavit by NTPC dated 23.11.12
(c) Submission vide affidavit by NRPC dated 26.11.12
(d) Submission vide affidavit by NERPC dated 27.11.12
(e) Reply by POSOCO (NLDC) dated 10.12.12
(f) Submission by NERLDC dated 15.12.12 and 17.12.12
(g) Submission vide affidavit by ERLDC dated 21.12.12
(h) Submission vide affidavit by WRLDC dated 21.12.12
(i) Submission vide affidavit by NRLDC dated 26.12.12
(j) Submission vide affidavit by SLDC MP dated 4.1.13
(k) Submission vide affidavit by MSLDC dated 6.2.13
(l) Submission vide affidavit by SLDC MP dated 8.2.13
(m) Submission vide affidavit by SLDC Gujarat (GETCO) dated 10.2.13
(n) Reply affidavit by JPL dated 11.2.13
(o) Submission vide affidavit by NRLDC (additional information) dated 10.2.13
(p) Reply affidavit by SLDC DTL dated 11.2.13

(q) Reply affidavit by SLDC Punjab dated 11.2.13
(r) Submission vide affidavit by NERLDC dated 11.2.13
(s) Reply affidavit by SLDC UP dated 12.2.13
(t) Submission vide affidavit by POWERGRID (additional information) dated 13.2.13
(u) Submission vide affidavit by ERLDC dated 13.2.13
(v) Submission vide affidavit by WRLDC dated 13.2.13
(w) Reply affidavit by Lanco-Amarkantak Power Ltd dated 14.2.13
(x) Submission vide affidavit by SRLDC dated 15.2.13
(y) Submission vide affidavit by NTPC dated 18.2.13
(z) Submission vide affidavit by SLDC Rajasthan dated 18.2.13
(aa) Submission vide affidavit by WRLDC dated 18.2.13
(bb) Submission vide affidavit by NTPC dated 19.2.13
(cc) Reply vide affidavit by SLDC (WBBSETCL) dated 20.2.13
(dd) Submission vide affidavit by NRLDC (during hearing) dated 20.2.13
(ee) Submission vide affidavit by Submission vide affidavit by HVPNL dated 8.3.13, 19.3.13
(ff) Submission vide affidavit by SLDC Rajasthan dated 22.3.13
(gg) Reply vide affidavit by SLDC UP dated 25.3.13
(hh) Submission vide affidavit by NRPC dated 26.3.13
(ii) Submission vide affidavit by NHPC dated 28.3.13
(jj) Submission vide affidavit by NRLDC dated 28.3.13
(kk) Submission vide affidavit by SLDC Uttarakhand dated 30.3.13
(ll) Submission vide affidavit by WRLDC dated 1.4.13, 16.4.13
(mm) Submission vide affidavit by DVC dated 25.3.13
(nn) Submission vide affidavit by CTU (additional information) dated 20.2.13
(oo) Submission vide affidavit by MSLDC dated 6.4.13
(pp) Submission vide affidavit by POWERGRID dated 14.4.13
(qq) Submission vide affidavit by NRLDC dated 15.5.13
(rr) Submission vide affidavit by WRLDC dated 17.5.13

6. We have heard the counsels and representatives of the respondents present during the hearings and examined the submissions and data available on record. We address the issues in the following manner:

(a) Statutory provisions in the Electricity Act, 2003 (hereinafter referred to as '2003 Act') and the Regulations of the Commission and the Central Electricity Authority which directly impact the grid operation, grid safety and security.

(b) Details of violations of the provisions of the Act and regulations by the constituents and other agencies preceding and during the grid failure on 30.7.2012 and 31.7.2012.

(c) Remedial course of action for future

(d) Actions proposed for non-compliance.

(A) Statutory provisions with regard to grid safety and security

7. The Commission has been vested with the functions of regulation of inter-State transmission of electricity and to specify the Grid Code under section 79 of the 2003 Act. In exercise of the powers under section 178 read with section 79(1) (h) of the 2003 Act, the Commission has specified the Grid Code. Similarly, in exercise of the powers under section 79(1) (c) read with section 178 of the 2003 Act, the Commission has specified CERC (Measures to relieve congestion in real time operation) Regulations, 2009, Indian Electricity Grid Code (IEGC), 2010 and Central Electricity Authority (CEA) has specified CEA (Technical Standards for Connectivity to the Grid) Regulations, 2007 & CEA (Grid Standards), 2010. The provisions of the Act, CERC Regulations and CEA Standards contain sufficient statutory provisions for safe, secure and reliable operation of the grid and to take care of unforeseen contingencies including grid disturbance.

8. These regulations are implemented in real-time by the RLDCs while discharging their functions under the Electricity Act, 2003. The RLDCs are the apex bodies for ensuring integrated operation of the power system in the concerned region and in due discharge of their statutory duties, are required to carry out optimum

scheduling and despatch of electricity within the region in accordance with the principles, guidelines and methodologies specified in the Grid Code, monitor grid operation, keep accounts of the quantity of electricity transmitted through the regional grid and to exercise supervision and control over the inter-State transmission system. RLDCs have been empowered to issue directions and exercise supervision and control for ensuring stability of grid operations and for achieving the maximum economy and efficiency in the operation of the power system in the region under its control. Every licensee, generating company, generating station, sub-station and any other person connected with the operation of the power system are bound to comply with the directions of RLDCs. Concerned SLDCs are required to ensure compliance of the directions of RLDCs by the intra-State licensees, generating stations and sub-stations. Though any dispute regarding safe, secure and integrated operation of the grid or the directions issued by RLDCs are to be adjudicated by this Commission, pending decision by this Commission, all concerned are obligated to comply with the directions of RLDCs. Therefore, in the matter of grid safety and security, the directions of RLDCs are paramount and the concerned agencies are required to comply with the directions of RLDCs without questioning or negotiating with such directions. Sections 28 and 29 of the 2003 Act, which deal with functions of RLDCs and compliance of its directions are reproduced hereunder:

> ***"28. Functions of the Regional Load Despatch Centre (1)*** *The Regional Load Despatch Centre shall be the apex body to ensure integrated operation of the power system in the concerned region.*
>
> *(2) The Regional Load Despatch Centre shall comply with such principles, guidelines and methodologies in respect of the wheeling and optimum scheduling and despatch of electricity as the Central Commission may specify in the Grid Code.*
>
> *(3) The Regional Load Despatch Centre shall -*

(a) be responsible for optimum scheduling and despatch of electricity within the region, in accordance with the contracts entered into with the licensees or the generating companies operating in the region;

(b) monitor grid operations;

(c) keep accounts of the quantity of electricity transmitted through the regional grid;

(d) exercise supervision and control over the inter-State transmission system; and

(e) be responsible for carrying out real time operations for grid control and despatch of electricity within the region through secure and economic operation of the regional grid in accordance with the Grid Standards and the Grid Code.

(4) The Regional Load Despatch Centre may levy and collect such fee and charges from the generating companies or licensees engaged in inter-State transmission of electricity as may be specified by the Central Commission.

29. Compliance of directions (1) The Regional Load Despatch Centre may give such directions and exercise such supervision and control as may be required for ensuring stability of grid operations and for achieving the maximum economy and efficiency in the operation of the power system in the region under its control.

(2) Every licensee, generating company, generating station, sub-station and any other person connected with the operation of the power system shall comply with the directions issued by the Regional Load Despatch Centres under subsection (1).

(3) All directions issued by the Regional Load Despatch Centres to any transmission licensee of State transmission lines or any other licensee of the State or generating company (other than those connected to inter State transmission system) or sub-station in the State shall be issued through the State Load Despatch Centre and the State Load Despatch Centres shall ensure that such directions are duly complied with the licensee or generating company or sub-station.

(4) The Regional Power Committee in the region may, from time to time, agree on matters concerning the stability and smooth operation of the integrated grid and economy and efficiency in the operation of the power system in that region.

(5) If any dispute arises with reference to the quality of electricity or safe, secure and integrated operation of the regional grid or in relation to any direction given under sub-section (1), it shall be referred to the Central Commission for decision:

Provided that pending the decision of the Central Commission, the directions of the Regional Load Despatch Centre shall be complied with by the State Load Despatch Centre or the licensee or the generating company, as the case may be.

(6) If any licensee, generating company or any other person fails to comply with the directions issued under sub-section (2) or sub-section (3), he shall be liable to a penalty not exceeding rupees fifteen lacs."

9. We proceed to discuss non-compliance of statutory provisions of the Act mentioned in para 7 and 8 of this order.

(B) Violations of the statutory provisions during grid failure on 30.7.2012 and 31.7.2012

10. After going through the report of POSOCO & CTU and the submissions of the system operators, regional entities, we proceed to deal with the violations under the following heads:

I. Non-compliance of the RLDCs' directions SLDC and other Regional Entities.

II. Role of different entities namely (a) POWERGRID and RPCs in regard to coordination of outage planning and protection system in the region, and (b) POSOCO in congestion maintenance and contingency planning,

III. Non-submission of information required for analysis of grid disturbance, and

IV. Other miscellaneous issues like provision of Telemetry and df/dt Relays and Under-Frequency Relays (UFR) and adequacy of relief.

(I) Non Compliance of directions of RLDCs by Control Areas.

11. The Regulation 5.4.2 of the Central Electricity Regulatory Commission (Indian Electricity Grid Code) Regulations, (hereinafter 'Grid Code') provides as under:

5.4.2 Demand Disconnection

(a) SLDC/ SEB/distribution licensee and bulk consumer shall initiate action to restrict the drawal of its control area, from the grid, within the net drawal schedule whenever the system frequency falls to 49.7 Hz

(b) The SLDC/ SEB/distribution licensee and bulk consumer shall ensure that requisite load shedding is carried out in its control area so that there is no overdrawl when frequency is 49.5 Hz. or below.

c) Each User/STU/SLDC shall formulate contingency procedures and make arrangements that will enable demand disconnection to take place, as instructed by the RLDC/SLDC, under normal and/or contingent conditions. These contingency procedures and arrangements shall regularly be / updated by User/STU and monitored by RLDC/SLDC. RLDC/SLDC may direct any User/STU to modify the above procedures/arrangement, if required, in the interest of grid security and the concerned User/STU shall abide by these directions.

d) The SLDC through respective State Electricity Boards/Distribution Licensees shall also formulate and implement state-of-the-art demand management schemes for automatic demand management like rotational load shedding, demand response (which may include lower

tariff for interruptible loads) etc. before 01.01.2011, to reduce overdrawl in order to comply para 5.4.2 (a) and (b) . A Report detailing the scheme and periodic reports on progress of implementation of the schemes shall be sent to the Central Commission by the concerned SLDC.

e) In order to maintain the frequency within the stipulated band and maintaining the network security, the interruptible loads shall be arranged in four groups of loads, for scheduled power cuts/load shedding, loads for unscheduled load shedding, loads to be shed through under frequency relays/ df/dt relays and loads to be shed under any System Protection Scheme identified at the RPC level. These loads shall be grouped in such a manner, that there is no overlapping between different Groups of loads. In case of certain contingencies and/or threat to system security, the RLDC may direct any SLDC/ SEB/distribution licensee or bulk consumer connected to the ISTS to decrease drawal of its control area by a certain quantum. Such directions shall immediately be acted upon. SLDC shall send compliance report immediately after compliance of these directions to RLDC.

f) To comply with the direction of RLDC, SLDC may direct any SEB/ distribution licensee/bulk consumer connected to the STU to curtail drawal from grid. SLDC shall monitor the action taken by the concerned entity and ensure the reduction of drawal from the grid as directed by RLDC.

(g) RLDCs shall devise standard, instantaneous, message formats in order to give directions in case of contingencies and /or threat to the system security to reduce overdrawl by the bulk consumer, SLDC/ State at different overdrawal conditions depending upon the severity of the overdrawal. The concerned SLDC shall ensure immediate compliance with these directions of RLDC and send a compliance report to the concerned RLDC.

(h) All Users, SLDC/ SEB/distribution licensee or bulk consumer shall comply with direction of RLDC/SLDC and carry out requisite load shedding or backing down of generation in case of congestion in transmission system to ensure safety and reliability of the system. The procedure for application of measures to relieve congestion in real time as well as provisions of withdrawal of congestion shall be in accordance with Central Electricity Regulatory Commission (Measures to relieve congestion in real time operation) Regulations, 2009

(i) The measures taken by the Users, SLDC, SEB/distribution licensee or bulk consumer shall not be withdrawn as long as the frequency remains at a level lower than the limits specified in para 5.2 or congestion continues, unless specifically permitted by the RLDC/SLDC.

12. NRLDC in its submission dated 26.12.2012 has submitted that the over-drawal by State entities from the grid continued despite directions from NRLDC. The schedule vs drawal of constituents of the Northern Region on 30th July, 2012 in two time blocks viz. 02:00-02:15 hours and 0215-0230 hours as recorded by the Special Energy Meters is tabulated as under:

(Figures in MW)

Control Area	30-July-2012					
	02:00- 02:15 hours			02:15-02:30 hours		
	Schedule	Actual	UI	Schedule	Actual	UI
Chandigarh	242	239	-3	240	242	2
Delhi	3067	2720	-347	2989	2682	-308
Haryana	2605	3586	981	2595	3679	1084
Himachal Pradesh	92	-70	-162	89	-78	-167
Jammu & Kashmir	690	154	-536	684	156	-528
Punjab	4862	5296	434	4849	4953	104
Rajasthan	1738	1529	-210	1726	1469	-257
Uttar Pradesh	5518	6970	1453	5478	7105	1627
Uttarakhand	494	608	114	476	261	-215
Total	**19308**	**21033**	**1725**	**19125**	**20468**	**1344**

13. However in the real time, the drawal position of NR constituents from the Grid at 02:30 hours on 30.7.2012 was as given below:

Control Area	**Schedule (MW)**	**Actual (MW)**	**OD (+) / UD (-) (MW)**
Chandigarh	295	234	-61
Delhi	2987	2715	-123
Haryana	2586	3103	518
Himachal Pradesh	88	-93	-181
Jammu & Kashmir	683	-1	-683
Punjab	4769	5092	325
Rajasthan	1717	1379	-335
Uttar Pradesh	5475	6331	861
Uttarakhand	475	636	161
Total	**19075**	**19396**	**482**

14. According to RLDC, it is evident that in the 15-minute time block (02:15–02:30 hours) just prior to the grid disturbance on 30th July, 2012, the average over-drawal by the control areas of Uttar Pradesh and Haryana was 1627 MW and 1084 MW respectively. The instantaneous over-drawal by these State control areas is also evident from SCADA data. In real time at 02:30 hours the over-drawals for the control areas of UP and Haryana were 861 MW and 518 MW respectively. There was some error in the telemetry data in SCADA system, which showed lower figures in respect of these control areas. For control area of Punjab, the 15 minute average actual over-drawal was 104 MW from 02:15-02:30 hours, whereas the over-drawal as per SCADA system was 325 MW at 02:30 hours.

15. NRLDC in its affidavit dated 26.12.2012, has submitted the details of the messages issued prior to grid disturbance which are extracted as under:

Important messages issued from NRLDC on 29th & 30th July, 2012			
Date	**Time**	**Summary of Messages**	**Issued to**
29-07-12	14:41	Violation of WR-NR TTC, Reduce Drawal to avoid tripping /disturbance	Control areas of Punjab, Haryana, Rajasthan, Delhi, UP, Uttarakhand, HP and J&K
29-07-12	16:34	Restrict over-drawal to control overloading, in NR-WR load angle 58 degree and improve reliability; IR over-drawal 1000 MW, Punjab 550 MW, Haryana 70 MW, U.P. 1100 MW and Uttarakhand 180 MW	Control areas of Punjab, Haryana, Rajasthan, Delhi, UP, Uttarakhand, HP and J&K
29-07-12	19:25	Restrict drawal within schedule due to system constraints in NEW grid and to reduce WR-NR load angle in interest of grid safety and security	Control areas of Punjab, Haryana, Rajasthan, Delhi, UP, Uttarakhand, HP and J&K
29-07-12	19:29	Message-A	SLDC,Punjab
29-07-12	19:30	Message-A	SLDC,Haryana

29-07-12	19:46	Message-B	SLDC Punjab
29-07-12	19:47	Message-B	SLDC,Haryana
29-07-12	21:10	Power flow on 400 kV Agra-Gwalior is 896 MW; 2nd ckt is out. Reduce drawal within schedule: Over-drawal figures - Punjab: 994 MW, Haryana: 493 MW, UP: 366 MW; All the States will be responsible in case of untoward tripping	Control areas of Punjab, Haryana, Rajasthan, Delhi, UP and Uttarakhand
29-07-12	21:50	Request for opening 220 kV Badod-Kota in view of over loading in Rajasthan system shut down denied by NRLDC in view of outage of 400 kV Kankroli-Zerda &400 kV Gwalior-Agra-II and Vindhyachal angular separation 42degrees.	Rajasthan control area
29-07-12	22:58	Request for Un-requisitioned power within NR GPS to reduce loading of 400 kV Gwalior-Agra-II and reduce OD from other regions	Punjab, Haryana, Uttar Pradesh
29-07-12	23:30	Power flow on 400 kV Agra-Gwalior is 975 MW; Agra-Gwalior ckt-II, Zerda-Kankroli and Kota-Badod under shut down. Reduce drawal within schedule: OD figures-Punjab: 544 MW, Haryana: 315 MW, UP: 1000 MW; All the States will be responsible in case of untoward tripping	Punjab, Haryana, Uttar Pradesh
30-07-12	00:57	URS in Anta and Dadri GPS scheduled to Haryana due to overloading of IR lines	Haryana
30-07-12	01:21	Power flow on 400 kV Agra-Gwalior > 1050 MW; Punjab OD 641 MW**;** Violation of Punjab ATC of 5100 MW; Request to reduce drawal	Punjab
OD = Over-drawal, URS = Un-requisitioned surplus IR = Inter-regional, GPS = Gas Power Station, ATC = Available Transfer Capacity			

16. The schedule vs actual drawal of the control areas of the Northern Region on 31.7.2012 in two time blocks viz. 12:30-12:45 hours and 12:45-13:00 hours as recorded by the Special Energy Meters are tabulated as under:

(Figures in MW)

Control Area	**12:30-12:45 hours**			**12:45-13:00 hours**		
	Schedule	Actual	UI	Schedule	Actual	UI
Chandigarh	323	246	-77	323	243	-80
Delhi	2806	2557	-249	2805	2477	-328
Haryana	2221	3008	787	2222	3391	1169

Himachal Pradesh	196	82	-114	198	60	-138
Jammu & Kashmir	690	665	-25	687	650	-37
Punjab	4575	5179	604	4574	5051	477
Rajasthan	1574	2410	835	1565	2521	955
Uttar Pradesh	3344	3215	-128	3342	3462	120
Uttarakhand	449	566	117	449	66	-382
Total	**16177**	**17929**	**1752**	**16165**	**17920**	**1756**

UI = Unscheduled Interchange

It is evident that during the 15-minute time block (12:45-13:00 hours) just prior to the Grid Disturbance on 31st July 2012, the average over-drawal by control areas of Haryana, Rajasthan, and Punjab was 1169 MW, 955 MW, and 477 MW respectively.

Schedule and drawal of constituents of Northern Region at 12:57 hours on 31.7.2012 is given below:

State	Schedule (MW)	Actual (MW)	OD (+) / UD (-) (MW)
Chandigarh	295	242	-53
Delhi	2820	2650	-171
Haryana	2292	3562	1270
HP	197	70	-128
JK	686	628	-58
Punjab	4661	4582	-79
Rajasthan	1635	2397	762
UP	3339	3438	99
Uttarakhand	448	627	179
Total	**16373**	**18196**	**1821**
OD = Over-drawal, UD = Under-drawal			

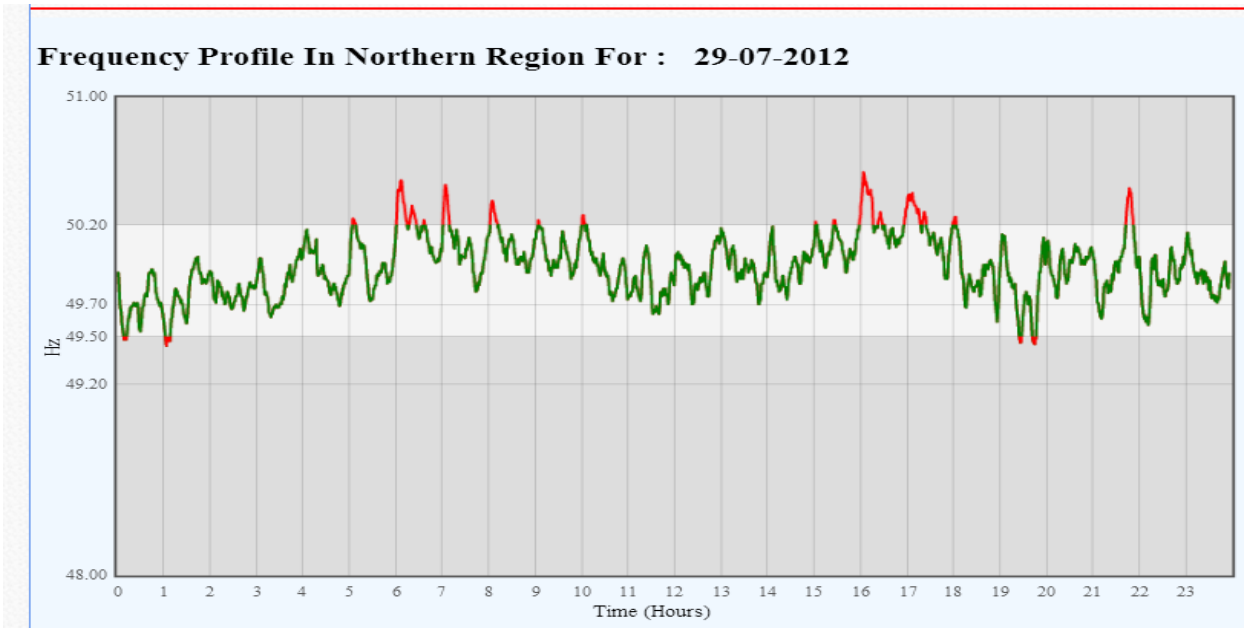
Further on 31/07/2012, NRLDC issued a number of messages; some of which are summarized below:

S	Date	Time	Summary of	Frequency	Remarks

No.		(hrs)	message	(Hz)	
1.	30.7.2012	17.18	Low frequency operation/ restrict Over Drawal (OD)	49.27	SLDC Haryana OD = 444 MW OD
2.	30.7.2012	17.19	Low frequency operation/ restrict OD	49.25	SLDC UP OD = 784 MW
3.	30.7.2012	19.19	Low frequency operation/ restrict OD	48.81	SLDC Haryana OD = 434 MW
4.	30.7.2012	19.20	Low frequency operation/ restrict OD	48.80	SLDC UP OD = 647 MW
5.	30.7.2012	20.55	Low frequency operation/ restrict OD	49.64	SLDC RAJASTHAN OD = 171 MW
6.	30.7.2012	20.57	Low frequency operation/ restrict OD	49.66	SLDC UP OD = 314 MW
7.	30.7.2012	20.58	Low frequency operation/ restrict OD	49.66	SLDC J&K OD = 107 MW
8.	31.7.2012	5.14	Low frequency operation/ restrict OD	49.41	SLDC RAJASTHAN OD =300 MW
9.	31.7.2012	5.16	Low frequency operation/ restrict OD	49.40	SLDC UTTARAKHAND OD =155MW
10.	31.7.2012	5.18	Low frequency operation/ restrict OD	49.31	SLDC HARYANA OD =170MW
11.	31.7.2012	5.46	Low frequency operation/ restrict OD	49.35	SLDC UP OD =370 MW
12	31.7.2012	8.34	Low frequency operation/ restrict OD	49.58	SLDC HARYANA OD =321MW
13.	31.7.2012	8.35	Low frequency operation/ restrict OD	49.59	SLDC PUNJAB OD =320MW
14.	31.7.2012	8.36	Low frequency operation/ restrict OD	49.57	SLDC UTTARAKHAND OD =309MW
15	31.7.2012	8.37	Low frequency operation/ restrict OD	49.51	SLDC RAJASTHAN OD =405 MW

From the details given above it is clear that NRLDC issued frequent messages to NR constituents to reduce their over-drawal.

Further the Frequency graphs of 29th, 30th and 31st July 2012 and summary of violation of IEGC as submitted in the various messages issued by NRLDC to NR constituents is given below:



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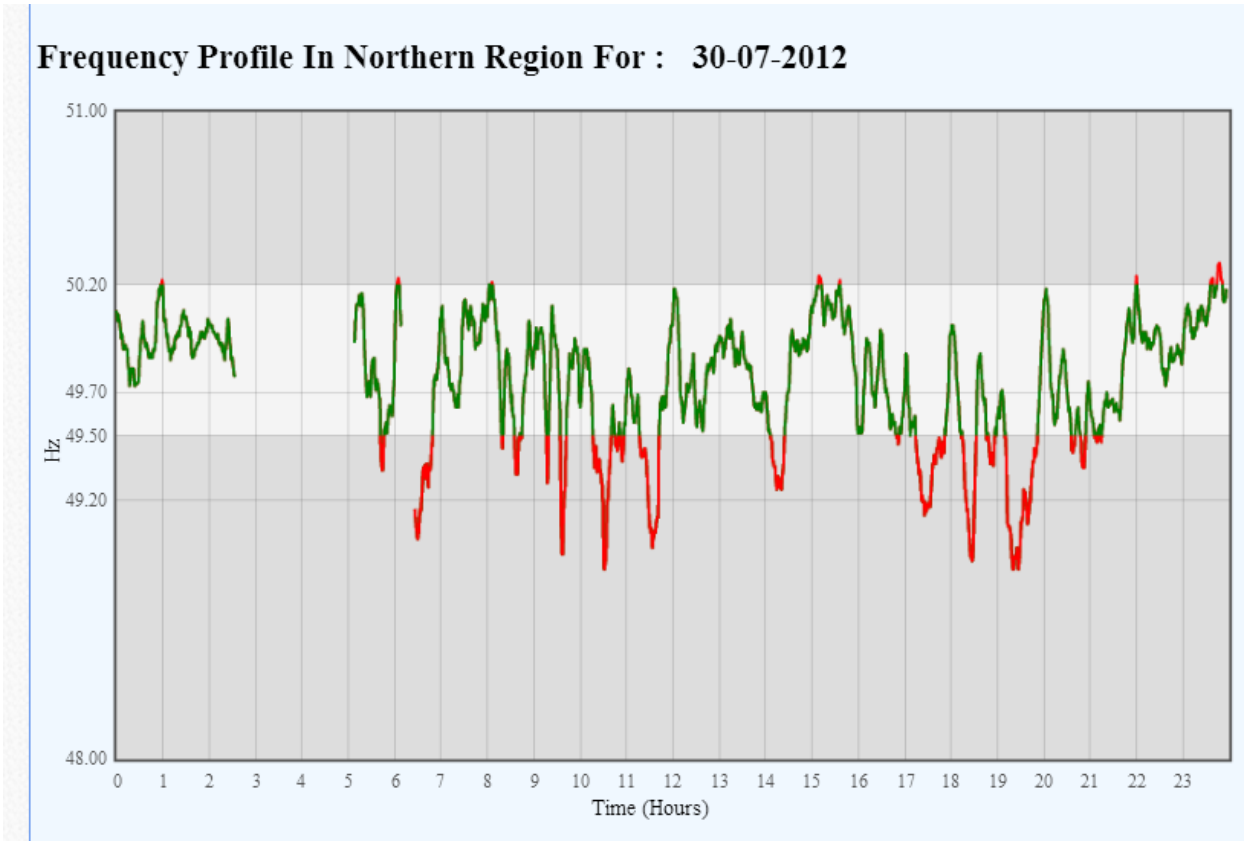
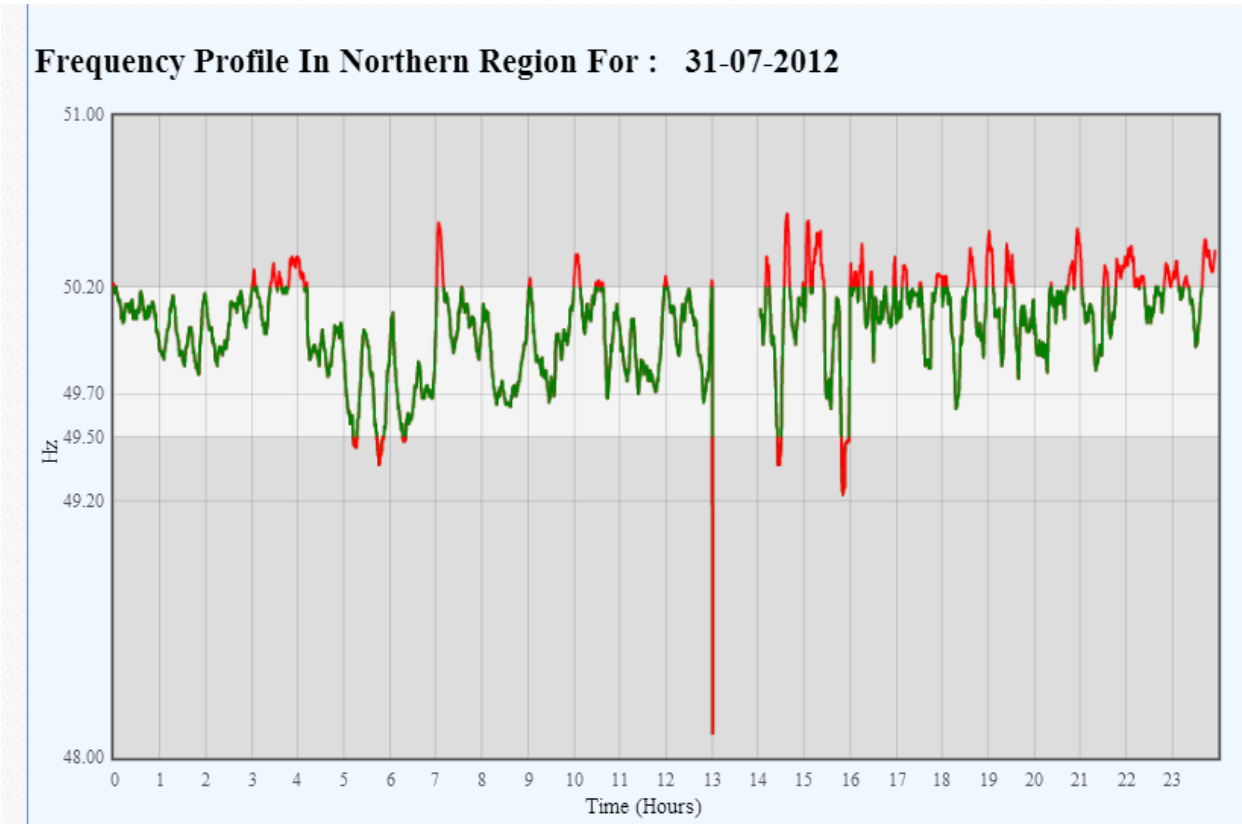




Summary of messages issued by NRLDC for non-compliance of IEGC during 29-31st July, 2012 is given below:

S No.	Date/Time	Violations of IEGC	Frequency (Hz)	Issued to
1	29.07.2012/19:29	5.4.2(a), (b),(e), 6.4.7,	49.55	Punjab (612 MW), Haryana (598 MW)
2	29.07.2012/19:46	5.4.2(a), (b),(e), 5.2 (m), 6.4.7,	49.46	Punjab (584 MW), Haryana (497 MW)
3	30.07.2012/17:18	5.4.2 (a), (b) 6.4.7	49.27	Haryana (444 MW), UP (784 MW)
4	30.07.2012/19:19	5.4.2 (a), (b) 6.4.7	48.81	Haryana (434 MW), UP (647 MW)

5	30.07.2012/20:55	5.4.2 (a), (b) 6.4.7	49.64	Rajasthan (171MW),
6	30.07.2012/20:57	5.4.2 (a), (b) 6.4.7	49.66	UP(314 MW), J&K (107 MW)
7	31.07.2012/5:14	5.4.2 (a), (b) 6.4.7	49.41	Rajasthan (300 MW),
8	31.07.2012/5:16	5.4.2 (a), (b) 6.4.7	49.4	Uttarakhand (155 MW),
9	31.07.2012/5:18	5.4.2 (a), (b) 6.4.7	49.51	Haryana (170 MW)
10	31.07.2012/5:46	5.4.2 (a), (b) 6.4.7	49.35	UP (370 MW)
11	31.07.2012/8:34	5.4.2 (a), (b) 6.4.7	49.58	Haryana (321 MW), Punjab (320 MW), Uttarakhand (309 MW), Rajasthan (405 MW)

17. The responses of the constituent of the Northern Region were as under:

- **SLDC, Punjab:**

(a) SLDC Punjab in its affidavit dated 11.2.2013 has submitted that the grid disturbances are due to non-availability and tripping of inter-regional lines maintained by CTU and controlled by RLDCs (WRLDC/NRLDC). The lines in question were taken out on permit for scheduled shut down by the authority concerned without taking due permission from respective RPCs during OCC meeting which is a mandatory requirement as per provisions of IEGC. Further, at present there is no intra-State UI Regulation in Punjab. The entire activities of drawal of electricity demand availability estimation and regulation of power, etc., are performed by PSPCL (Punjab State Power Corporation Limited) directly on daily/monthly basis. As such SLDC does not have any direct role to play in the scheduling and dispatch or the demand estimation, etc. On receipt of messages from NRLDC, SLDC immediately takes up matter with PSPCL officers present in SLDC and other higher officers to take action for reduction in over-drawal etc.

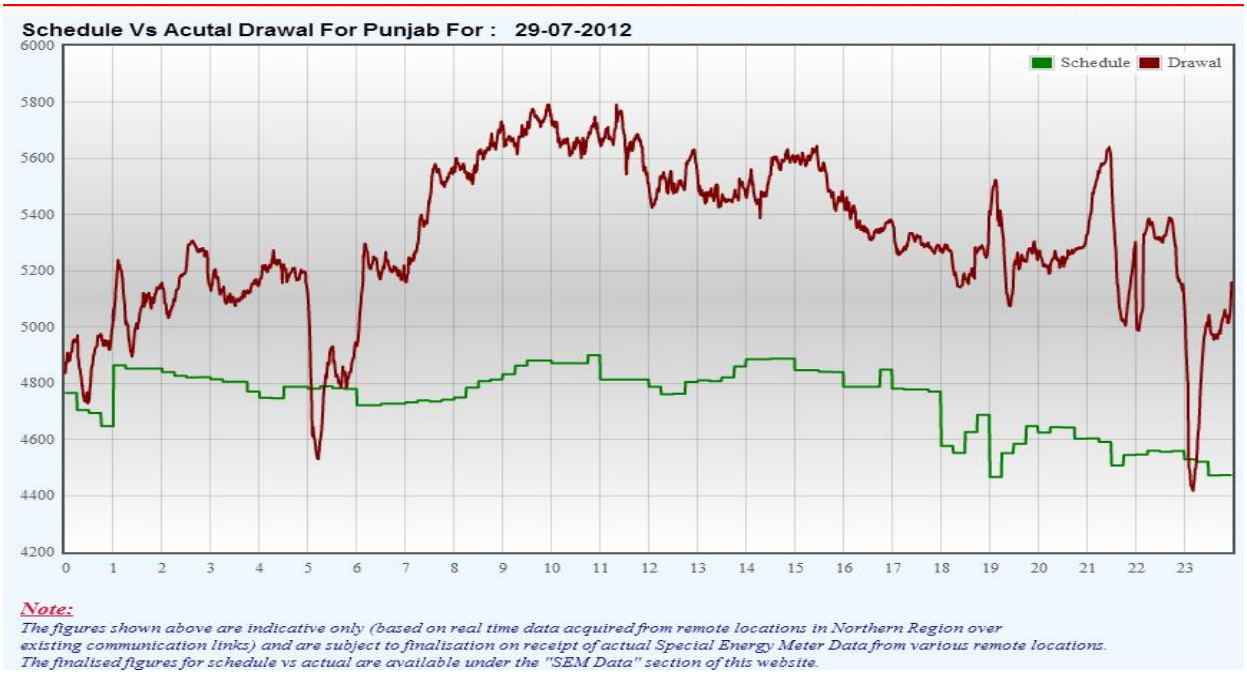
Further, there is no automatic demand disconnection scheme in Punjab. Further SLDC has filed Petition No.49/2012 before PSERC under section 33(6) of the Act against PSPCL for violation of the Grid Code and over-drawal from the grid. PSERC in its order dated 16.1.2013 has directed PSPCL for complying with the directions of SLDC/NRLDC and to take necessary measures for carrying out demand estimates and plan power purchase in advance without relying on UI mechanism. Further, SLDC Punjab has submitted details of action taken report on receipt of messages from NRLDC on 29th & 30th and 31st July, 2012 and has submitted the details of restricted /non restricted demand met as per SCADA for these 3 days. SLDC Punjab has stated that it has been complying with the messages of NRLDC and also as per Enquiry Committee report; Punjab had not over drawn from the grid and rather was in under-drawal mode before the Grid failure as on 31.07.2012, based on SCADA values. This indicates that SLDC Punjab exercised extra vigilance and responded to the NRLDC messages more effectively subsequent to the first grid failure on 30.07.2012

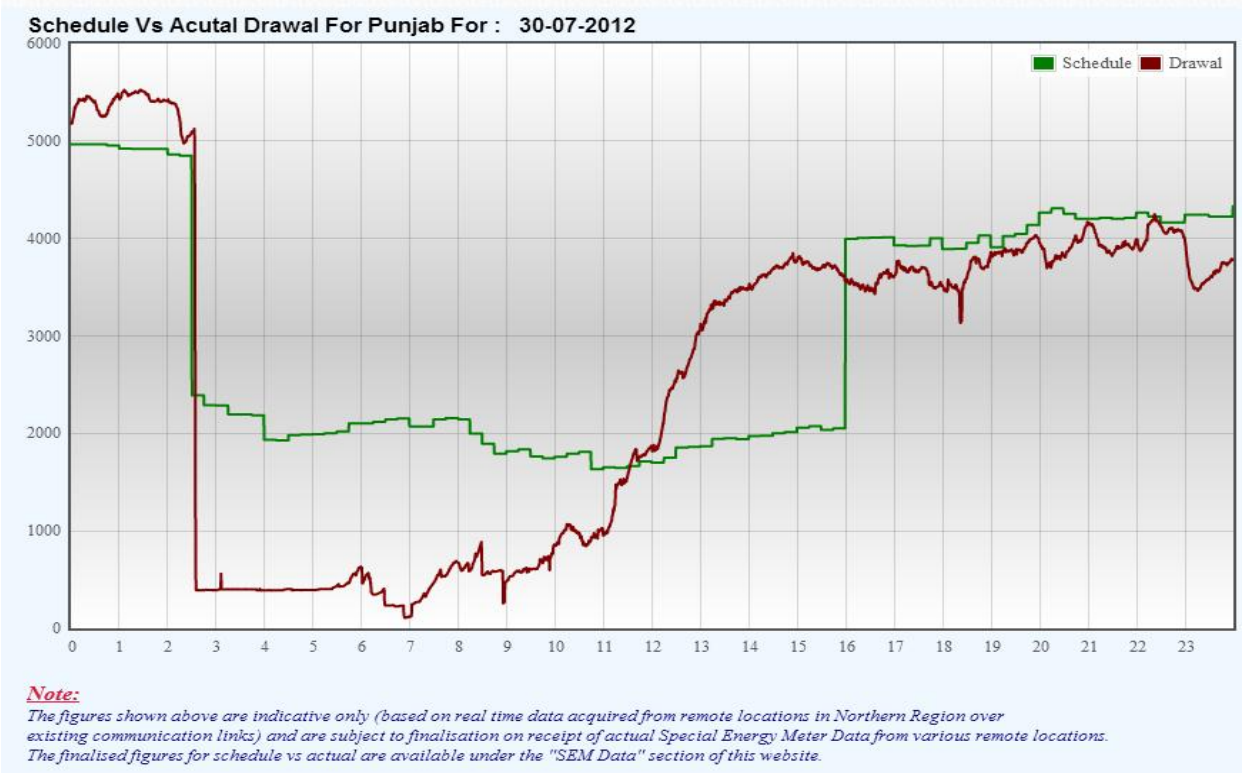
18. From the submission of SLDC Punjab, we find that it had filed a petition (49/2012) with PSERC against PSPCL regarding violation due to over-drawal and non-compliance of various provisions of grid code on 19/9/2012. It was a delayed action by SLDC, which they undertook after the Grid Disturbances.

    Further, on the action taken by SLDC on receipt of messages from NRLDC on 29th, 30th and 31st July of 2012, SLDC has submitted details of power cuts imposed and expected relief after such actions. For instance, from 16:00 hours to 1700 hours on 29.7.2012, respondent SLDC directed a power cut, which expected a relief of 165 MW. The over-drawal by Punjab at 16:34 hours, as per SCADA system data was 550 MW whereas in the succeeding time block the

over-drawal was 480 MW. Similarly from 18:00 hours to 19:00 hours, the power cut was imposed on '3 wire group B1 and B2' which expected a relief of 252 MW. As per real time data logged in SCADA system, over-drawal at 19:25 hours, over-drawal was 914 MW and the same in the succeeding time block was 562 MW. The net over-drawal by Punjab remained very high except at one instance at 22:58 hours on 29th July 2012.

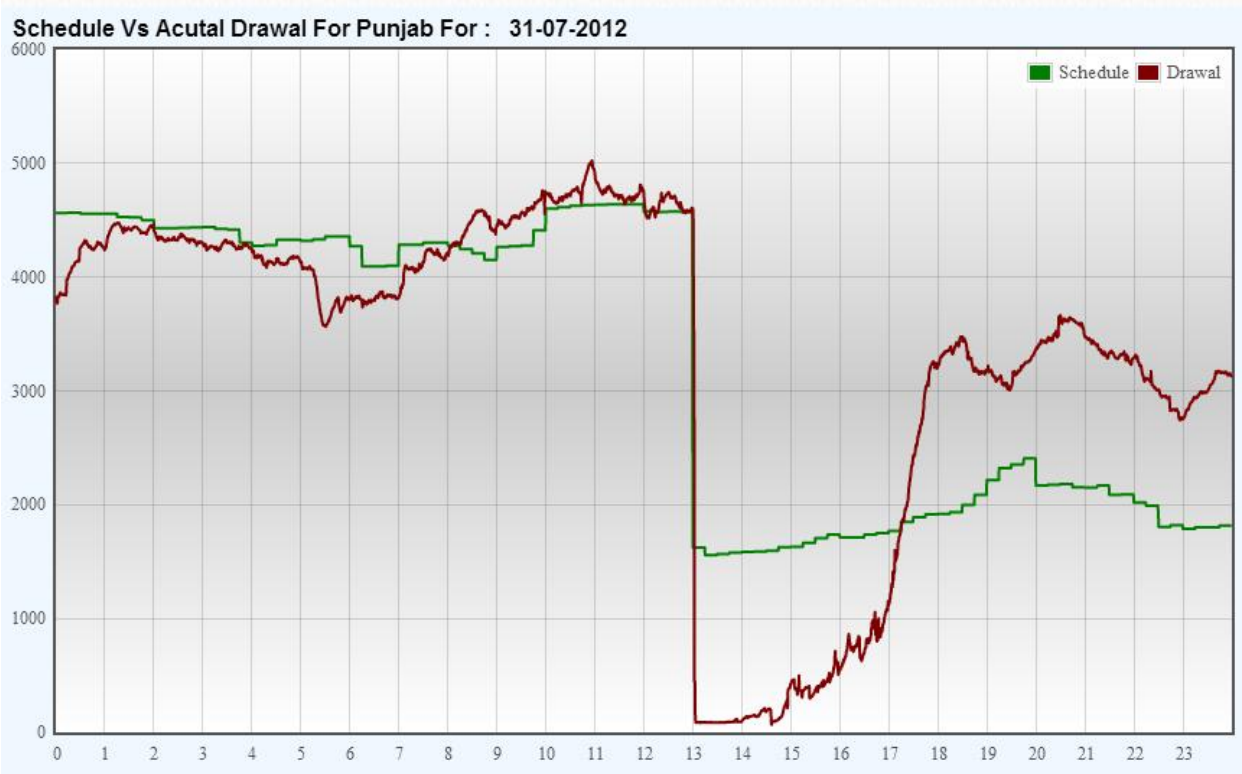
We find that SLDC Punjab has not effectively taken action on the messages issued by NRLDC to curtail its over-drawal. Heavy over-drawal was continued by the control area of Punjab even when there was overloading of inter-regional lines**.** The drawal pattern of Punjab is given below:





Note:

The figures shown above are indicative only (based on real time data acquired from remote locations in Northern Region over existing communication links) and are subject to finalisation on receipt of actual Special Energy Meter Data from various remote locations. The finalised figures for schedule vs actual are available under the "SEM Data" section of this website.



Note:

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It may be seen from the graph that control area Punjab had been heavily overdrawing from the Grid almost throughout the day on 29.07.2012 and in the

night of 29/30th July, 2012, the net drawal of Punjab was around 400 MW and at 10 p.m. its drawal was within schedule around 23:00 hours for a short period and over-drawal to the tune of 200-500 MW again started as shown in the graph for 30.07.2012. Also on 31st July 2012, the over drawal of Punjab increased after 8 am. Hence we find that SLDC Punjab failed to take effective measures to curtail over-drawal in its control area before Grid Disturbance which aggravated the WR-NR import and contributed to tripping of Agra- Gwalior line due to load enhancement and hence failed to comply with the directions of NRLDC specified under section 29 of the Electricity Act 2003 and also violated Regulations 5.4.2 (a), (g), (h) & (i) of the Grid Code.

- **SLDC, Uttar Pradesh:**

(b) SLDC, Uttar Pradesh has, vide its affidavit dated 12.2.2013, has submitted the details of messages issued by RLDCs and the action taken by SLDC in pursuance of the said directions. Some of the actions include opening of supply of Gorakhpur, Aligarh and Mirzapur town at 14:41 hours on 29.7.12, opening of supply of all district headquarters of UP at 20:10 hours on 29.7.12, opening of supply of Ghaziabad town at 23:30 hours on 29.7.12. SLDC, UP claims to have taken steps to curb over-drawal on various towns/tehsil and rural areas on receipt of messages.

The details of the messages issued by RLDC and action taken by SLDC, UP are given below:

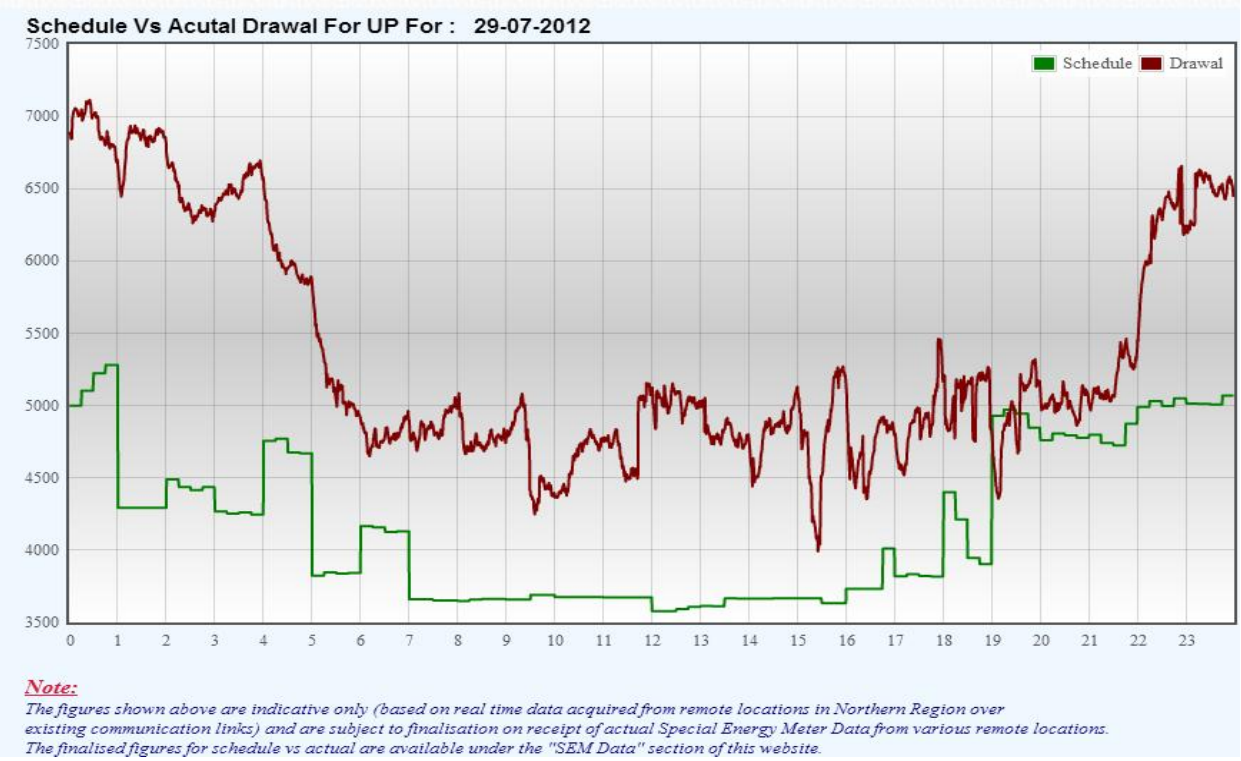
S No.	Detail of the messages issued by the NRLDC	Detail of the action taken by the SLDC
1	Hand written message at 14:41 hours on 29.07.2012	(a) Supply of Gorakhpur Town opened (b) Supply of Aligarh Town opened

		(c) Supply of Mirzapur Town opened
2	Hand written message at 16:34 hours on 29.07.2012	-
3	Hand written message at 19:25 hours on 29.07.2012	-
4	Hand written message at 21:10 hours on 29.07.2012	Supply of all District Headquarters of Uttar Pradesh Opened
5	Hand written message at 22:53 hours on 29.07.2012	Supply of all Tehsil and Rural area of Taj Trepazium opened
6	Hand written message at 23:30 hours on 29.07.2012	Supply of Ghaziabad Opened
7	Hand written message at 12:39 hours on 29.07.2012	(a) Supply of Tehsil and Rural areas of Panki Sub SLDC opened (b) Supply of Self Tehsil and Rural areas of Panki Sub SLDC opened
8	Message –A at 17:19 hours on 30.07.2012	Supply of District headquarters of Panki Sub SLDC Opened
9	Message –A at 19:20 hours on 30.07.2012	(a) Supply of Gonda Town Opened (b) Supply of Faizabad Town Opened (c) Supply of Jhansi Town Opened (d) Supply of Banda Town Opened
10	Message –A at 20:57 hours on 30.07.2012	Supply of Tehsil and Rural areas of Modipuram Sub SLDC opened
11	Hand written message at 02:32 hours on 30.07.2012	(a) Supply of District headquarters of Taj Trepazium opened (b) Supply of Tehsil and Rural areas of Sarnath Sub SLDC Opened
12	Message –A at 05:46 hours on 30.07.2012	(a) Supply of Tehsil and Rural areas of Panki Sub SLDC Opened (b) Supply of Self Tehsil and Rural areas of Panki Sub SLDC Opened
13	Message –A at 05:53 hours on 30.07.2012	Supply of Aligarh Town opened

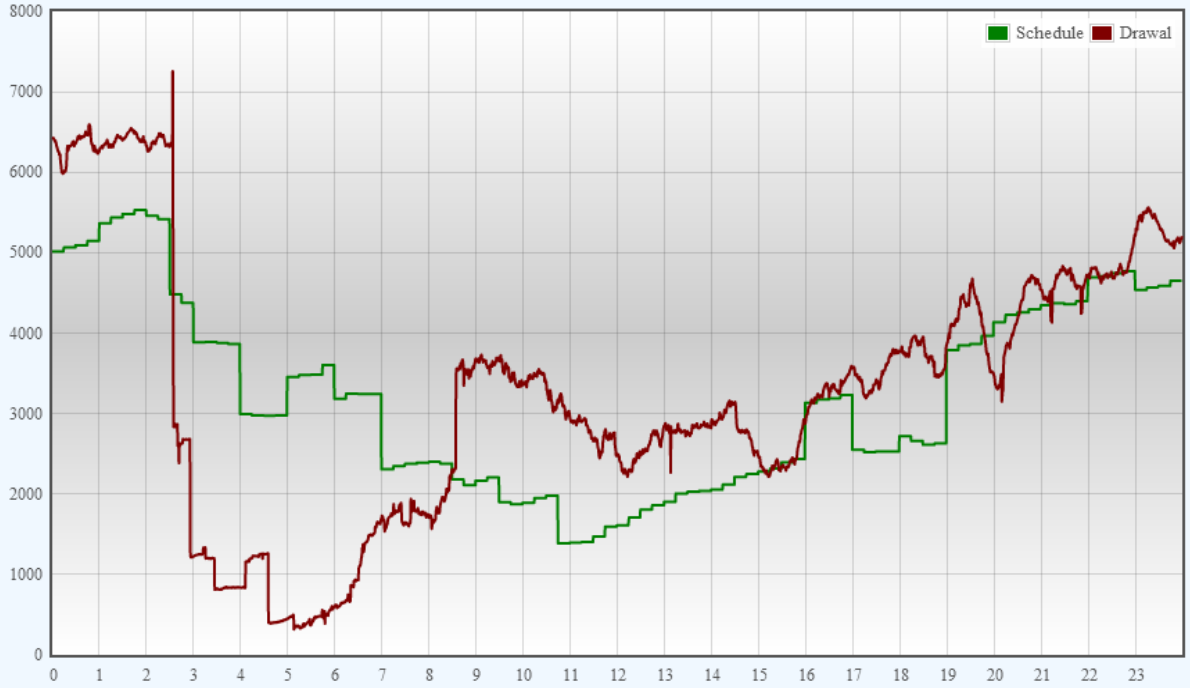
SLDC UP stated that the shift in charge of SLDC has done their all possible effort to avoid the situation of over-drawal.

19. We have gone through the submission made by the SLDC, UP and find that it has submitted photocopy of pages of log book of the control room, showing action taken by the shift in charge in shape of direction of power cuts in different areas. However, actual reduction of over-drawal is not visible from the submission.

The drawal pattern of UP is given below:



Schedule Vs Acutal Drawal For UP For : 30-07-2012



Note:

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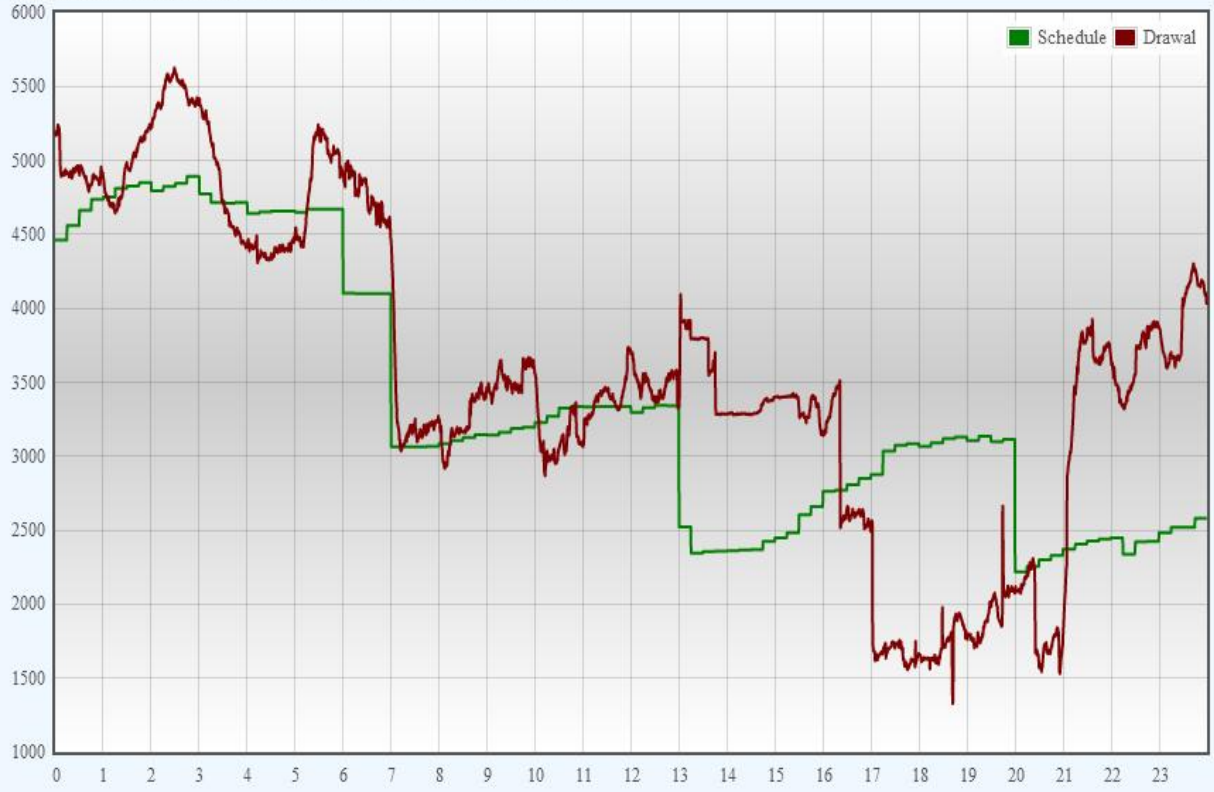
Schedule Vs Acutal Drawal For UP For : 31-07-2012



Note:

The figures shown above are indicative only (based on real time data acquired from remote locations in Northern Region over existing communication links) and are subject to finalisation on receipt of actual Special Energy Meter Data from various remote locations. The finalised figures for schedule vs actual are available under the "SEM Data" section of this website.

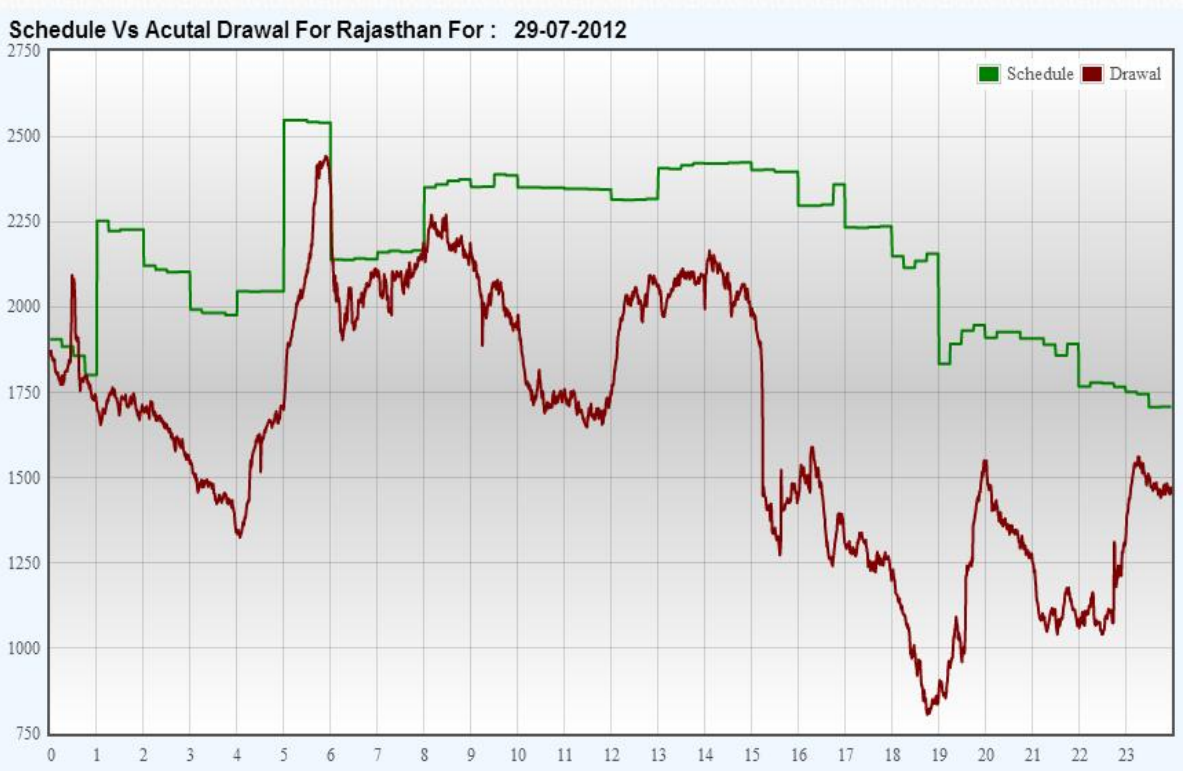
It may be seen that messages were issued by NRLDC to SLDC of UP on 29th July, 2012 at 14:41 hours, 16:34 hours, 19:25 hours, 21:50 hours, 22:58 hours and 23:30 hours. The details in regard may please be seen in the Table under para 15 of this order. Though, the schedule versus actual drawal pattern in respect of UP control area shows reduction in over-drawal at certain points of time, the actual drawal continued to be consistently more than the schedule and the over-drawal was not reduced to zero except for one hour starting from about 19:00 hours. The over-drawal gradually increased thereafter and it generally became as high as approximately 1000 to 1500 MW after 22:00 hours to midnight and thereafter till about prior to occurrence of grid disturbance on 30th July, 2012.

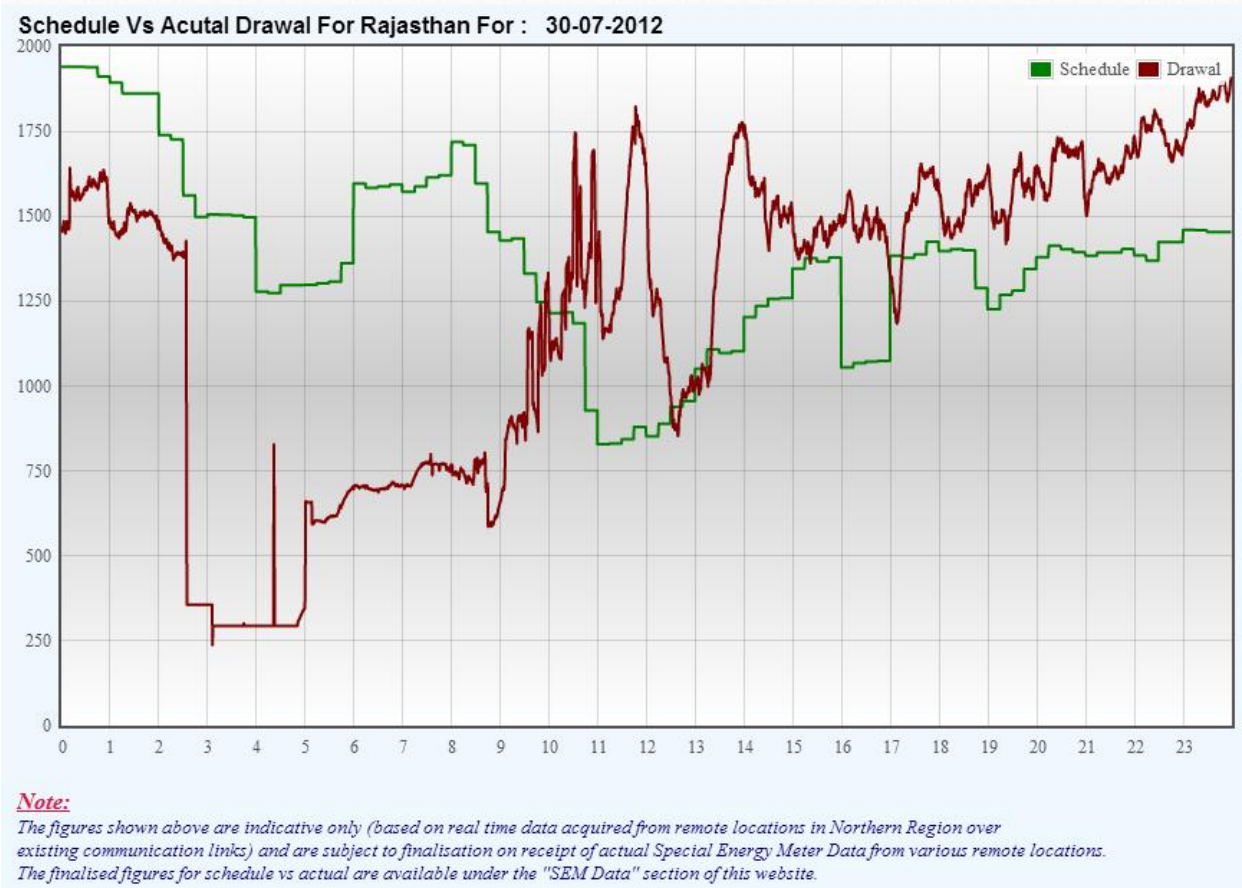
Hence SLDC, UP failed to comply with the directions of NRLDC specified under section 29 of the Electricity Act 2003 and also violated Regulations 5.4.2 (a), (g), (h) & (i) of the Grid Code

- **SLDC, Rajasthan:**

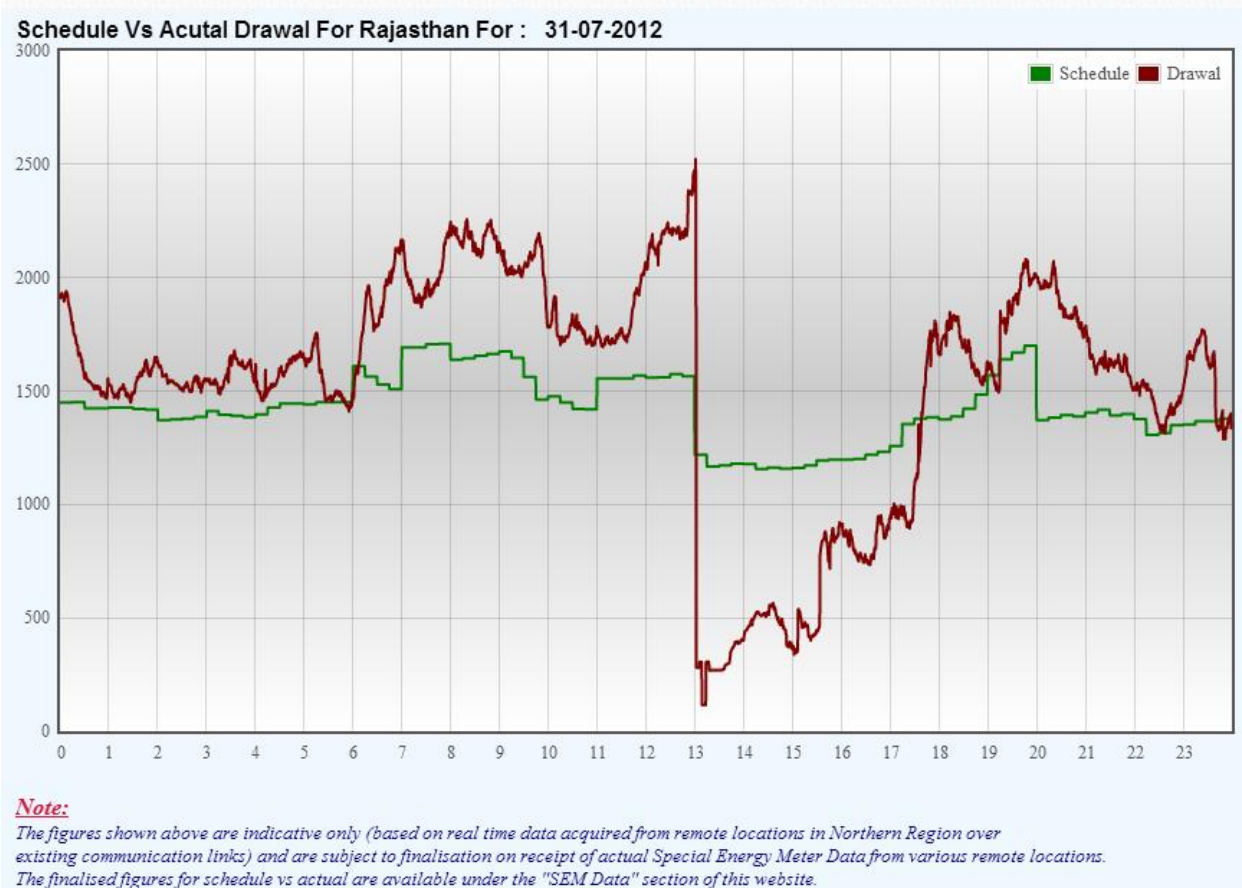
(c) SLDC, Rajasthan, vide its affidavit dated 18.2.13, has submitted the details of the action taken by it on various messages received from NRLDC. SLDC Rajasthan has submitted that it has not contributed towards the violation of WR-NR TTC, as during that period (14:41 hours of 29th July 2012), Rajasthan was continuously under drawing. SLDC Rajasthan has submitted that on 30.7.12 at 20:55 hours, it was shown in the message that over drawal of SLDC Rajasthan was 171 MW and on the directions of SLDC Rajasthan, the discoms reduced the over-drawal to 106 MW. At 20:55 hours, message A was issued to SLDC Rajasthan showing over-drawal as 171 MW. SLDC Rajasthan has stated that the instructions were issued to Discoms and the over- drawal was reduced

to 106 MW. We find that SLDC Rajasthan did not over draw from the grid and observed discipline on 29th July, 2012 and till about 10:30 hours of 30th July, 2012. Thereafter over-drawal was witnessed on 30th July 2012 except for certain periods of time as shown in the diagram below:





However on 31st July 2012, when over-drawal of Rajasthan control area was approximately 405 MW and message 'A' was issued by NRLDC to SLDC, Rajasthan, notices were issued by SLDC to Discoms for reducing over-drawal to maintain drawal within schedule. It has not been indicated whether drawal of Rajasthan control area was actually reduced or not. The schedule Vs actual drawal is given below:

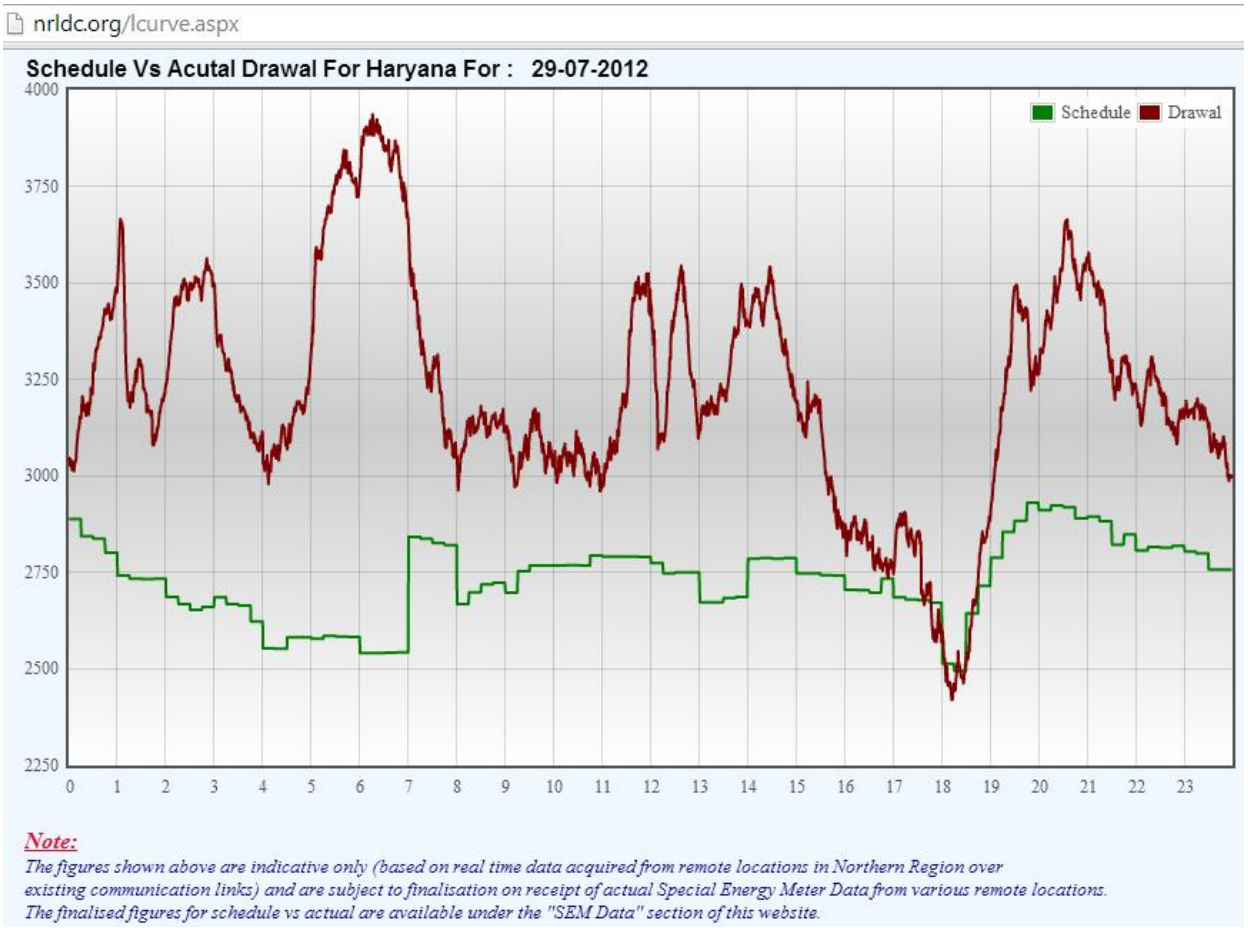


It is noted that drawal of Rajasthan control area was within schedule on 29th & 30th July, 2012 till 10 a.m. and thereafter substantial increase in over-drawal was witnessed. On 31st July, 2012, control area of Rajasthan had been overdrawing continuously since 6 o'clock and just before the grid disturbance its over-drawal was substantially high as can be seen from the graph above, it was over 900 MW. It is clear from the data that Rajasthan control area was over drawing from the grid prior to the incident on 31st July, 2012. Hence on 31st July, 2012, SLDC Rajasthan failed to comply with the directions of NRLDC issued under section 29 of the Electricity Act 2003 and also violated Regulations 5.4.2 (a), (g), (h) & (i) of the Grid Code.

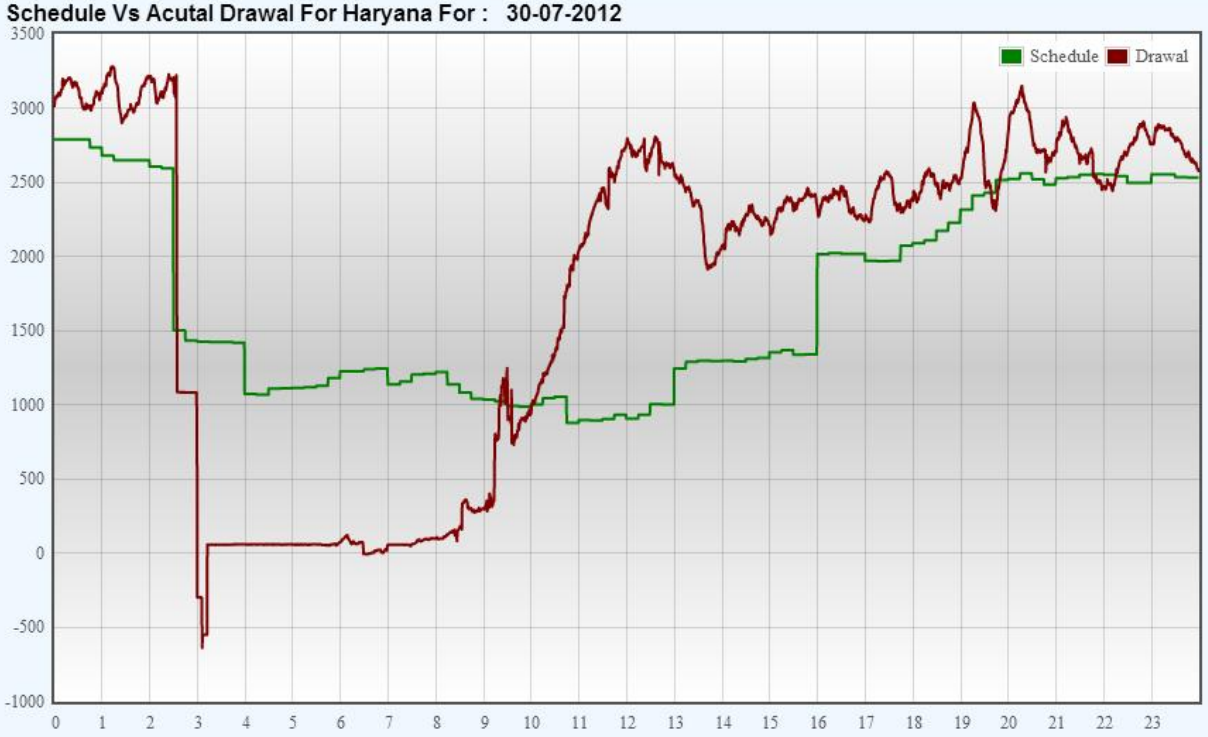
- **SLDC, Haryana:**

(d) SLDC, Haryana has, vide its submission dated 19.3.2013, stated that in addition to issuing warning messages to Discoms, it had opened 13 nos, 36

nos and 23 nos of lines on 29th, 30th and 31st July, 2012 respectively to curb the over-drawal from the Grid. The drawal vs schedule of Haryana for 29th & 30th July, 2012 is given below:



Schedule Vs Acutal Drawal For Haryana For : 30-07-2012



Note:

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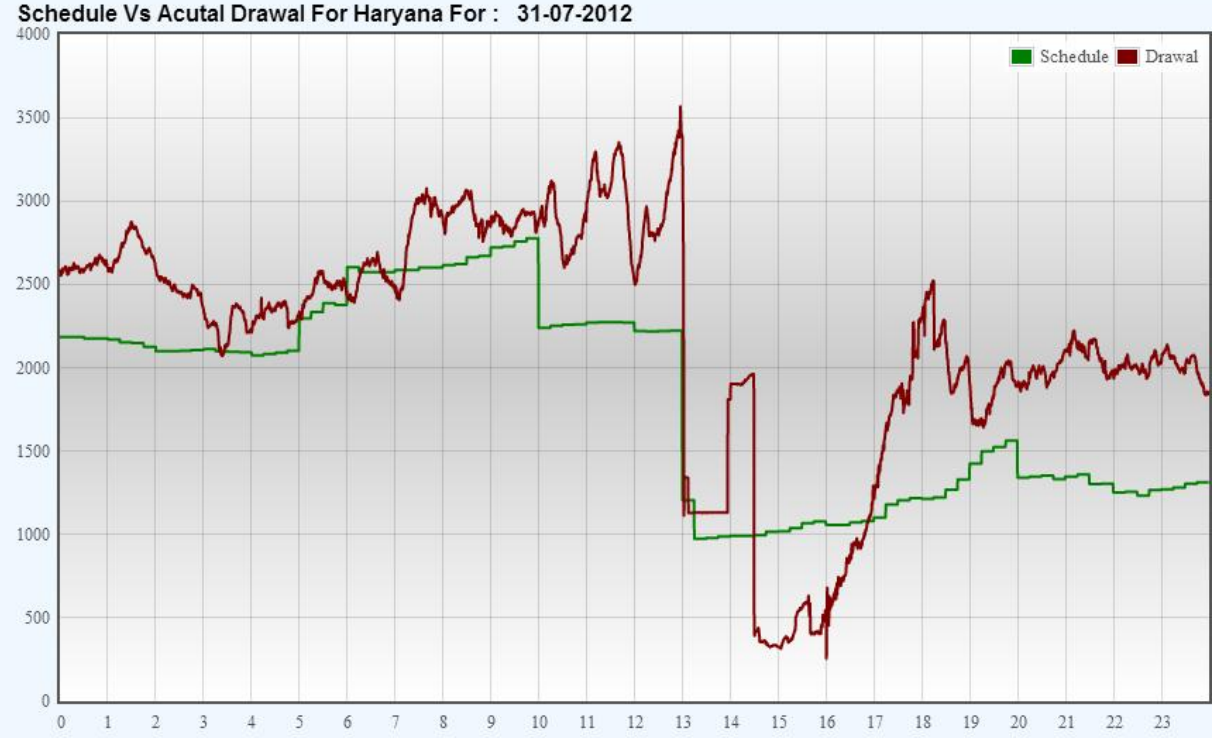
Schedule Vs Acutal Drawal For Haryana For : 31-07-2012



Note:

The figures shown above are indicative only (based on real time data acquired from remote locations in Northern Region over existing communication links) and are subject to finalisation on receipt of actual Special Energy Meter Data from various remote locations. The finalised figures for schedule vs actual are available under the "SEM Data" section of this website.

It may be seen from the graph that Haryana control area was continuously over drawing from the Grid since 7 pm on 29th July, 2012 and its overdrawl was around 100 MW prior to the grid disturbance on 30th July, 2012. Similar situation was there prior to grid disturbance on 31st July, 2012 as could be seen from the plot of schedule and actual drawal.

Hence on 31st July, 2012 it also failed to comply with the directions of NRLDC specified under section 29 of the Electricity Act 2003 and also violated Regulations 5.4.2 (a), (g), (h) & (i) of the Grid Code.

20. We have considered the submissions of SLDCs of Uttar Pradesh, Punjab, Haryana and Rajasthan. We are convinced from the SEM readings as well as from the SCADA data that these Utilities were overdrawing from the grid prior to the disturbance and contributed to overloading of transmission lines in WR-NR corridor. Actions by SLDC were analyzed with reference to the messages issued by RLDCs, it was observed that the actions taken by SLDCs were not effective in improving the security of the Grid. It was observed that action by SLDCs were more guided by instantaneous frequency at that moment instead of power flow on depleted network, specially the inter-regional links, The messages issued by RLDCs to SLDCs and SLDCs to State DISCOMs failed to bring seriousness of the situation. The action of feeder opening, etc., by SLDC was being taken as a routine load management practice rather than treating the situation as emergency. Also by increasing their drawal, the SLDCs were not taking cognizance of Regulation 5.4.2 (i) of IEGC, which is reproduced hereunder:

"5.4.2 (i) *The measures taken by the Users, SLDC SEB/distribution licensee or bulk consumer shall not be withdrawn as long as the frequency remains at a level lower*

than the limits specified in para 5.2 or congestion continues, unless specifically permitted by the RLDC/SLDC.

The over-drawal by constituents of Northern Region (NR) are to be looked very seriously in view of the fact that the Commission in its order dated 10.07.2012 in Petition No. 25/MP/2012 and IA No. 35/2012 & 38/2012 had issued instructions to State Utilities to comply with the directions of RLDCs and the State Utilities/SLDCs during the proceedings assured that there shall be no over-drawal. The control areas of Haryana, Punjab and Uttar Pradesh failed to comply with Section 29 of the Act and Regulations 5.4.2 (a), (g), (h) and (i) of the Grid Code on 30th July, 2012. Similarly, control areas of Haryana, Punjab and Rajasthan failed to comply with the Section 29 of the Act and Regulations 5.4.2 (a), (g), (h) and (i) of the Grid Code on 31st July, 2012.

Under drawal by WR constituents

21. WRLDC, in its affidavit dated 21.12.2012, has submitted the schedule and drawal of WR States/ constituents on 30.7.2012 in two time blocks viz. 02:00-02:15 hours and 02:15-02:30 hours and on 31.7.2012 in two time blocks viz. 12:30-12:45 hours and 12:45-13:00 hours as recorded by the Special Energy Meters (SEM) which is tabulated as under:

(Figures in MW)

Control Area	30 July 2012					
	02:00-02:15			02:15-02:30		
	Schedule	Drawal	UI	Schedule	Drawal	UI
	MW	MW	MW	MW	MW	MW
GUJARAT	1463	693	-770	1448	611	**-838**
MPSEB	1626	1212	-414	1629	1196	**-434**
MSEDCL	3778	3245	-533	3768	3255	**-513**
CSEB	496	288	-208	496	414	-82
Goa	228	220	-8	228	219	-9
DD	235	219	-16	235	216	-19
DNH	589	572	-17	589	570	-19
Total	**8415**	**6449**	**-1966**	**8393**	**6481**	**-1914**

Control Area	31 July 2012					
	12:30-12:45 hours			12:45-13:00 Hours		
	Schedule	Drawal	UI	Schedule	Drawal	UI
	MW	MW	MW	MW	MW	MW
GUJARAT	2090	1448	-642	2095	1182	**-913**
MPSEB	1539	1325	-215	1540	1484	-56
MSEDCL	4286	3597	-689	4280	3510	**-770**
CSEB	487	108	-380	487	113	**-374**
Goa	279	284	5	279	280	1
DD	255	223	-31	255	215	-40
DNH	572	533	-39	572	528	-44
Total	**9508**	**7518**	**-1991**	**9508**	**7312**	**-2196**

22. The real time data from SCADA system for constituents of Western Region at 02:00 hours 02:30 hours on 30.7.2012 and 12:45 and 12:57 hours are given below:

		30.7.2012		31.7.2013	
	State	**02:00 hours**	**02:30 hours**	12:45 hours	12:57 hours
1	Gujarat	-714	-799	-455	-1063
2	Madhya Pradesh	-808	-876	-28	49
3	Maharashtra	-472	-517	-447	-698
4	Chhattisgarh	-232	-104	-438	-373
5	Goa	-17	-23	-17	-14
6	DD	1	-6	-11	-6
7	Dadra& NH	-10	-10	2	-30
	Total	-2252	-2335	-1394	-2135

Further, a summary of messages WRLDC's submission from 29th to 31st July, 2012 is given below:

Date	Time (hours)	Message Summary	Frequency (Hz)	TTC Actual Flow (MW)		Issued to
				WR-NR	WR-ER	
29.07.2012	**21:37**	**TTC Violation**	**49.90**	**2000/-2519**	**1000/-1964**	**NLDC**
29.07.2012	21:47	TTC	50.33	2000/2295	1000/1759	GEB, MPSEB

		Violation				
29.07.2012	22.27	TTC Violation	49.75	2000/-2634	1000/-2089	GEB, MPSEB, MSEB
29.07.2012	22.27	TTC Violation	49.75	2000/-2634	1000/-2089	GEB, MPSEB, MSEB
29.07.2012	**22.48**	**TTC Violation**	**49.74**	**2000/2745**	**1000/2073**	**NLDC**
29.07.2012	22.50	TTC Violation	49.77	2000/2731	1000/2040	GEB, MPSEB, MSEB
29.07.2012	22.50	TTC Violation	49.77	2000/2731	1000/2040	GEB, MPSEB, MSEB
29.07.2012	22.50	TTC Violation	49.77	2000/2731	1000/2040	GEB, MPSEB, MSEB
29.07.2012	23.31	TTC Violation	49.65	2000/-2743	1000/-2190	GEB, MPSEB, CSEB, GMA
29.07.2012	**23.42**	**TTC Violation**	**49.65**	**2000/2748**	**1000/2184**	**NLDC**
29.07.2012	23.43	TTC Violation	49.73			GSEB-834MPSEB-392
29.07.2012	**23.45**	**TTC Violation**	**49.76**	**2400/-2755**	**1000/-2265**	**NTPC**
30.07.2012	00.10	TTC Violation	49.86	2000/2918	1000/2447	GEB, MPSEB, MSEB
30.07.2012	00.10	TTC Violation	49.86	2000/2918	1000/2447	GEB, MPSEB, MSEB
30.07.2012	**00.53**	**TTC Violation**	**49.90**	**2000/2689**	**1000/2424**	**NTPC**
30.07.2012	00.58	TTC Violation	50.16	2000/2669	1000/2477	GEB, MPSEB, MSEB
30.07.2012	00.58	TTC Violation	50.16	2000/2669	1000/2477	GEB, MPSEB, MSEB
30.07.2012	01.25	TTC Violation	50.02	2000/2629	1000/2326	GEB, MPSEB, MSEB
30.07.2012	01.30	TTC Violation	-	2000/2634	1000/2329	NLDC
31.07.2012	13.00					NLDC

It may be seen that WRLDC issued message to NLDC at 23:42 hours on 29.7.2012 indicating power flow on Bina-Gwalior-I over 990 MW, bus voltage at Gwalior 387kV and WR & NR angle at Vindhayachal Bus–51 degree. The frequency was 49.65 Hz, the actual flow on WR-NR corridor was 2748 MW against TTC of 2000 MW and 2184 MW on WR-ER corridor against TTC of 1000 MW. A similar message was also issued at 22:48 hours on 29.7.2012 where the power flow on WR-NR corridor was 2745 MW on and WR-ER corridor it was 2073 MW with loading of Bina-Gwalior-I line over 990 MW. Gwalior bus voltage was 379 kV and WR-NR angle at Vindhayachal was 41 degree. There is nothing on record that WRLDC had taken any action in anticipation of any contingency.

23. The responses of the constituent Sates of the Western Region are discussed as under:

(a) SLDC MP vide its submission dated 4.1.2013 has stated that POSOCO has observed that MP SLDC was under drawing to the tune of over 800 MW at 02:30 hours just prior to the grid disturbance on 30th July, 2012, it is to submit that the SCADA data of some of the CTU-MP interface points was not available during the night hours of 30th July, 2013. In such a situation to compute its drawal from the grid in real time, MP SLDC makes manual entries for the data which is not received in its SCADA system due to either communication or telemetry failure. The actual under drawal was within the range of 400 MW at frequency below 49.8Hz. This is confirmed from the SEM meter data for 30.07.2012 in two time blocks 02:00 to 02:15 hours

which are (-) 414.03 and (-) 433.664 MW respectively. The higher value of under drawal as reported by WRLDC, POSOCO is on account of non-updation of the real time data in RLDC system. This is one of the reason for mis-match in MP drawal monitored by WRLDC and MP SLDC. Though MP SLDC was under drawing by about 400 MW at frequency below 49.8 Hz, there was no violation of IEGC or CERC (Measures to relieve congestion in real time operation) Regulations, 2009.

(b) The main reason of system weakness was on account of unplanned shut down approved by POSOCO without discussing the same at appropriate regional forums. Although the up-gradation of 400kV Bina-Gwalior-Agra section into 765kV would not have been possible without commissioning of 765/400kV ICTs at Bina & Gwalior, the shut down on this route was availed. The TTC/ATC revision on account of outage of major trunk lines on WR-NR corridor was also not notified by the NLDC. Similarly the over drawal above the limit in WR-NR & WR-ER corridor was continued without imposition of congestion charge.

(c) The Shift In-charge, WRLDC had issued various messages to the constituents of Western Region as well as to NLDC from 21:37 hours of 29.07.2012 to 01:30 hours of 30.07.2012, in almost all the messages WRLDC indicated TTC violation from Western Region to Northern Region and from Western Region to Eastern Region. The frequency was prevailing below 50.0Hz most of the times and MP was under drawing from its schedule. Thus the MP has not violated the provisions of Central Electricity Regulatory Commission (Measures to relieve congestion in real time

operation) Regulations, 2009. The National Load Despatch Centre did not issue notice for TTC violation and imposition of congestion charges.

(d) 220kV Badod-Kota line was under forced outage since 15:14 hours of 29.07.2012 due to breaker problem at Kota (NR) end. At about 21:00 hours on 29.07.2012 the load on 220kV Badod-Modak line was 144 MW which started increasing despite repeated persuasion by MP SLDC to control within safe limits and at 00:00 hours of 30.07.2012, the line load on Badod-Modak reached 276 MW and increased to about 300MW at 00:10hrs resulting in tripping of 220 kV Badod-Modak line on over load condition. The line loading (Badod-Modak) at different times as recorded in the SCADA system is given hereunder:

Date	**Time**	**Flow (MW)**
29.07.2012	21:00	144
	21:30	166
	22:00	135
	22:15	190
	22:30	279
	23:00	272
	23:30	252
30.07.2012	00:00	273
	00:05	292
	00:06 to 00:09	301
	00:10	line tripped on over-load

(e) On both grid disturbances on 30.07.2012 and 31.07.2012, there was heavy power flow on remaining line of 400kV Bina-Gwalior-Agra. Total load on this single circuit increased beyond its maximum capacity after tripping of 220kV Badod-Modak line on 30.07.2012 and 220kV Badod-Kota & Badod-Modak line on 31.07.2012. Prior to tripping on 30.07.2012, the power flow on the 400kV Bina-Gwalior-I line was of the order of 1450 MW.

(f) Though MP was under drawing below 50.0 Hz due to reduction in demand on account of rains in the state, in response to messages received from WRLDC MP SLDC has taken prompt action by withdrawing hydro generation of 394MW between 00:00 hours to 02:30 hours on 30.07.2012. Hydro generation from 23:59 hours dated 29.07.2012 to 03:05 hours dated 30.07.2012. SLDC MP vide its affidavit dated 8.2.13 has submitted that the State had stopped its hydro generating units to reduce the quantum of under drawal. The discoms of the State, in light of prevailing system demand and available demand, were instructed to lift all type of load shedding in the state and there was no load shedding in the state from 07:00 hours of 29.7.12 to 06:00 hours of 30.7.2012 and from 09:00 hours to 18:00 hours on 30.7.2013. SLDC MP has also submitted the demand estimate on the day-ahead basis. To avoid the under drawal, the power was not requisitioned for about 78 MW from Kawas RLNG, 20 MW from Gandhar RLNG and 51 MW from Sugen Spot RLNG. Further no notice was received from NLDC/RLDC identifying MP as responsible for making congestion in WR-NR and any other inter regional corridor. MPSLDC stated that the instruction of WRLDC to reduce the under-drawal by MP had been complied promptly by reducing the generation and lifting the load shedding

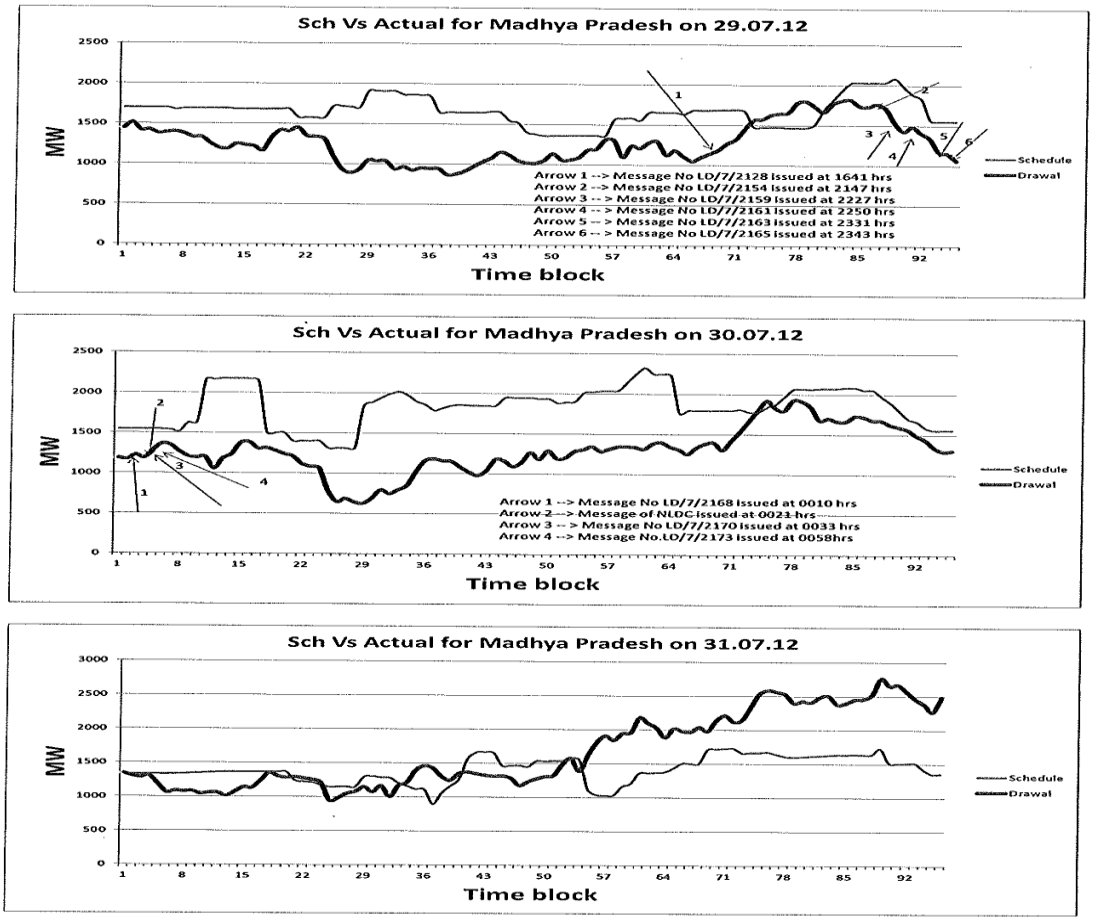
in the state. Further MPSLDC had made all out efforts to reduce the under drawal of MP and it has not violated the CERC (Measures to relieve congestion in real time operation) Regulations, 2010 as NR was importing entity below 50 Hz.

24. We have considered the submissions of MP SLDC and found that notices were issued by WRLDC to MPSEB indicating TTC of WR-NR and WR-ER being violated. It was found that on 29th July, 2012 the under drawl of MP kept increasing from 190 MW at 21:47 hours to 392 MW at 23:43 hours and further to 614 MW at 00:58 hrs. At 01:25 hours on 30th July, 2013 the under-drawal was 449 MW. MP SLDC has stated that the under-drawal was in the range of 220-350 MW as there was some error in SCADA data of WRLDC. However, WRLDC in its submission 13.02.2013 has submitted that as per IEGC clause 6.4.12, RLDC may direct the SLDCs/ISGS/ other regional entities to increase/decrease their drawal/generation in case of contingencies. In case of an instruction to reduce under-drawal in view of transmission constraints, the entities have full liberty to exercise the options of either

a. To reduce their own generation or
b. Reduce their requisition from ISGS or
c. Reduce their contractual power from LTA/MTOA or
d. Withdrawal of load shedding, if any or
e. Enter into any short term same day contracts with any other utility subject to corridor constraints

The graphs of schedule vs actual drawal of MP control area as submitted by WRLDC are given below

Schedule VS Actual Drawal of Madhya pradesh on 29th, 30th and 31st, July,2012 based on SEM data



It may be seen that messages were issued to SLDC, MP by WRLDC on 29th and 30th July 2012 but its under-drawal persisted on 30th July, 2012 before the grid disturbance on 30.7.2012 as shown in the diagram.

During the hearings, POSOCO had informed that WR constituents kept under drawing from the grid consistently and using UI as commercial mechanism. The data of preceding week was analysed and a clear pattern is evident that during night hours say 10 pm to 4 am every day, Control areas of Gujarat, Madhya Pradesh and Maharashtra were consistently under-drawing. The details are given below:

Week 2/7/12 to 8/7/12	
GUVNL	-12,81,02,320
MPPTCL	-13,39,43,584
MSEDCL	-21,66,57,284
NR	16,23,98,742
ER	68,39,18,818

Week 9/7/12 to 15/7/12	
GUVNL	-30,06,80,114
MPPTCL	-8,38,67,054
MSEDCL	78,83,272
NR	28,37,55,361
ER	50,09,71,326

Week 16/7/12 to 22/7/12	
GUVNL	-44,38,01,295
MPPTCL	12,65,14,179
MSEDCL	-24,92,07,375
NR	79,15,24,833
ER	83,67,77,838

Week 23/7/12 to 29/7/12	
GUVNL	-37,34,77,862
MPPTCL	-19,52,86,250
MSEDCL	-12,27,80,997
NR	84,94,34,629
ER	1,14,95,20,351

Week 2/7/12 to 29/7/12	
GUVNL	-1,24,60,61,591
MPPTCL	-28,65,82,709
MSEDCL	-58,07,62,384
NR	2,08,71,13,565
ER	3,17,11,88,333

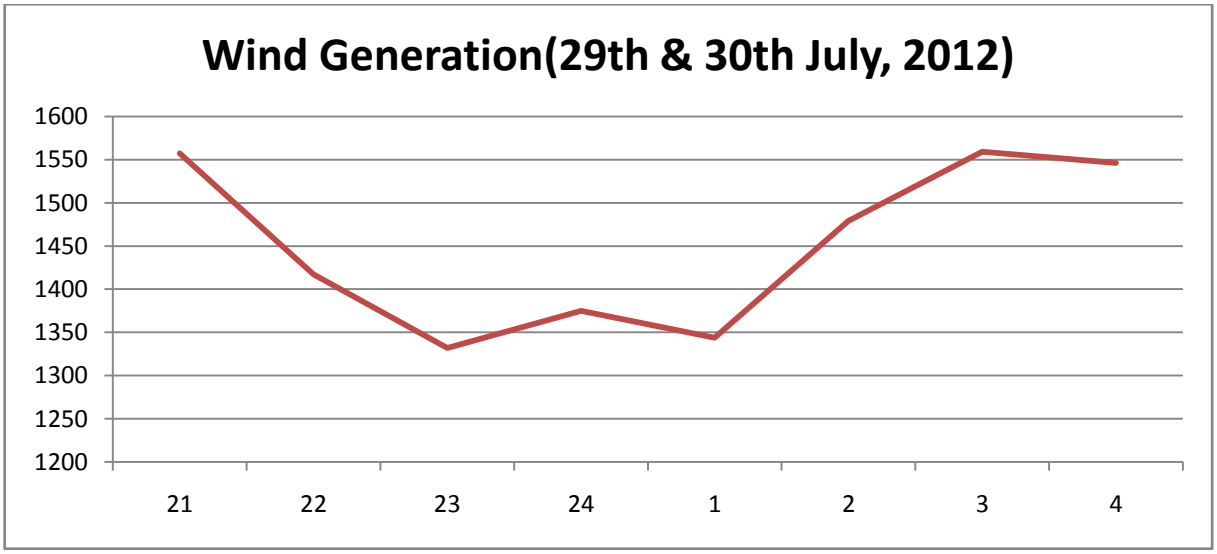
Further on pursuing the UI account of WR constituents it is found that WR constituents including control area of MP were consistently under drawing and UI receivable was in the range of Rs 8 to 19 crore. This was their intentional under-drawl for the purpose of earning through UI and jeopardizing the grid security in spite of direction from WRLDC to control its under-drawal. Hence, MPSLDC did not comply with the instructions of RLDC under section 29 of the Act and regulation 6.4.12 of the Grid Code on 30th July, 2012.

(b) SLDC Maharashtra, vide its affidavit dated 6.12.2013, has submitted that at 22:27 hours on 29.7.2012, the State's under-drawal was 241 MW at 49.56 Hz only and there was no mention of any congestion on any network element. Any

over-drawl/under-drawal, if not causing any transmission element congestion, is allowed as UI mechanism**.** Overloading of WR-NR corridor was intimated to SLDC, Maharashtra, at 22:50 hours and SLDC acted immediately by starting generating units at Ghatghar HPS in pumping mode, which consumed 150 MW and withdrawing load shedding. At 00:33 hours when its under-drawal was 424 MW, actions were taken and it was intimated to WRLDC that under-drawal had reduced to 201 MW. Further, backing down of generation was done and State's total generation was reduced from 8791 MW to 8470 MW and almost all the thermal units were running at their technical minimum level. Further, withdrawals of thermal units are not generally adopted as they are required in day time and will take more time to synchronize. However, the effort of system operators to reduce state generation was partially off-set by injection due to increase in wind generation from 1332 MW at 23:00 hours on 29.7.2012 to 1559 MW by 03:00 hours on 30.7.2012 i.e. variation of 227 MW. Further Maharashtra's under-drawal has been indicated as 537 MW but the average 15 min value was 200-400 MW from 00:15 to 03:00 hours.

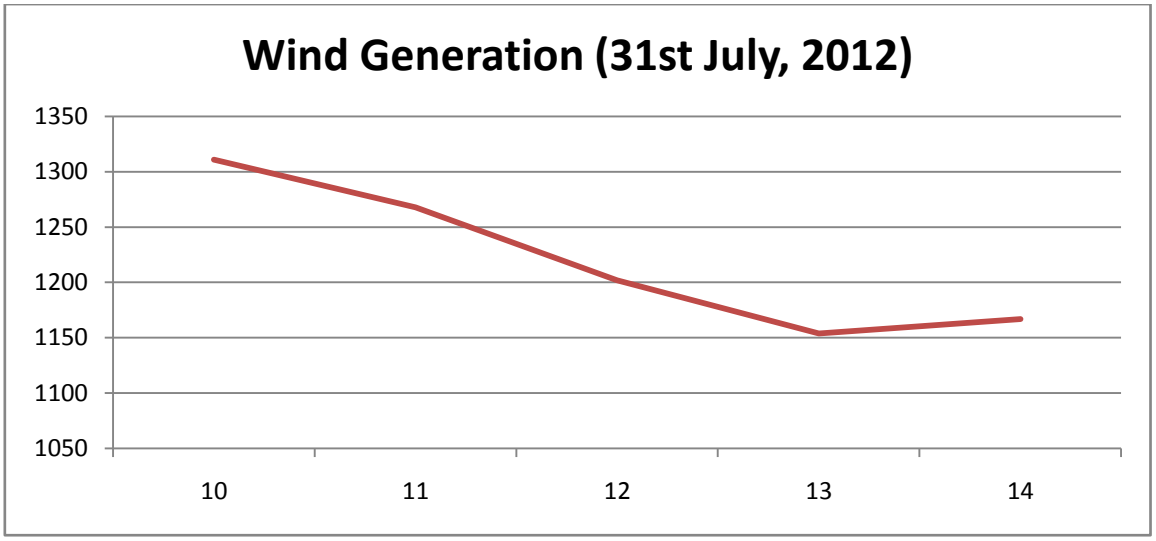
25. We have considered the submission of Maharashtra SLDC (MSLDC) and found on the purusal of the messages issued by WRLDC that Maharashtra was under drawing continuously during the night of 29th/30th July, 2012. WRLDC in the subject of the messages have mentioned the TTC violation and gave loading of Bina-Gwalior line apart from showing TTC figures for WR-NR as 2000 MW and WR-ER 1000 MW. The actual flow on these flow gates (WR-NR & WR-ER) were much above the TTC allowed. MSLDC has stated that there is no real time visibility of wind injection. Hence, most of the efforts of system operator to reduce state generation were partly eaten away by wind injection.

We have also considered the wind generation data supplied by MSLDC. The graphs of wind generation in Maharashtra on 29th and 30th July, 2012 (from 21:00 hours of 29th July to 04:00 hours of 30th July) and from 10:00 hours to 14:00 hours on 31st July, 2012 are given below:



MSLDC has stated that there was no real time visibility of wind injection and the efforts of the system operator to reduce state generation were partly eaten away by wind injection. Further, the contention of the SDLC that all the thermal generating units were running at the technical minimum level and this practice of withdrawal of thermal unit is not generally adopted as the same is required in day time and will take more time to synchronize. It appears that SLDC was more worried about supply of demand for the next day instead of prevailing over loading of flow gates and violation of TTC reported in the messages issued to SLDC.

Further, on 31st July, 2012, the under-drawal of control area Maharashtra was 698 MW-770 MW before the grid disturbance. The wind generation was also decreasing continuously as shown below:



Further, on pursuing the UI accounts from 2.7.2012 to 29.7.2012, it was found that the UI receivable by MSEDCL was over Rs.58 crore, out of which around Rs. 37 crore pertained to the last fortnight which indicates that the trend of under-drawal was continued to earn through UI. It is expected that during the real time operation, RLDC/SLDCs shall consider system security as top priority, which MSLDC failed to achieve. Hence, MSLDC failed to comply with the directions of RLDC in contravention of section 29 of the Act and Regulation 6.4.12 of the Grid Code.

SLDC, Gujarat

(c) Gujarat SLDC in its affidavit dated 10.2.2013 has submitted that around 700 MW backing down (including stopping of Sikka TPS Unit No.1 at 00:45 hours) was done from 22:00 hours on 29.7.2012 to 02:00 hours on 30.7.2012 from State's generating stations. The details of the station-wise relief showed that GSECL generators reduced generation of the order 548 MW whereas IPPs reduced by 156 MW. Further, most of the coal and gas based intra-State stations were operating at technical minimum. According to Gujarat SLDC, had WRLDC exercised its power under Regulation 6.5.20 of the Grid Code to reduce generation for better system operation, it would

have automatically reduced the schedule from ISGS and controlled the situation before the incident. However, based on the directions of WRLDC, SLDC had taken actions by (i) closing down of unit at their power stations viz. Dhuvaran, Ukai and Sikka as well as backing down generation at Wanakbori giving a relief of 400 MW and (ii) reducing Gujarat's requisition from Kawas and Gandhar power stations of NTPC. But despite the above measures**,** the variability on account of wind generation also created a problem. SLDC Gujarat has stated that revision request for ISGS stations was sent to WRLDC at 23:20 hours on 29.7.2012 and 01:40 hours on 30.7.12. Looking to the crisis situation prevalent at that time, SLDC Gujarat in its revision request sent at 01:40 hours on 30.7.12 had requested WRLDC to give effect from 01:45 hours. However the revision posted by WRLDC at 01:52 hours showed the effect from 03:00 hours. Only if WRLDC had implemented the effect at least from 02:00 hours, SLDC Gujarat could have been in a position to control the under drawl by a substantial quantum of around 250 MW and it would have indeed helped Gujarat system to a great extent especially when there was an unwanted increase of around 300 MW in wind generation. The details of maximum and minimum wind generation for the period 25th to 31st July, 2012 are shown below:

Date	**Max* wind injection (MW)**	**Time (hours)**	**Min* wind injection (MW)**	**Time (hours)**	**Difference between max & min wind injection in a day (MW)**
25-Jul-12	2116	19:00	1289	7:00	827

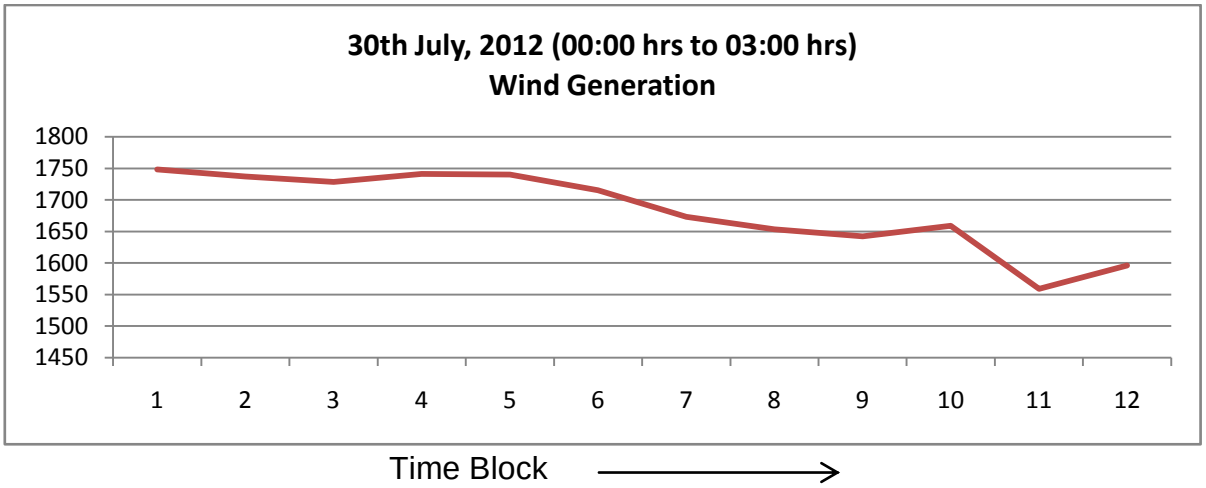
26-Jul-12	1989	19:00	1258	24:00	731
27-Jul-12	1752	17:00	987	7:00	765
28-Jul-12	2086	15:00	1074	8:00	1012
29-Jul-12	2111	14:00	1259	8:00	852
30-Jul-12	2148	15:00	1204	23:00	944
31-Jul-12	1974	19:00	894	7:00	1080

26. During last week of July, 2012, wind energy injection remained on higher side. A difference of around 900-1000 MW was observed daily between maximum and minimum generation by Wind farm generators. On 30.7.12, maximum WEG injection was 2148 MW while minimum injection was 1204 MW. On 31.7.12, maximum WEG injection was 1974 MW minimum injection was 894 MW. Wind generation of 1744 MW at 02:30 hours on 30.7.12 and 1500 MW at 13:00 hours on 31.7.12 was injected into the grid.

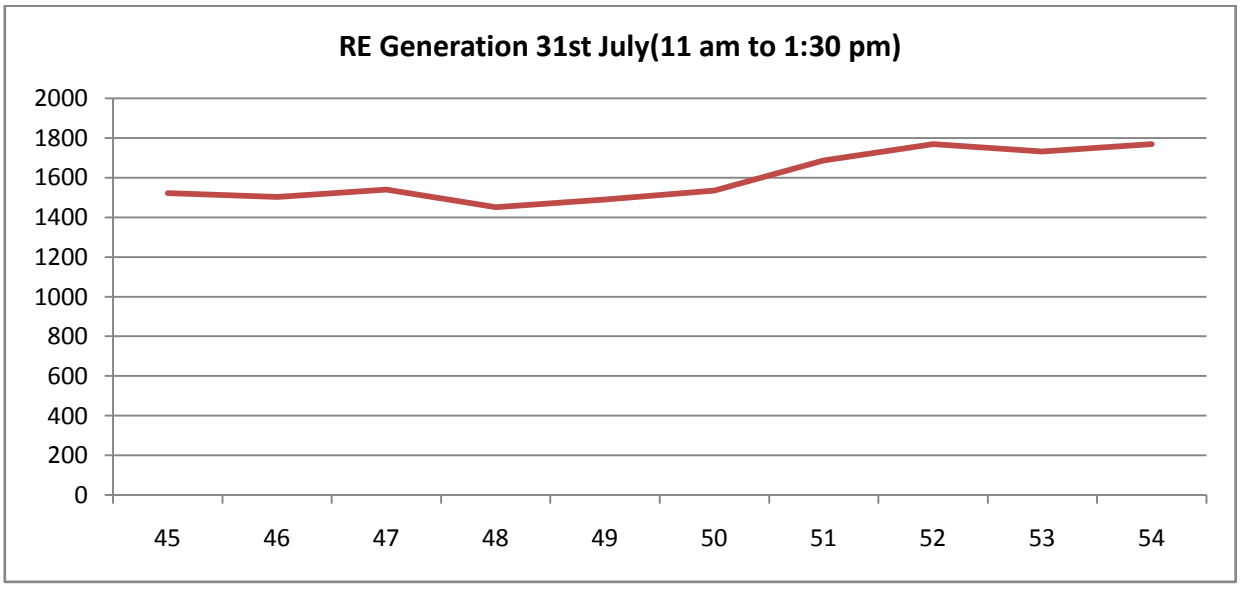
We have considered the submission of SLDC, Gujarat it may be seen that SLDC, Gujarat requested WRLDC to revise the schedule with effect from 01:45 hours by its revision request sent at 01:40 hours of 30.07.2012. It is surprising to note that SLDC made such a request for revision of schedule to be applicable in 5 minutes. The Grid Code provides that the schedules can be revised in 6 time blocks under normal conditions and 4 time blocks under urgent situations.

On pursuing the 15 minute time block wise data of RE generation for 30thJuly, 2012, it is observed that the wind generation was around 1740 MW around 01:00 hours and started decreasing gradually and was 1642 MW in the 9th

block i.e. (02:15-02:30 hours). The plot of actual RE generation from 00:00 hours 03:00 hours is shown below:



We find that the wind generation actually had a decreasing trend since midnight of 29/30th July 2012. However on 31st July 2012, the RE generation was around 1451 MW at 12:00 hours which became 1768 MW at 13:00 hours. The plot of the RE generation shown below:



It may be seen that the increase in RE generation was over 300 MW. However, the demand of the State was 9632 MW against the generation of 11338 MW. Considering export of about 559 MW, the under drawl was around 1100 MW. It seems that SLDC, Gujarat did not learn lesson from the last night's disturbance. It

also shows that system operators were not aware about the aggravated situation. SLDC failed in controlling under drawl in its control area, hence failed to comply with RLDC's directions. It is also found that during the month of July, 2012 (2/7/12 to 29/7/12), the under-drawal by Constituents of Western Region was huge and was not only because of deviation in the Renewable Energy. This cannot be said to be unintentional. The UI mechanism is for handling unscheduled interchanges and if the operational behavior of utility was consistently on one side of deviation (under-drawal) and they were not abiding by the instructions of the RLDC inspite of repeated TTC violation both in NR-ER corridors endangering the grid security. This amounts to non-compliance of directions of RLDC by the under-drawing entities of WR as well as non-compliance of Regulation 5.4.2(h) of IEGC. It was the responsibility of WRLDC to point it out and refrain the utility from doing so. It appears that WRLDC has not taken any action in this and based on system condition. The under-drawals by WR Constituents were utilized by NR constituents to over-drawal from the grid as frequency was not abnormally low and UI rate was low. By not taking any action WRLDC provide tacit approval for this behavior on both sides of the grid. WRLDC should have taken action in accordance with Regulation 6.4.25 of IEGC and would have brought this to the notice of WRPC as provided below Regulation 6.4.25:

"25. RLDC shall periodically review the actual deviation from the despatch and net drawal schedules being issued, to check whether any of the regional entities are indulging in unfair gaming or collusion. In case any such practice is detected, the matter shall be reported to the Member Secretary, RPC for further investigation/action

27. WR constituents have stated that they were not able to control their underdrawl as it was due to unbalance created by Wind Generation. This plea cannot be accepted because each SLDC is responsible for managing load generation balance under its control area. It has been found that the under drawl has reduced substantially since the grid disturbance. Hence, we are convinced that variation of wind could have been managed effectively within a state control area."

It may be seen that when the system conditions were favourable and adequate inter regional links were available for power transfer from WR to NR during night

hours, the mechanism acted as efficient market mechanism. However, this brought perpetual indiscipline. When the system was not sufficient to transfer power from WR to NR which was generally being transferred, grid disturbance happened. The communication from WRLDC to Western Region constituents had not clearly brought the condition of depletion in transmission system and WRLDC had not revised the schedule of the utilities on its own. The system operator was continuously monitoring the flow across the WR-NR flow gate and Regulation 6.5.20 of IEGC empowers WRLDC to revise schedule on its own in the interest of system operation. Regulation 6.5.20 of IEGC is reproduced below:

"If, at any point of time, the RLDC observes that there is need for revision of the schedules in the interest of better system operation, it may do so on its own, and in such cases, the revised schedules shall become effective from the 4th time block, counting the time block in which the revised schedule is issued by the RLDC to be the first one."

SLDC, Chhattisgarh

(d)We have not got any submission from SLDC Chhattisgarh. On perusing the information of WRLDC vide dated 21.12.2012, it was found that Chhattisgarh was also under drawing from the grid before disturbance on 30th July as well on 31st July 2012. A massage was issued to SLDC CSEB Bhilai at 2345 dated 30.7.2012 that due to persistent over drawl by the WR constituents including CSEB (279MW), the NR-WR and WR-ER corridor lines were critically loaded. Considering the system security, they were requested to take out any load shedding / regulate excess generation.

No reply from SLDC Chhattisgarh was available. We are of view that SLDC Chhattisgarh failed to follow the directions of WRLDC which is contravention of Section 29 of the Act. Further they failed to appear before this Commission.

27. Further vide RoP of 10.1.2013, WRLDC was asked to clarify as whether the format of instructions issued by them to SLDCs was the normal format of the messages or should they not have been asked to revise their schedule from Central Sector Generating stations or reduce their own generation.

The WRLDC has in its reply dated 13.1.2013 submitted that the normal formats are in shape of messages A, B and C to control over-drawal in case of

low frequency and TTC/ATC violation message format. As per IEGC clause 6.4.12, RLDC may direct SLDC/ISGS/other regional entities to increase/decrease their drawal/generation in case of contingencies e.g. overloading of lines/transformers, abnormal voltages threat to system security. In case of an instruction to reduce under drawal in view of transmission constraints, the entities have full liberty to exercise the option of reduction in own generation, reduction in requisition from ISGS, reduction in their contractual power from LTA/MTOA or withdrawal of load shedding, if any, or entering into any other short term contracts with any other utility subject to corridor constraints. WRLDC is of the view that all the options could be exercised as per prevalent Regulations and merit order despatch of the concerned state utilities. However if, the congestion in the system can be alleviated by reduction of generation at a particular generating station or load reduction at a particular sub-station, RLDC can mention such specific requirements in the message for the better system operation and security. WRLDC further stated that on the night of 29.7.12/30.7.12 and 31.7.12, the constraints were prevalent on the inter-regional links, the excessive generation had to be reduced and hence the formats issued by WRLDC were adequate to intimate the entities regarding the constraints in the system and action required by the concerned entities.

28. SLDC, Gujarat submitted that RLDC should have acted as per Regulation 6.4.12 and 6.5.20 of IEGC and would have revised the schedule by their own. We agree with the contention of SLDC Gujarat that WRLDC should have revised the schedule Suo-motu in the interest of better system operation as provided in the Grid Code. However, we find that SLDC as apex body in the State is equally responsible to ensure secure and reliable operation and it should have revised the schedules of its constituents in line with State Grid

Code and it cannot pass its responsibility to RLDC. Hence, SLDC of Gujarat, Maharashtra, MP and Chhattisgarh failed in their responsibilities by not acting on their own to revise schedule of their Constituents and generating stations as per State Grid Code as well as under sector 29 of Electricity Act, 2003.

29. The details of TTC on WR-NR and WR-ER corridors with under drawal by WR constituents are given below:

Flow gate gap TTC WR-NR=2000 MW, WR-ER=1000 MW

Time/Date	**Actual flow (MW)**		**Under drawal by Control Areas of WR (MW)**			
	WR-NR	WR-ER	Gujarat	Maharashtra	Madhya Pradesh	Chhattisgarh
2137/29.7.12	2519	1964	Data not given			
2147	2295	1759	429		190	
2227	2634	2089	813	241	267	
2248	2745	2073	Data not given			
2250	2731	2040	607	321	312	
2331	2743	2190	707	362		
2342	2748	2184	Data not given			
2345	2755	2265	Data not given			
30-07-12	2918	2447	1223	361	553	
0022	2722	3026	1012	417	575	108
0053	2689	2424	Data not given			
0058	2669	2477		413	614	
0125	2629	2326		476	519	
0130	2634	2329	Data not given			

It may be seen that the control areas of Gujarat, Maharashtra, and Madhya Pradesh were under drawing continuously when the loading in WR-NR and WR-ER flow gates was continuously beyond the TTCs. It was also intimated during the hearing that such situation had been happening since last few days and there was a hit and near miss situation just a day ago. It indicates that system operators were not able to visualize the critical position themselves and effective measures were therefore not taken to control the under-drawal.

30. WRLDC gave clear messages to SLDCs of Gujarat, Maharashtra, and Madhya Pradesh to increase their drawal from the grid and adhere to their schedule, but they did not act accordingly. Control Areas of Gujarat, Maharashtra, and Madhya Pradesh had been continuously **under drawing.** The situation became precarious due to outage of 400 kV Bina-Gwalior link. Under such condition, the Grid Code provides remedial measures under Regulation 6.4.12 and 6.5.20 as given below:

"6.4.12. However, notwithstanding the above, the RLDC may direct the SLDCs/ISGS/other regional entities to increase/decrease their drawal/generation in case of contingencies e.g. overloading of lines/transformers, abnormal voltages, threat to system security. Such directions shall immediately be acted upon. In case the situation does not call for very urgent action, and RLDC has some time for analysis, it shall be checked whether the situation has arisen due to deviations from schedules, pursuant to short-term open access. These shall be got terminated first, before an action, which would affect the scheduled supplies to the long term and medium term customers is initiated in accordance with Central Electricity

Regulatory Commission (Grant of Connectivity, Long-term Access and Medium-term Open Access in inter-state Transmission and related matters) Regulations,2009."

"**6.5 Scheduling and Despatch procedure for long-term access, Medium – term and short-term open access:**

20.*If, at any point of time, the RLDC observes that there is need for revision of the schedules in the interest of better system operation, it may do so on its own, and in such cases, the revised schedules shall become effective from the 4th time block, counting the time block in which the revised schedule is issued by the RLDC to be the first one."*

31. We find that system operators at the State as well regional level failed to visualize the impact of under-drawal by WR constituents and corresponding over-drawal by NR constituents contributing to skewed flow of power from WR to ER and WR to NR which contributed to factors which ultimately led to the disturbance. We find that WRLDC also failed to implement Regulation 6.5.20 inspite of consistent under drawl by the WR constituents.

    It emerges that on 30.7.2012, control areas of Maharashtra, Gujarat and Madhya Pradesh failed to comply with regulation 6.4.12 of Grid Code and Section 29 of the Act. Similarly on 31.7.2012, the control areas of Gujarat and Maharashtra failed to comply with Regulation 6.4.12 of Grid Code and Section 29 of the Act prior to grid disturbances. Further, WRLDC failed to implement Regulation 6.5.20 of the Grid code prior to the grid disturbance.

32. NERLDC vide their submission dated 21.12.2012 submitted that all its Constituents were drawing power within their schedule.

(II) Non Compliance by NR and ER Constituents in providing adequate UFR relief:

33. NRLDC vide its affidavit dated 26.12.2012 has submitted the frequency profile of the Northern Regional grid on 30th and 31st July, 2012 as recorded by the Phasor Measurement Units installed in Northern Region as displayed below:

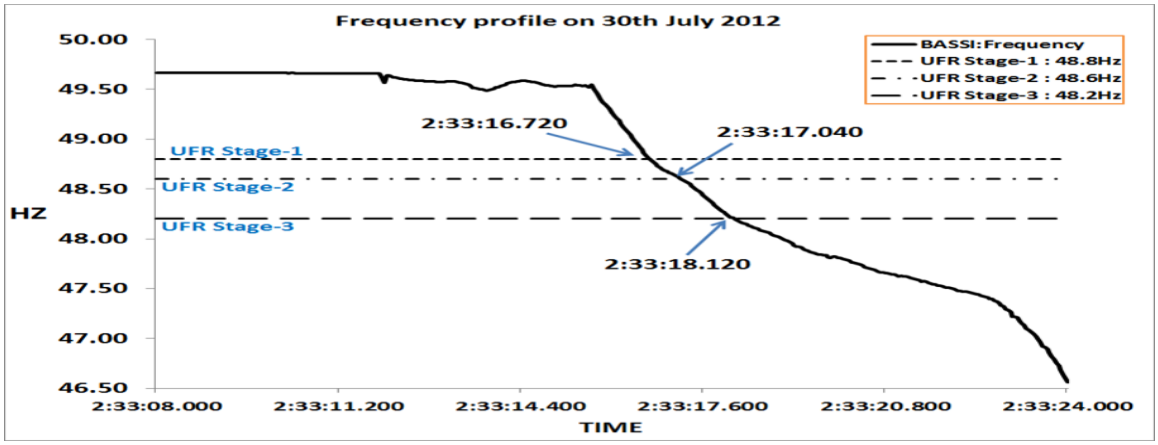


Figure: Frequency profile in Northern Region on 30th July 2012

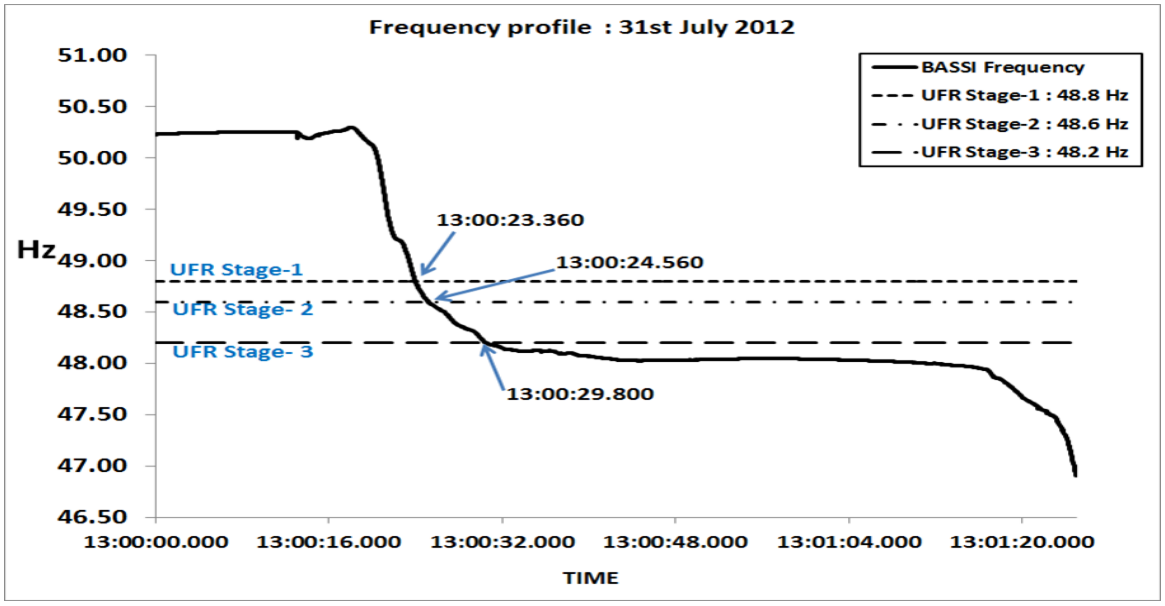


Figure: Frequency profile in Northern Region on 31st July 2012

That it may be seen from the above figures that subsequent to isolation from the other regions, the loss of import in Northern Region resulted in rapid decline of frequency which should have triggered the automatic load shedding through the Under Frequency Relays and Rate of Change of Frequency Relay based load shedding schemes. However the relief obtained through the UFR and df/dt load

shedding scheme in Northern Region was inadequate to arrest the fall in frequency. Further, NRLDC has reported that based on the survey by PGCIL after the gird disturbances , it was found that the total load shedding actually obtained from UFR was only 19% of the expected quantum on 30.7.2012 and 18% on 31.7.2012. Likewise the load shedding through df/dt relays was 9% of the expected quantum on 30.7.2012 and 9% on 31.7.2012 as per the details given below:

Table 1: Performance of UFR and df/dt relays on 30-July-2012

State	Expected load relief (in MW) as per the scheme			Actual load relief (in MW) obtained on 30-July-2012			Actual load relief on 30-July-2012 as % of planned load relief		
	UFR	Df/dt	Total	UFR	Df/dt	Total	UFR	Df/dt	Total
	A	B	C =A+B	D	E	F =D+E	G =D/A	H =E/B	I =F/C
Punjab	800	1410	2210	297	0	297	37%	0%	13%
Haryana	600	900	1500	55	412	467	9%	46%	31%
Rajasthan	695	1070	1765	52	175	227	7%	16%	13%
Delhi	600	810	1410	176	126	302	29%	16%	21%
Uttar Pradesh	905	1060	1965	196	0	196	22%	0%	10%
Uttarakhand	160	210	370	0	102	102	0%	49%	28%
Himachal Pradesh	115	190	305	0	0	0	0%	0%	0%
Jammu & Kashmir	165	270	435	0	0	0	0%	0%	0%
UT Chandigarh	10	100	110	0	0	0	0%	0%	0%
Total	4050	6020	10070	776	815	1591	19%	14%	16%

Table 2: Performance of UFR and df/dt relays on 31-July-2012

State	Expected relief (in MW) as per the scheme			Relief Obtained (in MW) on 31-July-2012			Actual load relief on 31-July-2012 as % of planned load relief		
	UFR	Df/dt	Total	UFR	Df/dt	Total	UFR	Df/dt	Total
	A	B	C =A+B	D	E	F =D+E	G =D/A	H =E/B	I =F/C
Punjab	800	1410	2210	267	0	267	33%	0%	12%
Haryana	600	900	1500	35	129	164	6%	14%	11%

State	Expected relief (in MW) as per the scheme			Relief Obtained (in MW) on 31-July-2012			Actual load relief on 31-July-2012 as % of planned load relief		
	UFR	Df/dt	Total	UFR	Df/dt	Total	UFR	Df/dt	Total
	A	B	C =A+B	D	E	F =D+E	G =D/A	H =E/B	I =F/C
Rajasthan	695	1070	1765	38	153	191	5%	14%	11%
Delhi	600	810	1410	223	124	347	37%	15%	25%
Uttar Pradesh	905	1060	1965	170	7	177	19%	1%	9%
Uttarakhand	160	210	370	12	115	127	8%	55%	34%
Himachal Pradesh	115	190	305	0	0	0	0%	0%	0%
Jammu & Kashmir	165	270	435	0	0	0	0%	0%	0%
UT Chandigarh	10	100	110	0	0	0	0%	0%	0%
Total	4050	6020	10070	745	528	1273	18%	9%	13%

34. It was also mentioned by ERLDC in their submission dated 21.12.2012 that no load relief was provided by UFR operation by the utilities of the States of Odisha, Bihar and Jharkhand in Eastern Region.

Hence all the constituent utilities of Northern Region and constituent utilities in the States of Odisha, Bihar and Jharkhand in Eastern Region failed to comply with the Regulation 1 of part-IV of the Central Electricity Authority (Technical Standards for Connectivity to the Grid) Regulations, 2007 and Regulation 9 of the Central Electricity Authority (Grid Standards) Regulations, 2010 and Regulation 5.2 (n) of the Grid Code.

Regulation 1 of part-IV of the Central Electricity Authority (Technical Standards for Connectivity to the Grid) Regulations, 2007 is reproduced below:

"Under Frequency/df/dt Relays

Under frequency licensees shall provide adequate reactive compensation to compensate the inductive reactive power requirement in their system so that they do not depend upon the grid for reactive power support. The power factor of the distribution system and bulk consumer shall not be less than 0.95."

(III) Role of RPCs, POWERGRID and POSOCO in approval of shutdown of 400 kV Bina-Gwalior-Agra line

35. Now we consider the role of RPCs and RLDCs in approval of shut down of 400 kV Bina-Gwalior–Agra line. The report submitted by POSOCO states that Bina-Gwalior-II and Gwalior-Agra-II were under planned outage from 10:26 hours on 27.7.2012 and 11:47 hours of 28.7.2012 respectively. The outage planning is provided under Regulation 5.7.4 of IEGC as given below:

"5.7.4 Outage Planning Process:

a) The RPC Secretariat shall be primarily responsible for finalization of the Annual Load Generation Balance Report (LGBR) and the annual outage plan for the following financial year by 31st December of each year. The LGBR shall be prepared by the respective RPC secretariat for peak as well as off-peak scenarios.

b) All SEBs/STUs, transmission licensees, CTU, ISGS, IPPs, MPPs and other generating stations shall provide to the respective RPC Secretariat their proposed outage plan in writing for the next financial year by 31st October of each year. These shall contain identification of each generating unit/transmission line/ICT etc., the preferred date for each outage and its duration and where there is flexibility, the earliest start date and latest finishing date. Each SLDC shall submit LGBR for its control area, for peak as well as off-peak scenario, by 31st October for the next financial year, to respective RPC Secretariat. The annual plans for managing deficits/surpluses in respective control areas shall clearly be indicated in the LGBR submitted by SLDCs.

c) RPC Secretariat shall compile LGBR for peak as well as off peak scenario and also prepare annual outage plan in the respective region. RPC Secretariat shall then come out with the draft LGBR and draft outage plan for the next financial year by 30th November of each year for the regional grid taking into account the utilization of available resources in an optimal manner and to maintain security standards. This will be done after carrying out necessary system studies and, if necessary, the outage plan shall be rescheduled and LGBR shall be modified, accordingly. Adequate balance between generation and load requirement shall be ensured while finalizing outage plan. The draft LGBR and draft outage plan shall be uploaded by the RPCs on their websites."

d) The outage plan shall be finalized in consultation with NLDC and RLDCs. The final LGBR after considering comments/observations of the stakeholders shall be prepared by RPC Secretariat by 31st December of each year. The final outage plan and the final LGBR shall be intimated to NLDC, Users, STUs and CTU, other generating stations connected to the ISTS and the RLDC by 31st December of each year for implementation. The final outage plan and the final LGBR shall be made available on the websites of the respective utilities and on the websites of RPCs, RLDCs and NLDC.

e) The above annual outage plan shall be reviewed by RPC Secretariat on quarterly and monthly basis in coordination with all parties concerned, and adjustments made wherever found to be necessary.

f) In case of emergency in the system, viz., loss of generation, breakdown of transmission line affecting the system, grid disturbances, system isolation, RLDC may conduct studies again before clearance of the planned outage.

g) NLDC/RLDC are authorized to defer the planned outage in case of any of the following, taking into account the statutory requirements:

i. Grid disturbances

ii. System isolation

iii. Partial Black out in a state

iv. Any other event in the system that may have an adverse impact on the system security by the proposed outage.

h) The detailed generation and transmission outage programmes shall be based on the latest annual outage plan (with all adjustments made to date.

i) Each User, CTU and STU shall obtain the final approval from RLDC prior to availing an outage.

j) RPCs shall submit quarterly, half-yearly reports to the Commission indicating deviation in outages from the plan along with reasons .These reports shall also be put up on the RPC website."

36. CERC in its ROP of 10.1.2013 asked CTU to clarify, "If initial outage of Agra-Gwalior line was for three days, when extension was requested and when work was actually completed? Whether approvals of RPCs were taken for this outage?"

37. PGCIL has in its submission dated 13.2.2013, submitted that simultaneously outage of 400 kV Bina-Gwalior and Agra-Gwalior ckt-2 was requested from 27.7.12 to 29.7.12 through e-mail. NLDC had cleared the outage. The work could not be completed by 29.7.12 due to heavy rains around Bina sub-station on that day. Meanwhile, the other circuit of Bina-Gwalior line tripped on R-phase fault at 15:13 hours on 29.7.12 giving rise to extreme emergency in the system. Available man power and material deployed for Bina-Gwalior ckt-2 had

to be diverted emergently for Bina-Gwalior circuit-1 restoration, which could be synchronized at 19:34 hours. The work of circuit-2 remained unfinished and it was not possible to return the permit and to normalize it immediately. RLDCs verbally enquired about the completion and it was conveyed that shut down was to be continued. POWERGRID further stated that the shutdown requirement for transmission lines is submitted to RPCs on monthly basis as a routine practice as the same is approved by the OCC of the RPCs. On several occasions in discussion on the issue of shut-down planning of transmission line Northern Regional OCC has noted that POWERGRID is only utility which submits shut-down planning. The OCC in its 46th, 47th and 48th meetings have authorized NRLDC to approve need based shut-down as and when required depending on the system condition. For 400 kV Agra-Gwalior-II, POWERGRID had requested WRLDC for the outage. This outage proposal involved construction related activities and definite schedule for such outage is extremely difficult to plan one month in advance due to inherent uncertainties associated with such construction activities such as equipment delivery, availability of expert commissioning personnel and sudden changes in weather conditions at site. NLDC had approved a curtailed outage schedule.

38. The Regulation 5.7.4 of the Grid Code provides amongst others that the RPC Secretariat is primarily responsible for the finalization of annual outage plan for the following financial year by 31st January of each year. It is noticed that two important links, namely the 400 kV Bina–Gwalior-Agra-II were under planned shutdown at the time of peak demand (which generally occurs in the month of July and August) in the Northern Region. No details of the approval for outage planning have been made available by NRPC/WRPC. However, the following

information has been accessed from the web-site of NRPC as regards the agenda of the 79th OCC meeting dated 7.9.2013:

"*During 78th OCC meeting, in response to a query as to why shut down of one circuit of 400 kV Agra-Gwalior line for major work involving up-gradation from 400 kV to 765 kV was availed without the approval of OCC, representative of POWERGRID had sought time to explain the same. Accordingly, POWERGRID was requested to furnish reasons within 7 days. POWERGRID vide their e-mail dated 29.08.2012 have clarified that "Agra- Gwalior line belongs to Western Region and up-gradation work was also being executed by Western region. Therefore, shutdown of the aforesaid line was taken by Western Region. As the shutdown was taken by Western region, the approval of OCC was not taken by Northern region". This position has been checked with WRPC and it has been reported that approval of shut down was not taken by POWERGRID from OCC of WRPC either. Further, the provisions in IEGC and Grid Standards lead to interpretation that in case of inter-regional lines, its shutdown should have been got approved from OCC of both the regions."*

39. Relevant extracts from the minutes of the OCC meetings of Northern Region referred to by POWERGRID in its submission dated 13.2.2013 are given below:

"During 48th meeting held on 12th March, 2010, SE (O) stated that year wise plan had to be submitted by transmission utilities to optimize the transmission system outages in the Northern Grid. ***He expressed that this was important in view of the Limited shut-down available during peak period in a day in the peak summer & winter seasons.***

During 73rd OCC meeting held on 16th March, 2012, the transmission lines outages discussion the shut-down even for one day for crossing of 765 kV Fatehpur-Agra Line and Agra-Meerut Line were discussed and NRLDC suggested for completion of both the work in one day. In respect of proposed shut-down of Allahabad-Mainpuri I and II for completion of 765 kV Fatehpur Agra Line, ***NRLDC was of the opinion that load shedding or backing down may have to be carried out.***"

40. WRLDC in their reply dated 18.2.13 has stated that system studies were carried and reduction in TTC was suggested by WRLDC during the shutdown. WRLDC further stated that as per outage planning procedure, planned outages are being discussed in respective OCC meeting of WRPC and availed based on the actual grid conditions and or any changes on account of the transmission system owner. Normally the OCC meetings of WRPC are scheduled from 10th to 15th of every month, but planning and scheduling of all planned outages are not being proposed by the concerned utilities one month in advance despite the efforts of WRPC and WRLDC. The proposals received after OCCM which cannot wait till the next OCCM are processed by WRLDC as per operating procedure and based on system conditions. *The approval of emergency outages in the transmission network level is being coordinated by RLDCs and NLDC (for IR links) in real time based on system condition.* The 400 kV Gwalior-Agra line was not a part of the agenda by POWERGRID NR-1 and NR-2 and was not discussed in WR-OCC. The requisition for shut down of this line was subsequently received at NLDC/RLDC. Being an inter-regional link, the shutdown was received from NR-1 through NLDC.

41. Further on pursuing the record of e-mail, we find that an e-mail was sent by Chief Manager POWERGRID, Vadodara to WRLDC POSOCO at 10:58 am on 26.7.12. According to this e-mail, the shutdown was from 10:00hours of 27.7.12 to 18:00 hours of 29.7.12. NLDC commented “shut down may please be given from 07:00 hours of 28.7.12 to 19:00hours of 29.7.12 for 400 kV Agra-Gwalior ckt-II for above work. It is also discussed with CPCC NR-I (as Kankroli-Zerda emergency shutdown is required by NR-1 on 27.7.12 and Kankroli-Bhinmal is already out). So kindly allow shut down from 28.7.12.”

42. In response to the directions of the Commission in the Record of the Proceedings of 20.2.2013, POWERGRID, vide its affidavit dated 18.4.2013, has submitted as under:

"In construction activities, it is difficult to exactly give the progress status of the work one month in advance due to the inherent uncertainties involved. The situation changes on daily basis and many times critical problems of supply of equipment/erection, resource mobilization, Right-of-Way issues, sudden weather changes emerge which affects work progress. Similarly, timely availability of OEM engineers is also very difficult in most cases. Hence definite time schedule for shut-down related construction activities is difficult to plan one month in advance'

This is not a convincing reason for bypassing the procedure which needs to be coordinated and approved at an appropriate forum bringing it to the knowledge of all concerned well in advance."

43. We notice that POWERGRID availed shutdown of 400 kV Bina-Gwalior-Agra line-II without due deliberation in the OCC forum where all the constituents are present. The role of POSOCO in approving the shutdown in a hurry through e-mail indicates lack of due diligence in permitting the shutdown, which in our view should have been carried out well in advance in a coordinated manner. The shut-down of Bina-Gwalior-Agra II should have been brought to the notice of RPCs and constituents so that necessary actions with respect to backing down and load shedding could be planned during actual shut-down. POWERGRID cannot apply such shortcuts when there is a need for deliberate discussion and study while allowing shut-down of vital ISTS and Inter Regional Lines in the absence of any emergency. We find that POWERGRID and POSOCO have overstretched the liberty given by RPC to allow need based shut-down. It is noted that NR had a requirement of 45,860 MW in the month of June 2012, with shortage of over 11 %, and NLDC/RLDCs should be prudent while allowing shut down in such situations.

44. It is evident from the submission of POWERGRID and POSOCO that in the entire process of shut down of Agra-Gwalior-Bina ckt–II, NRPC and WRPC were not involved. POWERGRID in OCC meeting of NRPC first informed that shutdown was taken after permission from WRPC. On verification from WRPC, it was found by NRPC that WRPC had not given any such permission. In view of the e-mail which was submitted by POWERGRID to the Commission vide their submission dated 13.02.2013, it appears that correct information was not being shared with stakeholders.

45. The NRLDC was authorized to give shutdown only in case of emergency. The communication (email) from CTU to RLDC did not mention any emergency situation. The up-gradation from 400 kV to 765 kV is not an emergency condition and cannot be said to be unplanned outage. It appears that there was an effort on the part of POERGRID to take advantage of commissioning of the line at 765 kV from 1st August, 2012 to avail COD as per CERC Tariff Regulations, 2009. In view of this, to avoid bunching of commissioning, of assets during the last few days of a month, Commission has proposed amendment so as to enable commissioning of assets on any day of the month.

46. We find that RLDCs have over-stretched the authorization given by RPC for allowing need based shutdown. We find that POWERGRID failed to comply with Regulation 5.7.4 (c) of the Grid Code. WRLDC and NRLDC have failed to comply with Regulation 5.7.4(g) (iv) of Grid Code relating to outage planning.

(iv) Role of POWERGRID in implementing protection philosophy in 400 kV Bina-Gwalior line-I

47. POSOCO report contains that voltage at Bina node at the time of tripping of 400 kV Bina-Gwalior line- I was 220 kV (Ph-N) with phase current of 2.23 kA corresponding to 1450 MVA flow. The event list at Bina indicates that Zone-3 Main-II protection has operated. There was no incidence of a fault and

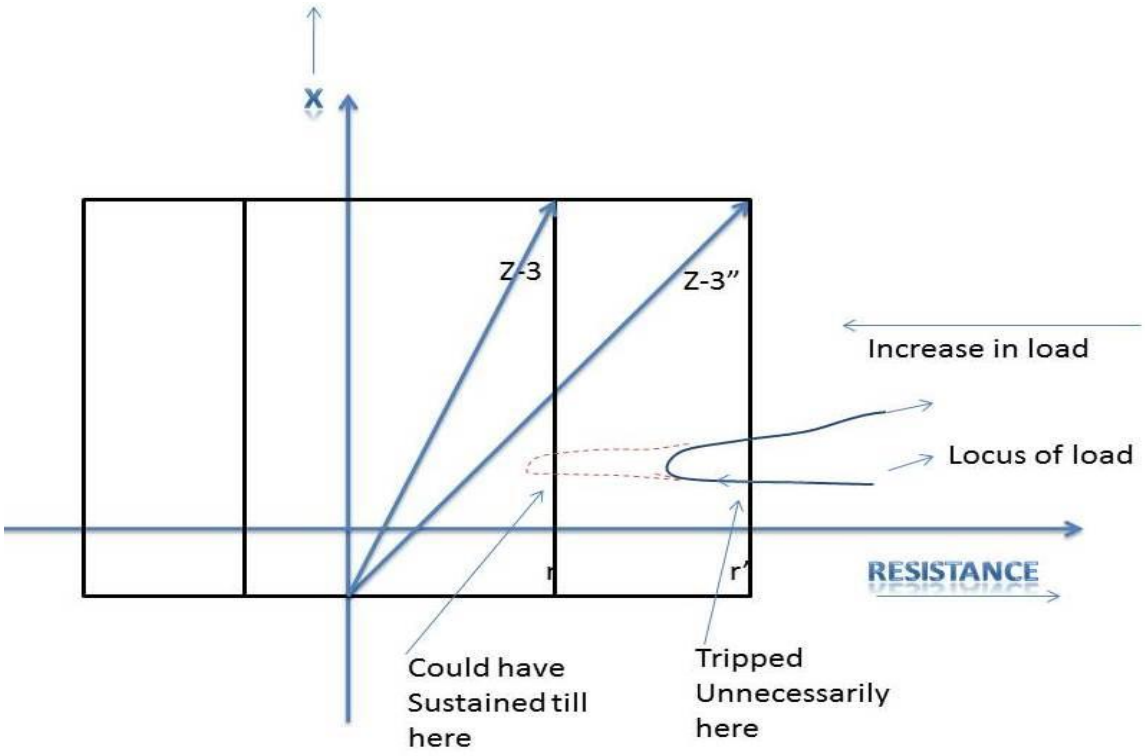
therefore it appears to be a case of load encroachment. No details of relay setting were provided in the report submitted by POSOCO as well as Report of the Enquiry Committee constituted by Govt. of India. In order to understand the reason of actual tripping we directed WRPC Secretariat, in the hearing on 10.1.2013 (RoP dated 31.1.2013) to submit its views on whether the line tripping at load encroachment is correct and whether RPCs' protection philosophy for blocking of tripping on Power swing in zone I and II and zone III is followed.

WRPC Secretariat submitted and explained during hearing on 20.2.2013 that a team of engineers from WRPC, MSETCL and TPC has done simulation testing of the relay (Main-II) and found that the relay had tripped due to load encroachment. In response to our query as to whether the settings adopted on Main-II relay of Bina-Gwalior line by POWERGRID was correct, the representative of WRPC submitted that the reactive reach for Zones 1, 2 and 3 adopted in 400 kV Bina- Gwalior line-1, Main-II relay are in line with CBIP Protection Guidelines. However, the relay requires a phase to phase resistive reach and phase to earth resistive settings to be set. There are no precise guidelines for resistive reach settings to be adopted. As per data submitted by POWERGRID, the resistive reach adopted for phase to phase fault was equal to that for phase to earth fault during the two incidents. POWERGRID has not provided basis of calculation for the same. However, it is clear that phase to phase resistive reach is generally smaller than phase to earth resistive reach. POWERGRID have themselves, vide test report dated 10.8.2012, suo-motu revised these settings and the same were forwarded by WRPC to the Commission earlier and now these revised settings are in order for the resistive

reaches. Further WRPC submitted that during testing conducted by the WRPC team, the relay tripped at about 1500 MVA for the first incident and about 1300 MVA for the second incident due to voltage and permitting more loading.

48. POWERGRID in the hearing on 23.4.2013 has submitted that they had made settings considering the limitation of terminal equipment at both Bina and Gwalior 400 kV sub-stations, rated for 2000 Amp., which corresponds to 1500 MVA (approx).The load considered for relay setting of Bina-Gwalior transmission lines is 1500 MVA even though the transmission lines are of Quad conductor. The transmission line can carry high current but current has to be restricted to remain within the carrying capacity of the station equipment.

We appreciate the efforts of protection testing team of WRPC in clearly bring out the reason of tripping and inadvertent resistive settings in Main-II relay that caused tripping of the relay which in turn contributed to the Grid disturbance on both incidents. Further this setting was not in line with the setting adopted for resistive reach of Main-I. We are displeased with POWERGRID about non-disclosure of error in the resistive setting to POSOCO as well as to the Enquiry Committee and the Commission. We agree with the view of protection testing team of WRPC that the wrong resistive setting caused the tripping of the relay. The tripping due erroneous setting is explained below in a simplistic manner:



Let us say the setting was done for Z3' (corresponds to r'), a higher value in place of Z3 (corresponds to r). The setting increased the area seen by the relay. When the line relay sensed the approaching load and when the load crossed this preset value ("Z3"), the relay signaled the tripping of circuit breaker considering as zone-3 fault.

We note that it was an inadvertent error but POWERGRID did not acknowledge the same. POWERGRID should have conveyed the erroneous resistive setting to all concerned. Further Regulation 3(e) of the CEA Grid Standards, Regulations 6(4)(a) of CEA (Technical Standards for Connectivity to the Grid) Regulations, 2007 and 5.2 (l) of the Grid Code provide as under:

3. Standards for Operation and Maintenance of Transmission Lines.- (1) All Entities, Appropriate Load Despatch Centres and Regional Power Committees, for the purpose of maintaining the Grid Standards for operation and maintenance of transmission lines, shall,-

(a) xxxx.

(b) xxxx.

(c) xxxx.

(d) xxxx.

(e) Provide standard protection systems having the reliability, selectivity, speed and sensitivity to isolate the faulty equipment and protect all components from any type of faults, within the specified fault clearance time and shall provide protection coordination as specified by the Regional Power Committee.

Regulations 6(4)(a) of CEA (Technical Standards for Connectivity to the Grid)

Regulations, 2007:

6(4)(a)"The Requester and user shall cooperate with the Regional Power Committee, and Appropriate Load Despatch Centres in respect of the matter listed below, but not limited to:-

a) Protection coordination and setting of its protective relays accordingly;"

2.4.2 Of Grid code provides that "The following functions which go to facilitate the stability and smooth operation of the systems are identified for the RPC:

(f) xxxx.

(g) xxxx.

(h) xxxx.

(i) xxxx.

(j) xxxxx;

(f) To undertake operational planning studies including protection studies for stable operation of the grid;

(g) To undertake planning for maintaining proper voltages through review of reactive compensation requirement through system study committee and monitoring of installed capacitors;

(h) To evolve consensus on all issues relating to economy and efficiency in the operation of power system in the region."

Regulation 5.2 (l) of the Grid Code provides as under:

"(l) Provision of protections and relay settings shall be coordinated periodically throughout the Regional grid, as per a plan to be separately finalized by the Protection sub-Committee of the RPC".

49. NRPC in its affidavit dated 26.11.2012 has submitted that the responsibility of protection coordination has been entrusted to RPC in accordance with the Regulation 3(e) of the CEA Grid Standards Regulations and 5.2 (I) of the Grid Code were not complied with. Accordingly, NRPC has formulated a uniform protection philosophy. Besides this, protection related issues are discussed regularly in the Protection Sub-Committee meetings which are generally held quarterly. The protection philosophy of NRPC on power swing is given below:

"Block tripping in all zones, all lines. Out of Step tripping to be applied on all inter regional tie lines block time delay = 2s."

WRPC protection philosophy also provides Block tripping in all zones for 2 seconds. However the report of POSOCO gives the following details of tripping on 30th and 31st July, 2012 on power swing:

S No.	Time	Line	Remarks
30th July 2012			
1	02:33:15:400	400 kV Muzaffarpur-Gorakhpur-1	Tripped from Gorakhpur end due to operation of Main-1 protection apparently due to power swing/load encroachment.
2	02:33:15:491	400 kV Biharsharif-Balia-1	Both Main-1 (MICOM P442) and Main-2 (SIPROTEC) distance protection operated at Biharsharif end due to power swing.
3	02:33:15:491	400 kV Biharsharif-Balia-2	Both Main-1 (MICOM P442) and Main-2 (SIPROTEC) distance protection operated at Biharsharif end due to power swing
4	02:33:15:576	400 KV Patna-Balia-1	Tripped at Patna end on operation of Main-2 protection due to power swing.
5	02:33:15:576	400 kV Patna-Balia-2	Tripped at Patna end on operation of Main-2 protection due to power swing.
31st July 2012			
6	13:00:19:948	400 kV Raigarh-Rourkela-3	The DR at Rourkela end at Exhibit 6.16 shows the voltage dipping to 23 kV phase to ground viz. 40 kV phase to phase and a current of 2.2 kA. The line tripping could be due to power swing/load encroachment.
7	13:00:20:2013	400 kV Ranchi-Rourkela-1	Line tripped at Rourkela end on operation of Main-1 protection. The line appears to have tripped due to power swing/load encroachment.
8	13:00:19:981	400 kV Talcher-Rourkela-2	Tripped at Rourkela end on operation of Main-1 and Main-2 distance protection. The line appeared to have tripped due to power swing.

9	13:00:19:986	400 kV Talcher-Rourkela-1	Tripped at Rourkela end on operation of Main-1 and Main-2 distance protection. The tripping is apparently on power swing.

It is evident that on 30.7.2012 and 31.7.2012, many inter-regional lines (ER-NR) tripped on power swing, which occurred after tripping of 400 kV Bina-Gwalior line-I.

50. NTPC has suggested that the distance protections of lines are not intended for tripping on Power Swings. The problem is that the otherwise robust distance protection relays suffer from their inability to discriminate between the three phase fault impedance from the fictitious impedance presented to it during Power Swings. The relays can overcome this handicap by a supplementary logic of Power Swing Blocking (PSB) inherent to the relay. However, the choice of blocking one Zone, all Zones or any combination of Zones on Power Swing detection is left to the user. The practice followed in India is mostly of blocking Zone-2 and Zone-3 and allow the distance protection relay to trip in Zone-1. The situation leads to tripping of lines even for stable power swings. The worldwide practice is to block distance relay tripping in all zones and to apply Loss of Synchronism protection on pre-chosen axis to cause separation in the event of unstable swings**.** The arrangement will cause no tripping for stable swings and positively separate for loss of Synchronism. In case the above is adopted the lines would not trip for most Power Swings and the machines and the load in the system will adjust to its new equilibrium in case of a line fault and readjusted load flows. In case of actual risk of instability or loss of synchronism, the system needs to be split along the pre-chosen axis by application of “Loss of Synchronism” protection on selected lines. This

suggested treatment of Power Swings in Protection application needs to be discussed among protection engineers for deciding the appropriate solution.

51. We find that the protection settings adopted by POWERGRID were not in line with the protection philosophy approved by RPCs. Accordingly, we conclude that POWERGRID failed to comply with Regulation 3(e) of the CEA Grid Standards and Regulation 5.2 (l) of the Grid Code. RPCs shall ensure that the approved philosophy is adopted by all users. Any non- compliance shall be reported to the Commission under Regulation 1.5 (ii) of the Grid Code which reads as under:

1.5 Compliance Oversight

(ii) The Regional Power Committee (RPC) in the region shall also continuously monitor the instances of non-compliance of the provisions of IEGC and try to sort out all operational issues and deliberate on the ways in which such cases of non-compliance are prevented in future by building consensus. The Member Secretary RPC may also report any issue that cannot be sorted out at the RPC forum to the Commission.

52. In the disturbance of 30th July 2012, POSOCO had relied on POWERGRID's affirmation that it was load encroachment tripping on 400kV Bina-Gwalior line-I and allowed the charging of line. Had they known that resistive settings were wrong, they would have advised revision of settings before allowing charging of line. We direct ISTS licensees to submit details of updated distance protection relay setting of all inter-regional lines with POSOCO & RPCs. Further, record of distance protection relay settings of all lines emanating in respective substations be kept there.

(V) Role of POSOCO in Congestion maintenance

53. NLDC has, in its affidavit dated 10.12.2012, made submission on three issues out of the issues highlighted in the Commission's order dated 16.12 2012 as under:

(a) Net over-drawal by constituents of the Northern Region was about 500 MW and the 400 kV Gwalior-Agra section was still overloaded: NLDC has submitted that after checking the data from SEM meters for the period 0200-0215 hours and 0215-0230 hours of 30.7.2012, the net over-drawal/under-injection of entities within the Northern Region was actually of the order of 1700-1800 MW. The mismatch was mainly on account of the over-drawal by the control areas of Haryana, Punjab and UP which were showing much lower value in SCADA, leading to the confusion.

(b) Revision of TTC and ATC after outage of 400 kV Zerda-Kankroli S/C line on 29.7.2012: TTC/ATC computation used to give broad indication of the estimated power transfer ensuring grid N-1 security and provide the data for approving transactions under short term open access. Calculation of TTC/ATC are done by RLDCs/NLDC three months in advance and revised periodically either due to planned outages, changes in load generation, geographical disposition affecting network loadings and/or whenever the line goes on forced outage and is likely to remain for prolonged periods. The actual operating conditions may vary from what was assumed in the studies for computing TTC/ATC and the operator has to be guided by the real time flows and network topology. In the case in hand, the sequence of events as brought out in the report is as follows:

- 220 kV Kota-Badod went under forced outage since 15:15 hours of 29.7.2012

- 400 kV Bina-Gwalior-Agra ckt-II shutdown was scheduled to return at 18:00 hours of 29.7.2012 but got extended.
- 400 kV Bhinmal-Kankroli went under forced outage at 21:45 hours of 29.7.2012

The situation was critical, particularly after the above outages and over-drawal by many of Northern Region constituents leading to heavy power flows in the West to North lines over the remaining transmission lines. The task of NLDC/RLDC was to bring down the drawal on emergency basis and revision of TTC/ATC would not have brought down the power flows till actions by Northern and Western Region constituents were physically taken for curtailment of UI followed by STOA. After the situation was brought under control and the position of the different circuits known, TTC revision could be taken up by RLDC.

54. NLDC further states that Enquiry Committee has recommended the following:

NLDC and each RLDC should have one real-time security desk in all the shifts to be manned by engineer capable of carrying out TTC calculations. To facilitate this, manpower at NLDC and RLDCs need to be enhanced with regulatory support to take care of financial aspects. Till this arrangement can be firmed up, various scenarios of outages could be built, which then can be used by despatcher in real time. Faster algorithm for calculation of TTC may be adopted by the load despatchers to update it in real time under outage conditions.

Post disturbance NLDC/RLDCs are taking up the above recommendation for manning of security desk at each RLDC and NLDC by engineers capable of carrying out TTC calculations.

(c) No Notice for application of congestion charges was given by NLDC/WRLDC: In accordance with the Commission's order dated 17.3.2010 and clause 5.4 of the Procedure approved under the Congestion Regulations,

congestion charges cannot be imposed if the power flow on the corridor is as per the schedule but the congestion has been caused by forced outages of a line in the corridor which occurs after drawal schedule has been fixed. NLDC has submitted that the Commission vide para 22 of the order dated 17.3.2010 "Rate of Congestion charge in real time operation in inter-State transmission of electricity" directed as under:

> *"22. In view of the discussion in the foregoing paragraphs, we find that there is no objection to the proposed rate of congestion charge. Therefore, based on the rationale given in our order dated 8.1.2010, the following directions are issued:*
> **********
> *(d)* ***No congestion charge shall be levied for congestion in a transmission corridor, if the power flow on the corridor is as per the schedule, but the congestion has been caused by forced outages of a line in the corridor, which occurs after the drawal schedule has been fixed****.*
> *(e) Such contingencies would have to be tackled through emergency instructions by the concerned SLDCs/RLDCs/NLDC to the concerned regional entities in order to relieve the congestion on the considerations of grid security."*

55. NLDC has further submitted that as per clause 5.4 of "Detailed Procedure for Relieving Congestion in Real Time Operation" issued under the Congestion Charges Regulations, no congestion charges shall be leviable for the congestion caused by forced outage. The said provision is extracted below:

> *"5.4 If the power flow on the corridor is as per the schedule, but the congestion has been caused by forced outages of a transmission line in the corridor, which occurs after the drawal schedule has been fixed, then open access transactions shall be curtailed in the priority given in the Central Electricity Regulatory Commission (Grant of Connectivity, Long-term Access and Medium-term Open Access in inter-State Transmission and related matters) Regulations, 2009 followed by revision of TTC, TRM and ATC.* ***No congestion charge shall, however, be applicable in such a case."***

56. NLDC has submitted that as per the directions contained in the Commission's order dated 17.3.2010, and the Approved Procedure, congestion charge cannot be imposed if the power flow on the corridor is as per the schedule, **but the congestion has been caused by forced outages of a line in the corridor, which occurs after the drawal schedule has been fixed.**

57. We have considered the submission of NLDC. Though NRLDC had been intimating the constituents as regards the safety limits being crossed, it however did not apply congestion charges which would have deterred the constituents from over-drawal. We do not find that the interpretation of NLDC for non-application of the congestion charges prior to the grid disturbance when the lines were getting overloaded due to over-drawal by the constituents was proper. The information submitted in the responses of NRLDC, the details of the Total Transfer Capability (TTC)/ Available Transfer Capability (ATC) with respect to WR–NR and the respective flows have been examined. The details of TTC and flow available from the notices are as under:

Date	**Time**	**TTC/ATC**	**Actual Inter-Regional (IR) flow**	**Agra Gwalior–I loading**	**Remarks** **Over drawl**
	(Hrs)	(MW)	(MW)	(MW)	(MW)
29.7.2012	0952	2000/1800	Not available	833	
29.7.2012	1153	2000/1800	Not available	936	Har-715 MW Pun- 825 MW UP-1360 MW
29.7.2012	1159	2000/1800	Not available	833	Har-700 MW Pun- 700 MW UP-1500 MW Utt-350 MW WR Under-drawl- 2340 MW frequency- 49.74 Hz
29.7.2012	1441	2000/1800	2650	900	Haryana-520 MW Punjab- 698MW Uttar Pradesh-1200 MW Utt-320 MW
29.7.2012	2342	2000/1800	2748	990	Bus voltage Gwalior – 387 kV

NRLDC had considered 650 MW as the safe flow on the Agra-Gwalior line. It is clear from the above that there was congestion since the morning hours of 29.7.2012. However, at 14.41 hours, the TTC/ATC of WR-NR line was 2000/1800 MW and the actual flow was 2650 MW, which cannot be termed as instantaneous, as the situation was more or less the same since the morning. The first inter-regional element which had tripped was 220 kV Kota-Badod at 15:15 hours and in the Western Region, Bina-Gwalior line-I had tripped at 15:10 hours.

58. Relying on the Regulation 4 and 6 of the Congestion Charges Regulations and paras 5.2 to 5.6 of the Detailed Procedure issued under Congestion Charges Regulations, POSOCO has submitted that the 220 kV Badod-Modak line was under forced outage since 00:20 hours on 29.7.2012 and 220 kV Badod-Kota line was under heavy load due to heavy drawl by the Northern Region constituents. 400 kV Bina-Gwalior line-1 in the Western Region tripped at 15:10 hours (400 kV Bina-Gwalior-2 was already out since 27.7.2012 for up-gradation works and NRLDC noticed a reversal of flow on the 400 kV Gwalior-Agra-1 line). 400 kV Bina-Gwalior line-1 was restored at 19:35 hours and the 400 kV Kankroli-Zerda line was restored at 19:44 hours on 29.7.2013. NLDC has pointed out that as per approved procedure, the congestion charges cannot be imposed if the power flow on the corridor is as per schedule.
59. The clause 22 (d) of the Commission's order dated 17.03.2010 need to be applied with full comprehension, not in parts. The NLDC in its interpretation is missing "If the power flow on the corridor is as per schedule".

After the tripping of 220 kV Badod-Modak line at 00:20 hours on 29th July, 2012, as long as the flow remained within schedule, congestion charges were not applicable, because schedule was finalized before the event. Also drawal schedule need not have been revised as long as the flow in the corridor/IR remained within schedule and the schedule can be managed in depleted network as well.

However, if the power flows are beyond schedule due to UI and it endangers grid security, congestion charges need to be applied to discourage drawal beyond schedule.

We do not agree with the submission of POSOCO that since 220 kV Badod-Modak line had tripped as early as 00:20 hours on 29.7.2012, congestion charges could not be applied. If this is accepted, as almost at all times, there would be some tripping and congestion charges would never be applicable. When a line trips and the tripping does not cause the congestion due to redundancy in the system i.e. the drawal schedule is continued in spite of such tripping, congestion charges are not applicable. However, the tripping may call for revision of TTC/ATC, if POSOCO feels that it would substantially change the Transfer Capability. However in such case with the revised network topology, the schedule is continued; as it is lesser than the permissible Available Transfer Capability (ATC) limit. The Congestion charges are applicable when, due to over-drawal/ over injection, the actual flow in the corridor increases more than the prescribed Available Transfer Capability (ATC), in the existing network. However in the present case POSOCO did neither revise the schedule nor applied congestion charges.

60. POSOCO has prayed for clarification in interpretation of the Congestion Regulation. We have examined the matter and are of the considered view that sufficient mechanisms under the Grid Code and the Congestion Charges Regulations and the Procedure have been provided which empower RLDCs to take necessary action for safety and security of the Grid. Though POSOCO had sent messages to the constituents for curtailment of over drawl/under drawl, adequate action against the constituents for non-compliance of the regulations specified by the Commission should have been taken. For instance, the detailed procedure for the congestion charges provides an alternative that in case of forced outage, after the drawal schedule has been fixed; curtailment of open access should be carried out as per the priority given in the Connectivity Regulations followed by revision of TTC, TRM and ATC. It is noticed that similar situation had arisen on 29.7.2012 and POSOCO had failed to follow the provisions of the Regulations. It was also understood that WR constituents were heavily under-drawing and NR constituents were heavily overdrawing for a few days prior to the Grid disturbance on 30/31.7.2012, particularly during off peak hours and there were many hit and miss conditions. POSOCO should have taken effective regulatory measures to curb this practice. Perhaps POSOCO did not visualize severity of such conditions. There is sufficient regulatory mechanism to curb the over injection/under-drawal/ over-drawal by RLDCs. Regulations 6.5.20, 6.5.27 and 6.5.28 of the Grid Code empowers the RLDC to revise the schedule and curtail the transactions already scheduled as given.

20. If, at any point of time, the RLDC observes that there is need for revision of the schedules in the interest of better system operation, it may do so on its own, and in such cases, the revised schedules shall become effective

from the 4th time block, counting the time block in which the revised schedule is issued by the RLDC to be the first one.

27. When for the reason of transmission constraints e.g. congestion or in the interest of grid security, it becomes necessary to curtail power flow on a transmission corridor, the transactions already scheduled may be curtailed by the Regional Load Despatch Centre.

28. The short-term customer shall be curtailed first followed by the medium term customers, which shall be followed by the long-term customers and amongst the customers of a particular category, curtailment shall be carried out on pro rata basis.

While there could be an issue regarding the interpretation of the Congestion Procedure and Congestion Charges Regulations, we note that after tripping of lines at 15:15 hours on 29.7.2012, congestion should have been managed as per the provisions of the Congestion Regulations and revision of TTC/ATC could also have been resorted to. This, according to us, would have sent a clear message to the utilities of the WR and NR. **We direct POSOCO to take note of this.**

61. **Another important aspect of system operation which we want to analyse is that on the day of incident whether System Operator followed the principle of safe and secure operation of the Grid.**

The submission of the system operator was analysed with respect to the fact that the line which was scheduled to be restored after shut down had not actually been restored. The next day schedule was prepared and allowed with the presumption that this line would be available. ATC/ TTC computed for 30.07.2011 was done with the assumption that this line 400kV (Agra-Gwalior-Bina Line-II) would be available. In the ATC/TTC computation, it is mention that voltage at Gwalior 2nd, in case of tripping of 400 KV Agra Gwalior line is a limiting constraint. So the case, the line is not available whether the drawal schedule finalized for 30.07.2012 could have been accommodated or it required re-schedule? Also due to non-availability of line, 400 MW transfer capability is reduced whether this needs to be communicated to all stake

holders? As ATC/TTC computation are done for N -1 credible contingence, whether not availability this line resulted in affecting N-1 secure status network?

Regarding N-1 secure system operation, following comments in paper titled "**Transmission System operation and Inter Connection by Fernaldo Alvardo and Shamuel Oren"** may be quoted:

"Security

System security is achieved by making system operation tolerant of the outage of any component (some multiple outages are also considered). That is, the outage of any single system component (or predefined set of components) should not cause a cascading outage of equipment that leads to a total or partial blackout. The system should be secure even when an outage is the result of a "shock" such as a short circuit or fault on a component prior to the component's outage. A system that is resistant to the outage of any one component is said to be N-1 secure. In a planning time frame, N-1 security means that the intact system must be able to tolerate the outage of a component.

In a planning timeframe, some allowance is often made for limitations that the system will encounter in real time. One way in which this is sometimes done is by considering the simultaneous failure of any one line and any one generator when doing planning time frame studies. In an operations time frame, however, N-1 security means that the current system must be able to tolerate the "next worst" contingency. Because an actual operating system may have already sustained the outage of one or two components, this is tantamount to operating the system in an N-2 or N-3 condition from the planning point of view. Previous contingencies are "sunk events" from the perspective of system operations. This means that, once a contingency occurs, meeting the N-1 criterion means considering the altered system, not the original system, as the new base case to which the criterion must be applied. It is almost universally accepted that N-1 security is fundamental to system operation and that achieving this level of security is in roughly the same category as making sure that generation meets load: it must be done, regardless of cost. However, once the goal is to make the system N-2 or N-3 secure, cost and other similar considerations enter the picture. Operators have traditionally handled the threat of multiple contingencies adaptively. For example, operators have been known to "move" generation closer to loads when storms approach and the likelihood of an outage (or multiple outages) increases. "Moving" generation means increasing generation at a location near the load and reducing the output of generators far from the load (these actions must be taken together because balance between generation and load must be maintained).

Because of losses in the system depend on the pattern of flows in the transmission system, and changes in losses also depend on transmission system status, an increase in load by 1 MW may require more or less than 1 MW to attain a new system equilibrium. By moving generation around under stormy weather conditions, operators are, in effect, treating the weather as a contingency. Formalizing criteria for taking such measures is not always easy, but efforts are under way to do so. In a traditional environment, the costs of such

redispatch are borne by all, but in a competitive environment these costs will be differentiated by time and location and borne in accordance with the marginal price of electricity at any point in space and time. That is, every node in the system has a possibly unique marginal locational price for electricity (an LMP) which, in theory, reflects the cheapest way to deliver one additional MW of electricity to the location in question without exacerbating problems on any line or other limits. To maintain N-1 (or better) security and achieve a secure operating point that is resistant to cascading failures requires several preconditions:"

First it need to be examined that what options were available to the System operator in case a line which is under maintenance or shut down and expected to come into service at a particular time.

The Agra-Gwalior 400 kV Circuit II was under shutdown for construction activities since 27.7.2012 and was expected to back in service at 18:00 hours of 29th July, 2012. It is evident from 11th revision of ATC /TTC for the month of July, 2012 under which the transfer capability of WR-NR link was increased from 2000 MW to 2400 MW w.e.f from 18:00 hours of 29.7.2012.

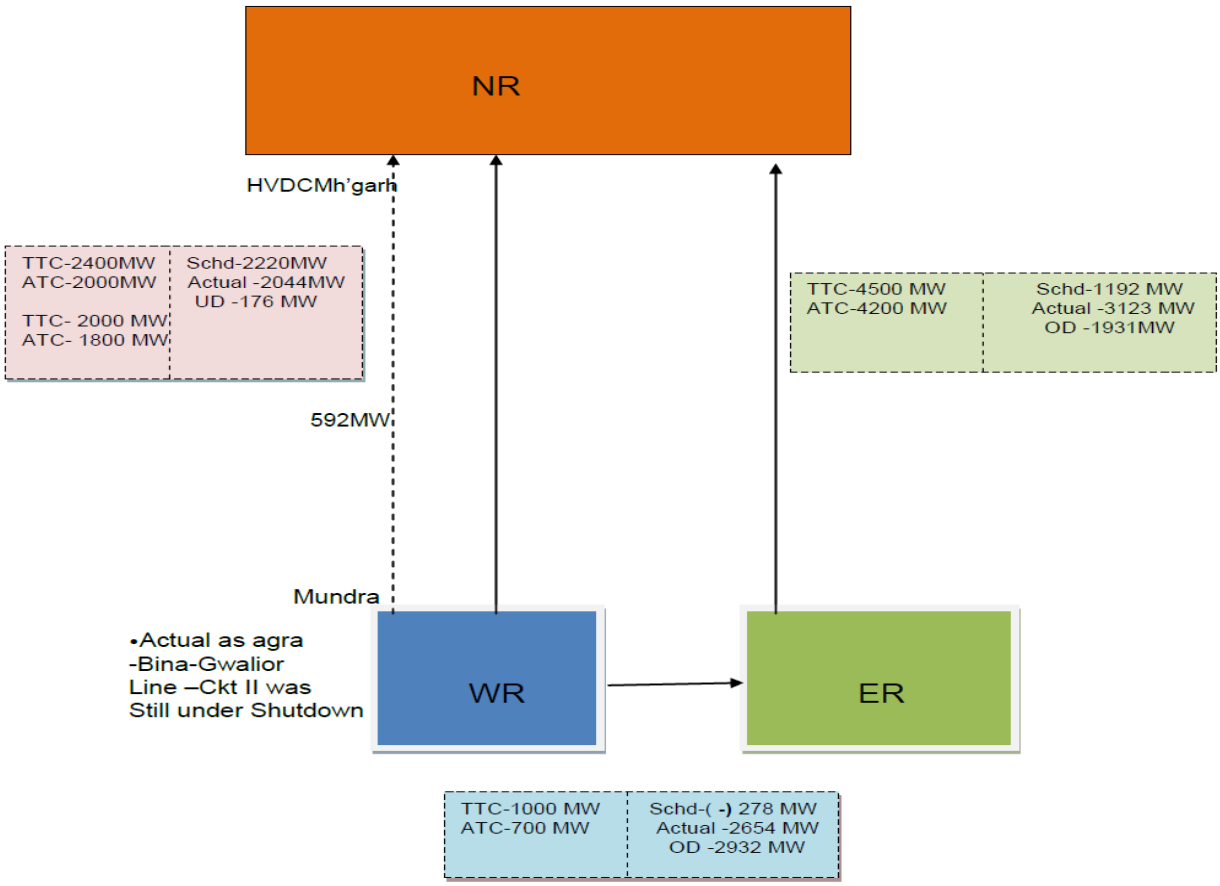
In accordance with the IEGC and procedure for collective transactions the time line for scheduling for the next day i.e. 30.7.2012 is as under:

1. At 3 PM: RLDCs clear Long Term scheduling and short term bilateral scheduling
2. At 3 PM: Collective transactions detail for next day arrives at NLDC for clearance.
3. At 4 PM: Collective transaction details are sent by NLDC to RLDCs.
4. At 5 PM: RLDC confirms to NLDC, the collective transactions which can be scheduled.
5. At 5:30 PM: NLDC confirms to Power Exchanges the collective transactions that can be scheduled.
6. At 6 PM: Despatch schedule of all generators and drawal schedule of all entities is finalised taking into account all three transactions.

It was made clear by NLDC during hearing that schedule for 30.7.2012 was prepared and collective transactions were cleared by taking the Agra-Gwalior –II into service. On the query of the Commission that whether it was ascertained that this line will come into service, it was informed that this is the normal practice that while clearing collective transactions for next day it is assumed that the lines which are scheduled to come out of shut down ,are considered to be in service. The reason stated by NLDC is that many lines are normally under planned maintenance and it is assumed that these will be in service on

scheduled time; it is required for optimum utilisation of the transmission system, otherwise less number of transactions can be scheduled.

Analysis:



Position at 2.30 hrs on 30.07.2013
(As per POSOCO Report)

The system operator is given a mandate for economic, efficient and secure operation. While the economic and efficient operation is to be considered at day ahead operational planning in real time system operation and contingency, secure operation takes precedence over all other considerations.

The decision to consider Bina –Gwalior-Agra ckt–II under operation after 18:00 hours on 29.7.2012 may be considered as a normal practice to enable maximum utilization. However two issues need attention. This line is not an intra-regional line but an inter-regional link serving demand of peak season in Northern Region by transferring power from Western Region. An important aspect about this line is that outage of this line is considered "a Limiting constraint" in ATC/TTC

computation for WR-NR. It is stated that under outage of Bina-Gwalior, low voltage at Gwalior is a limiting constraint. So availability of this line is a critical factor for determining transfer capability for WR-NR corridor.

Hence, even if it was considered to be under service while clearing collective transactions for 30.7.2012, as soon as it became known that it has not revived at scheduled time, the system operator at NLDC, NRLDC and WRLDC should have taken necessary steps for schedule revision because Grid operation is a dynamic activity and needs to be reviewed and necessary revision(s) carried out as soon as new information about status of the system, particularly the important elements becomes available.

In analysis of Total Transfer Capability (TTC), following margins were considered:

Date	Time Period (hrs)	Total transfer Capability (TTC) (MW)	Reliability Margins (MW)	Available transfer Capability (ATC) (MW)	Long Term and Medium Term Open access (MW)	Margin Available for Short Term Open Access (STOA) (MW)
29.7.2012	00-1900	2000	200	1800	260	1540*
29.7.2012	1900-2400	2400	200	2200	260	1940**
30.7.2012	00-24:00	2400	200	2200	260	1940**

* Bina- Gwalior-Agra 400 kV Circuit-II under shutdown
** After expected restoration of Bina- Gwalior-Agra 400 kV Circuit-II

Schedule for 30.7.2012 (26th Schedule) indicates that in the scheduling process following schedule was given for WR-NR link

	00:00-00:15	00:15-00:30	00:30-00:45	00:45-01:00	01:00-01:15	01:15-01:30	01:30-01:45	01:45-02:00	02:00-02:15	02:15-02:30	02:30-02:45	02:45-03:00
(ISGS)	384.81	384.81	384.81	384.81	384.81	384.81	384.81	384.81	359.24	359.24	359.24	359.24
(LTA)	-4.93	-4.93	-4.93	-4.93	-4.93	-4.93	-4.93	-4.93	-4.93	-4.93	-4.93	-4.93
(Bilateral)	1580.27	1580.27	1580.27	1531.17	1489.17	1461.17	1461.17	1461.17	1461.17	1461.17	1461.17	1461.17
(Wheeling)	2	2	2	2	2	2	2	2	2	2	2	2
(IEX)	604.6	648	678	723.1	766.3	798.17	798.35	798.65	798.25	798.4	798.54	798.63
(PXIL)	11.73	10.49	9.58	8.2	6.89	6.17	5.99	5.69	6.09	5.94	5.8	5.71
STOA	2198.6	2240.76	2269.85	2264.47	2264.36	2267.51	2267.51	2267.51	2267.51	2267.51	2267.51	2267.51

It can be seen that STOA was granted for the day touching the limits and also sometime encroaching the reliability margins also.

The transfer capability computation for July, 2012 while stating that low voltage at Gwalior, outage of Bina-Gwalior is limiting constraint, did not clearly state that

whether one circuit of this is considered under outage or both. As at the time of system operation on 00:00 hours, one circuit of Agra-Gwalior–Bina was under outage, two options were available for deciding transfer capability of WR-NR link to maintain it at the same level- revision of Short term open access or if it is to be maintained same, there is a need to closely monitor voltage at Gwalior end. Safer option for grid operation is that the schedules are revised downward so that system does not operate close to the limits.

For voltage management, reactive power management is crucial. The operation of distance relay at Bina end needs examination in this aspect as well. As the limiting constraint for NR import is mentioned as low voltage at Bina in case of outage of Bina-Gwalior, it is necessary that voltage profile in the area is examined in the region. As one circuit of Bina–Gwalior was under planned outage, the voltage condition at Bina end needs to be monitored closely. For handling this type of situation proper voltage management plan or reactive power management like capacitor in the area and reactive power supply from nearby generator needs to be ensured. This issue needs to be examined by CEA or System Study Committee under WRPC.

The cascade tripping of various transmission lines subsequent to tripping of a single line Gwalior-Bina Circuit-I itself indicates that system was not operating under N-I secure condition.

In view of the above discussion, we advise NLDC to take care of the protocols given below, while allowing collective transactions for the next day:

1. The lines which are within a region and not part of limiting constraints or credible contingencies may be considered under service at scheduled revival time. Prior to scheduled revival time, status shall be reconfirmed and if necessary, transaction shall be rescheduled in case the line has not been restored.

2. The transmission lines which are inter-regional or part of limiting constraints or credible contingencies shall not be considered to be in service till these are actually brought back into service. After putting the revival status on web site of NLDC, the margin shall be released for contingency market, if required.

2.Change in operating conditions after forced outage of 400 kV Zerda–Kankroli

While the 400 kV Agra-Gwalior-Bina ckt-II did not come into service at scheduled time at 18:00 hours on 29.7.2012, the operators did not take into consideration this situation and did take action. The system conditions changed further at 21:45 hours when 400 kV Zerda-Kankroli line tripped. Another 400 kV line between WR-NR i.e. Bhinmal-kankroli line also tripped due to insulator decapping. Before that in the afternoon of 29.7.2012, one 220 kV Badod-Kota line also tripped at15:15 hrs.

The Badod-Modak tripped on overload at 00:12 hours on 30.7.12. These were crucial changes in network and affected inter regional flows. After that at 01:35 hours on 30.7.12, 220 kV Gwalior (PG)-Gwalior (MP)-2 line tripped.

The N-1 security compliance requires that after every change in network topology or major change in scheduled generation or load, network analysis is done and it is verified that system is stable for credible contingencies. The POSOCO in its submission had not indicated what procedures are adopted for ensuring that system is N-1 compliant. In this a comparative analysis is required to be done in actual system condition (Network topology and load generation balance) and system conditions considered while computing ATC/TTC for inter-regional links. At a first glance from the submission of NLDC, it is clear that antecedent conditions at 02:00 hours are quite different from the base case considered for ATC/TTC computation for July, 2012. The Northern region generation (off peak) was 32636 MW against 34005 MW considered in base case and load at 2 am was 38322 MW against 36611 MW considered in study. As both network topology and load generation balance was different from base case considered for ATC TTC, the network security condition was quite different from the assumed conditions**. CEA is directed to constitute a system study group under WRPC to examine this issue in detail.**

The system operation should not be merely guided by ATC/TTC. In the US-Canada Power system outage Task Force report of August 14th, 2003 blackout; following recommendations have been made:

"Each transmission provider calculates Available Transfer Capability (ATC) and Total Transfer Capability (TTC) as part of its Open Access Transmission Tariff, and posts those on the OASIS to enable others to plan power purchase transactions. TTC is the forecast amount of electric power that can be transferred over the inter-connected transmission network in a reliable manner under specific system conditions. ATCs are

forecasts of the amount of transmission available for additional commercial trade above projected committed uses. These are not real-time operating security limits for the grid.

The monthly TTC and ATC values for August 2003 were first determined a year previously; those for August 14,2003 were calculated 30 days in advance; and the hourly TTC and ATC values for the afternoon of August 14 were calculated approximately seven days ahead using forecasted system conditions. Each of these values should be updated as the forecast of system conditions changes. Thus the TTC and ATC are advance estimates for commercial purposes and do not directly reflect actual system conditions. NERC's operating procedures are designed to manage actual system conditions, not forecasts such as ATC and TTC.

Within ECAR, ATCs and TTCs are determined on a first contingency basis, assuming that only the most critical system element may be forced out of service during the relevant time period. If actual grid conditions-loads generation dispatch, transaction requests, and equipment availability-differ from the conditions assumed previously for the ATC and TTC calculation, then the ATC and TTC have little relevance for actual system operations. Regardless of what pre-calculated ATC and TTC levels may be system operators must use real-time monitoring and contingency analysis to tract and respond to real-time facility loadings to assure that the transmission system is operated reliably.

As stated earlier the network condition and load generation balance on the day was quite different from the scenario assumed while computing ATC-TTC, so for scheduling and operation on 30.7.2012, relying too much on ATC-TTC was not a prudent operation practice. So to avoid such incidents in future, real time network security analysis needs to be used with half an hour scenario analysis. For effective working of this, it is required that real time data is integrated with EMS system and the deficiencies in data communication, if any need to be addressed and rectified on urgent basis.

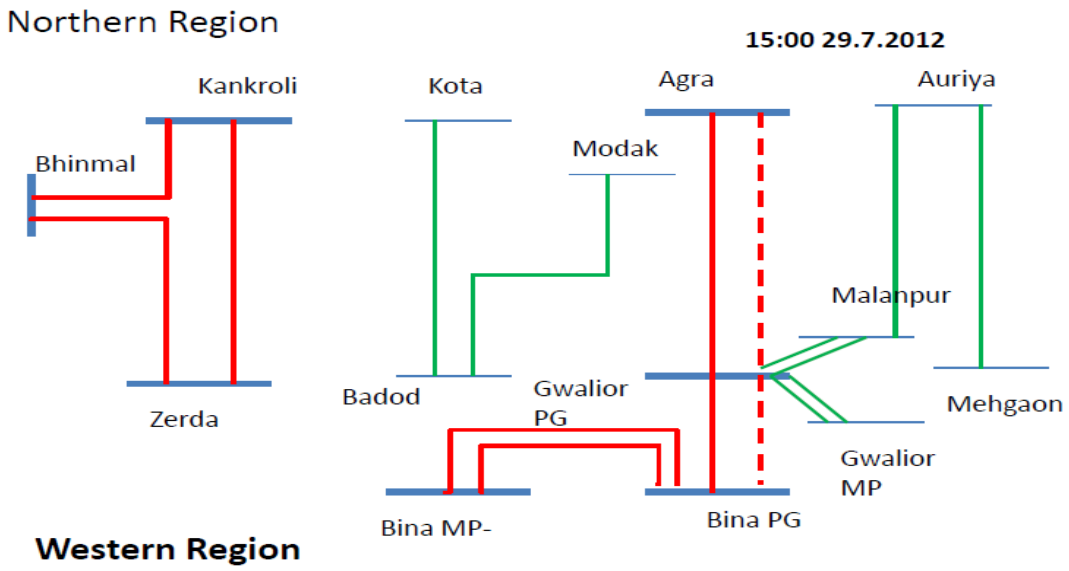
The facility to compute network security status needs to be commissioned urgently in NLDC and all RLDCs. The POSOCO may file a status report on the facility already available and any up gradation if required to conduct real time network security analysis.

We would like to see whether ATC/TTC limits were monitored by the system operators properly or not.

TTC–ATC Monitoring:

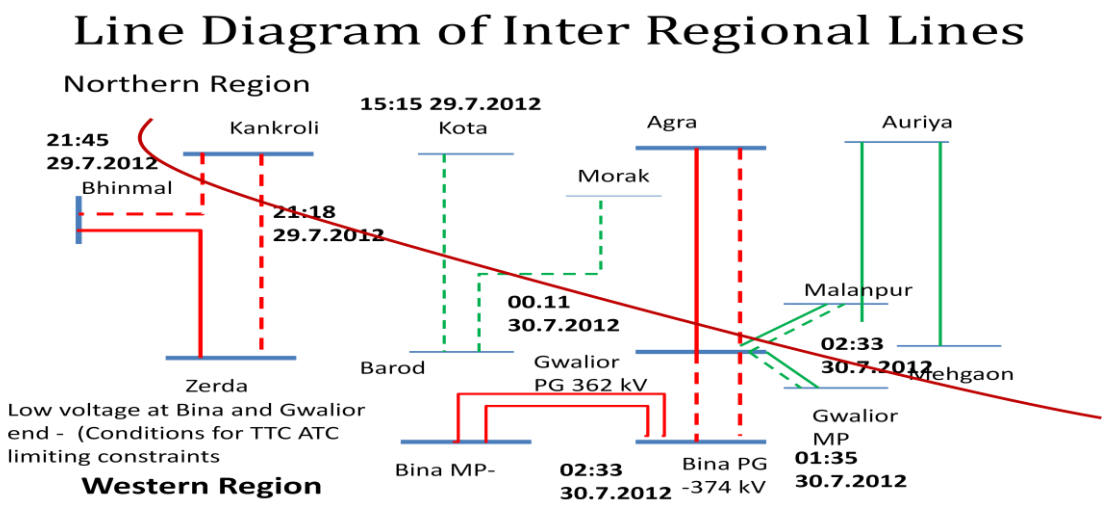
A network diagram for NR-WR depicting status of interconnection between WR and NR on 29.7.12 at 15:00 hours is enclosed with detail of subsequent tripping till grid disturbance.

Line Diagram of Inter Regional Lines



Network Status at 15:00 Hrs on 29.07.12 with Agra –Gwalior –Bina Circuit II Expected at 18:00 Hrs

Sr no	Date/Time (Hr)	Event	Remarks
1	29.07.2012 15:15	220 KV Kota- Badod Line	Tripped
2	29.07.2012 21:18	400 KV Zerda – Kankroli OUT	Went in forced Outage due to one T&P struck in polymer insulator. Taken to emergency shut down
3	29.07.2012 21:45	400 KV Bhinmal-Kankroli out	Tripped due to insulator de-capping
4	30.07.2012 00.11	220 KV Badod-Modak	Tripped on over Load
5	30.07.2012 01.35	220 KV Gwalior (PG)-Gwalior (MP)-2	Tripped on over Load
6	30.07.2012 02.33	220 KV Gwalior (PG)-Malanpur-1	Tripped on over Load
7	30.07.2012 02.33.11	400KV Bina- Gwalior-1 Tripped	Tripped on main -2 Voltage Phase-Phase 374 KV and Current 2.23 KA(1450 MVA) -400 KV Bina_Gwalior II was already Out



Network Status at 02:33 Hrs on 30.07.12 with 400 kV Gwalior –Bina Circuit I tripped. After tripping of the last available WR-NR link power started flowing from WR to ER to NR route. As the power flowing on WR-ER link was already much higher than TTC of WR-ER, no security margin was available the handle this contingency.

For 29th July to 30th July, 2012, following TTC/ATC Limits were given as ATC/TTC revision No. 9 to 13 for July, 2012:

WR-NR:

Date	Time	TTC (MW)	Reliability Margin (MW)	ATC (MW)
29.7.12	00-19	2000	200	1800
	19-24	2400	200	2000
30.7.12	00-24	2400	200	2000*

* With expected time of Agra-Gwalior-Bina Circuit-II at 18:00 hours.

WR-ER (11th July, 2012-31st July, 2012):

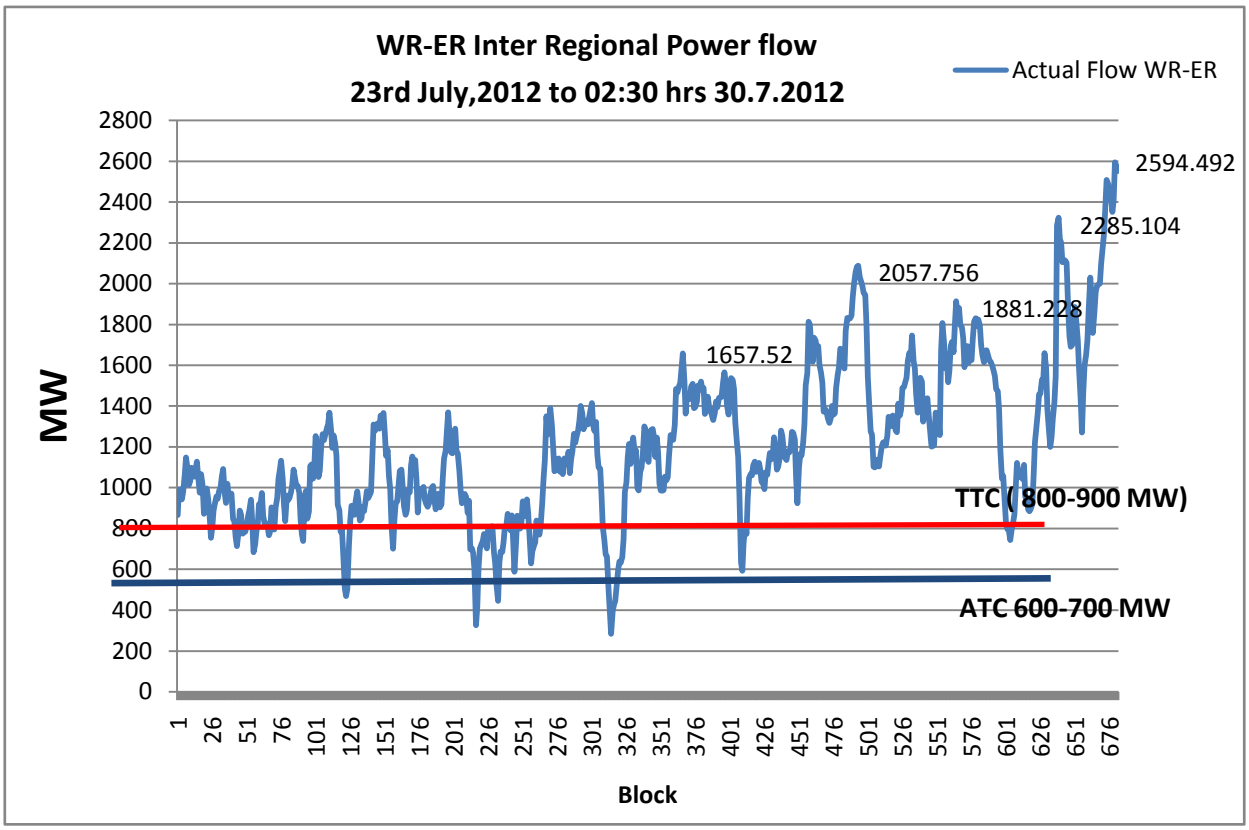
Date	Time	TTC (MW)	Reliability Margin (MW)	ATC (MW)
11.7.2012-31.7.2012	00-17, 23-24	900	200	700
	19-24	1000	200	800

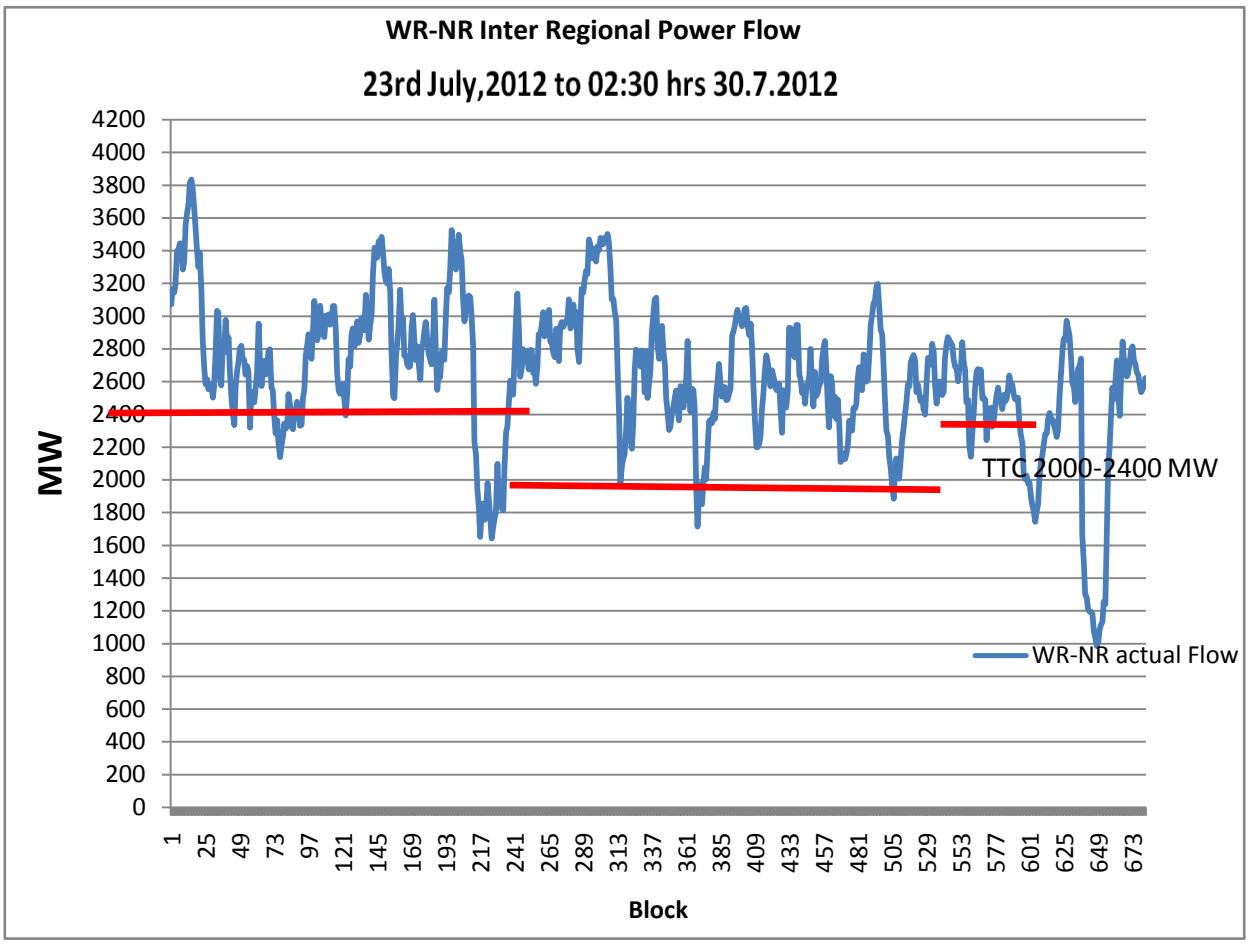
The analysis of data from WRPC UI accounts for the period 23.7.2012 to 30.7.2012 (till grid disturbance–up to 02:30 hours of 30.7.2012) indicates that TTC violation both on WR-ER and WR-NR inter-regional links was continued from 23rd July, 2012. Following graphs are given below:

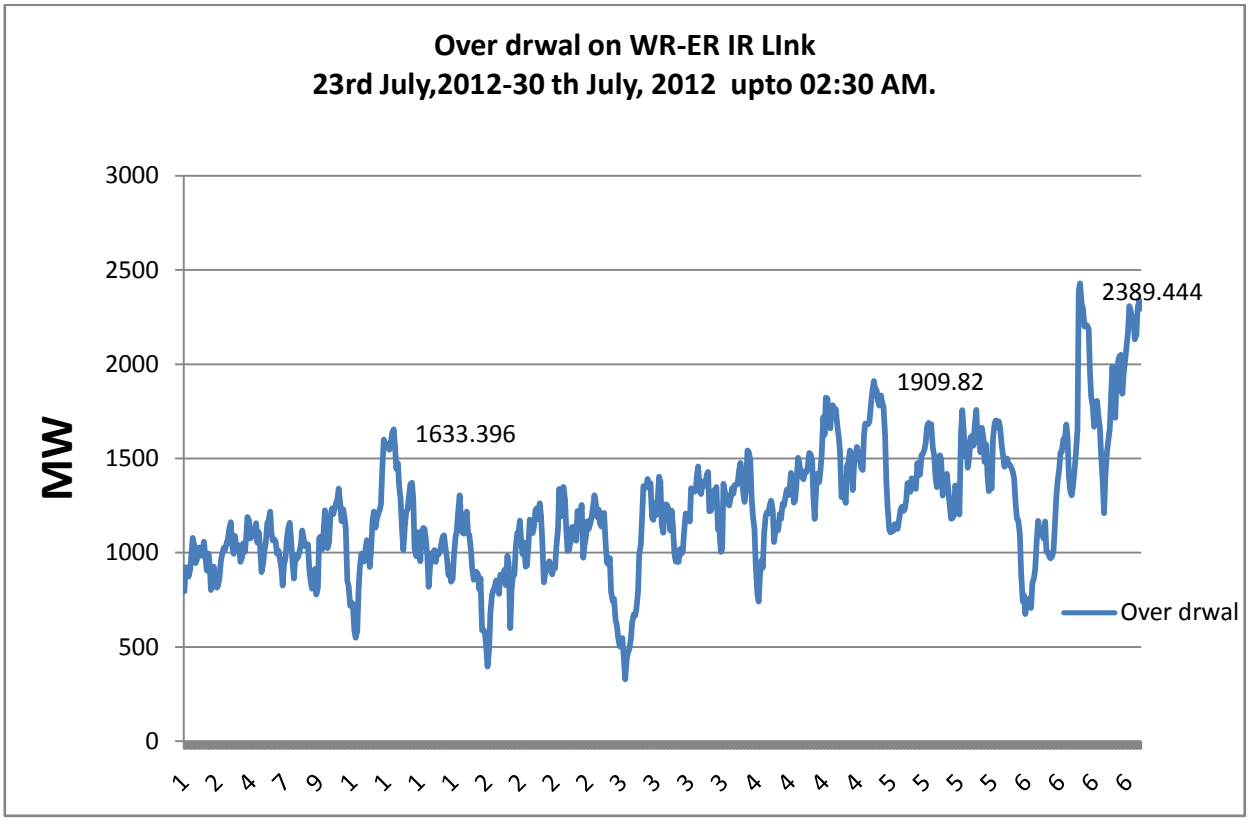
1. Actual Power flow on WR-ER Link during 23.7.2012-30.7.2012
2. Actual Power flow on WR-NR Link during 23.7.2012-30.7.2012

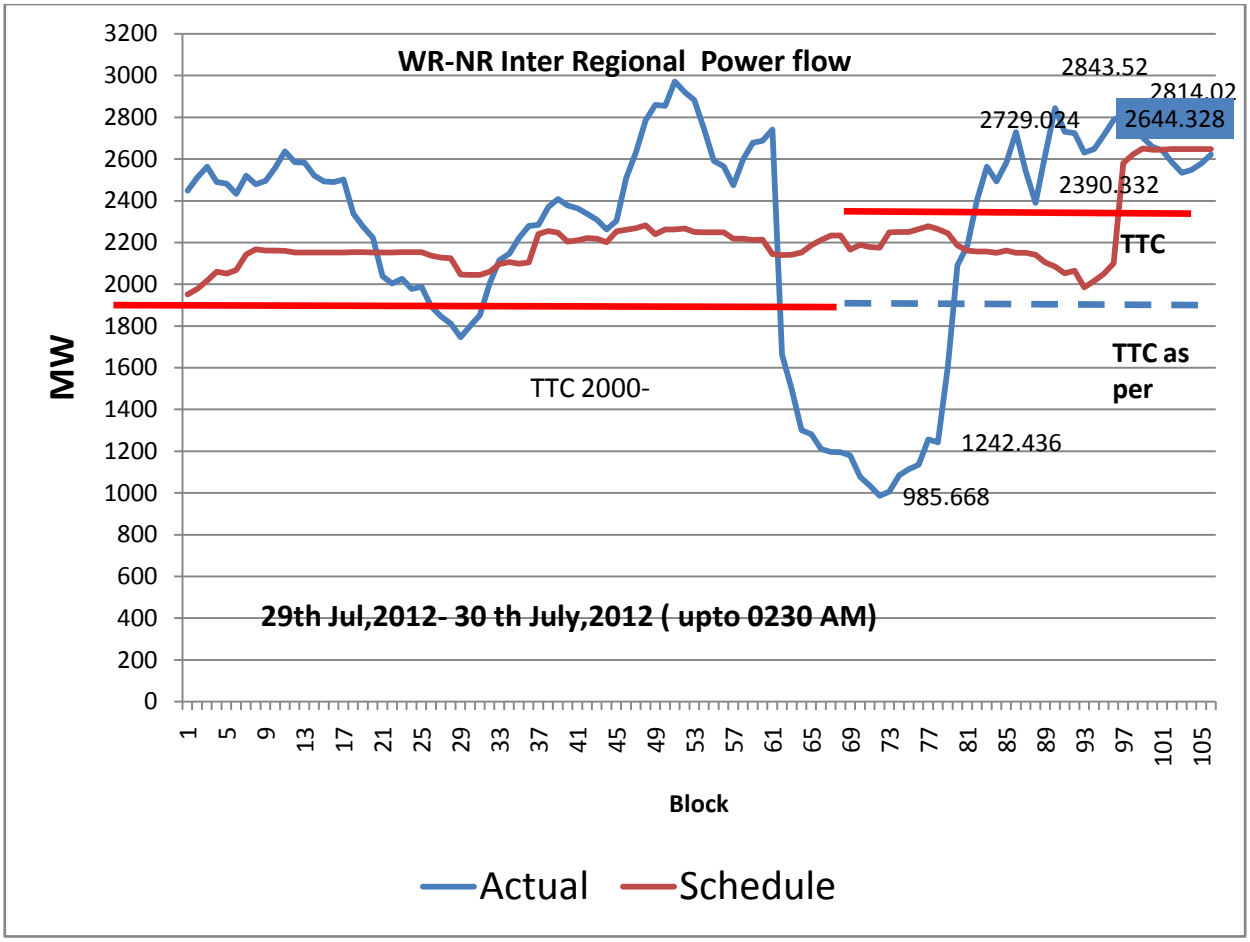
3. Actual Power flow on WR-ER link on 29.7.12-30.7.12
4. Actual Power flow and schedule on WR-NR link on 29.7.12-30.7.12
5. Over-drawal
6. ER-NR power flow during 29-7-2012 and 30-7-2012 (up to 2:30 pm).

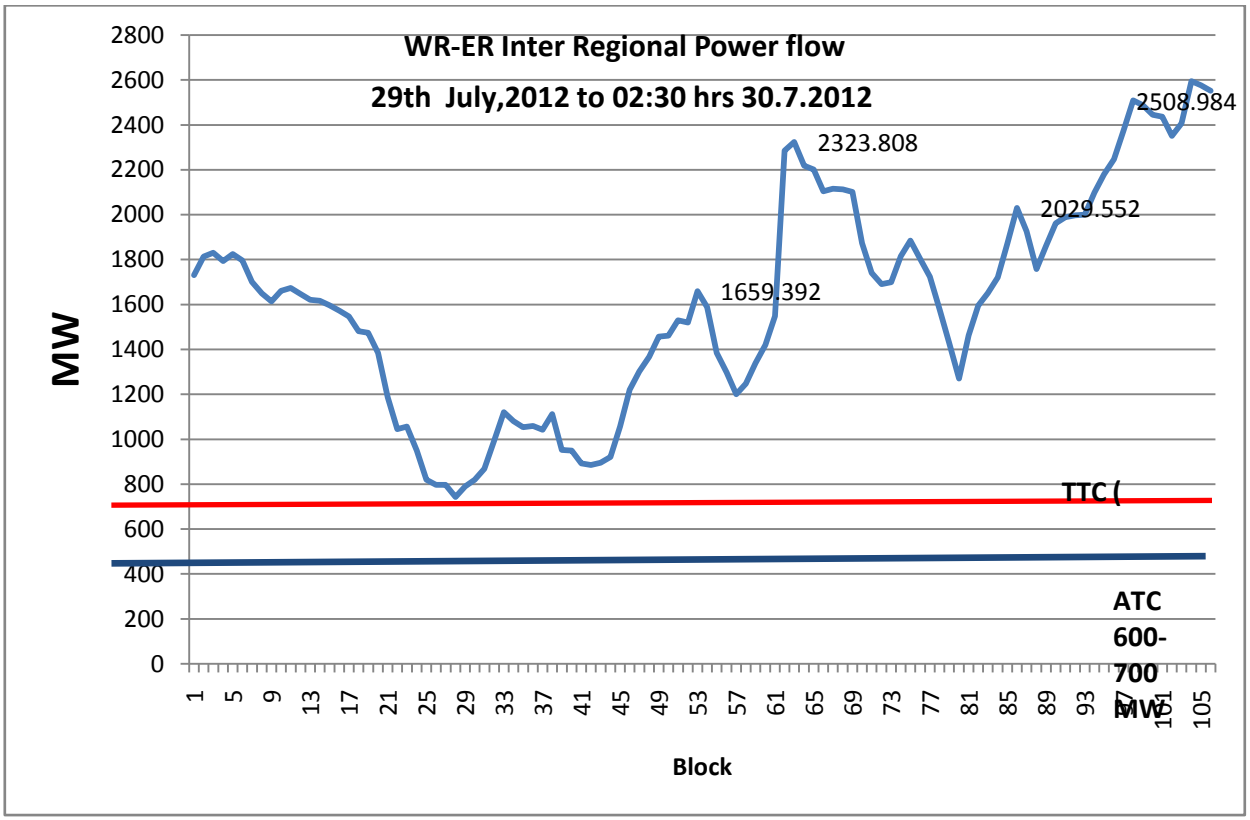
On 29th July, 2012 TTC violation of around 900 MW in WR-NR link at around 1 PM and on WR-ER link violation was about 1400 MW. The actual flows on WR-ER and WR-NR link at various time blocks is indicated in the figure below:

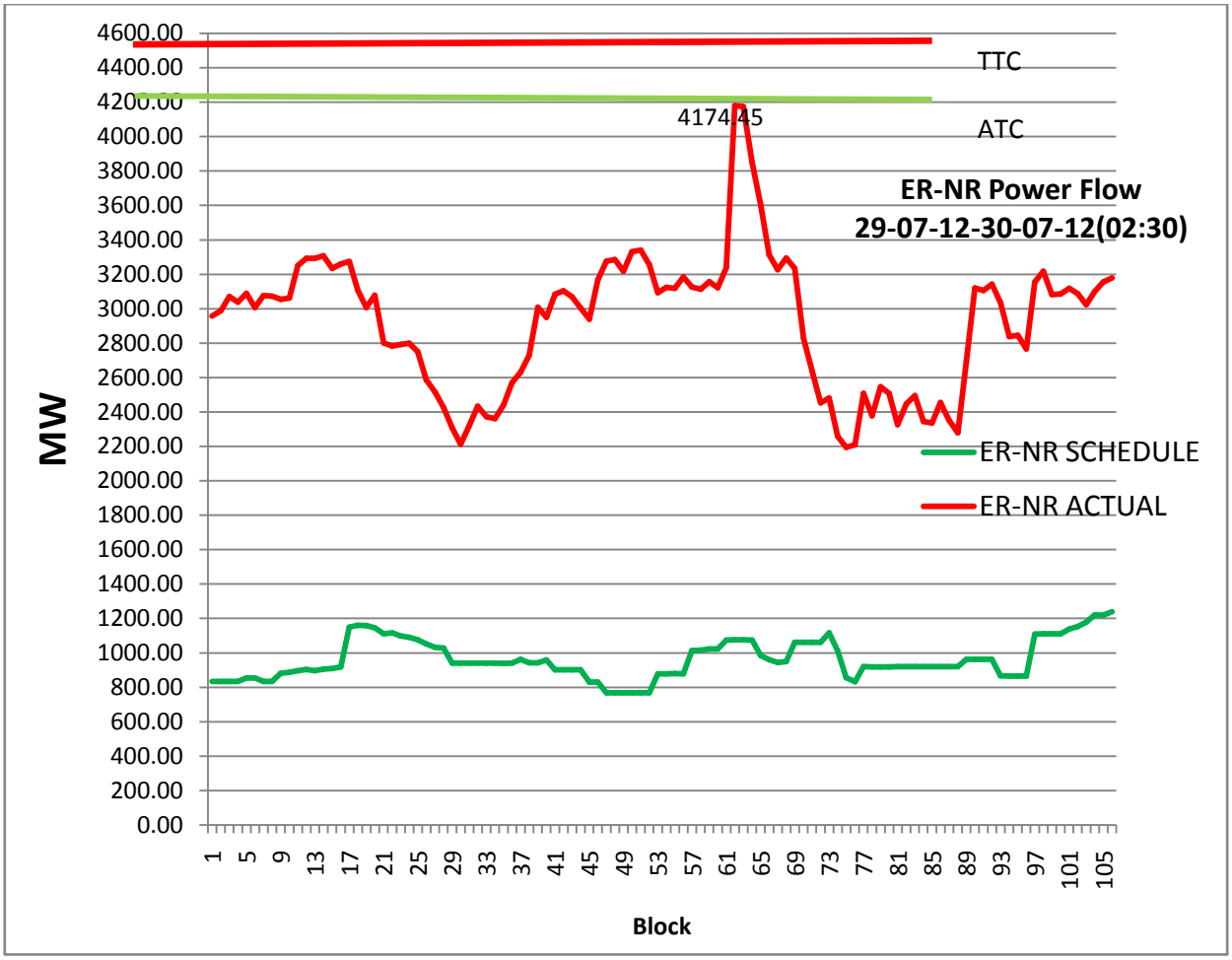



WR-NR Inter Regional Power Flow
23rd July,2012 to 02:30 hrs 30.7.2012
MW
Block
TTC 2000-2400 MW
WR-NR actual Flow


Over drwal on WR-ER IR LInk
23rd July,2012-30 th July, 2012 upto 02:30 AM.
MW
1633.396
1909.82
2389.444
Over drwal


WR-NR Inter Regional Power flow
2843.52
2814.02
2729.024
2644.328
2390.332
TTC
TTC as per
TTC 2000-
1242.436
985.668
29th Jul,2012- 30 th July,2012 (upto 0230 AM)
MW
Block
Actual
Schedule


WR-ER Inter Regional Power flow
29th July,2012 to 02:30 hrs 30.7.2012
2508.984
2323.808
2029.552
1659.392
TTC (
ATC 600-700 MW
MW
Block



From the analysis of inter-regional power flows from WR-NR and WR-ER, it is evident that interregional UI energy transactions were very high. In engineering terms this can be termed as deviation across regional boundary. While for state control areas, states are responsible. The so much deviation on IR link is endangering security of the grid as no margin is lift for any contingencies as evident from the events. Similar, analysis was done for NR-ER load, although there is no TTC violation however differential from schedule reached to the extent of 3103 MW. For inter-regional link such a large deviation from schedule indicate that real time operation is a quite different from the operation planning scenario.

Sample data for flow on these two links is given blow:

WR-NR & WR-ER:

			WR-NR	WR-NR
Date	**Block**	**Time**	**MW**	**MW**
29.7.2012	63	15:45	1491	2323
	72	18:00	985	1690

	78	19:30	1242	1580
	80	20:00	1604	1270
	86	21:30	2729	2029
	88	22:00	2400	1758
	90	22:30	2843	1961
30.7.2012	1	00:15	2814	2374
	2	00:30	2734	2509
	4	1:00	2658	2444
	8	2:00	2620	2594

If it is viewed against detail of tripping on WR-NR corridor it is observed that while physical network was depleting across this corridors as expected 400 kV Agra-Gwalior-II had not comes into service, 400 kV Zerda-Kankroli line forced tripped and also lower level 220 kV circuit like Kota–Badod & Badod-Modak tripped. The power flow across WR-ER was also increasing due to this network depletion on WR-NR.

The power flows on WR-NR corridor and WR-ER corridors were much above TTC. It is evident that due to non-availability of sufficient transmission network on WR-NR side, power was flowing on WR-ER-NR route. This affected the system security, as the physical network was not capable of handling that much flow. The scheduling in early hours of 30.7.2012 is appeared to be on higher side than the system capability.

The system operation in preceding week and on 29th and 30th July, 2012 indicates that security of the grid was under risk on many occasions. While RLDCs were sending messages to constituents of Northern Region to reduce over-drawal and to Western Region constituents to reduce their under-drawal, it can be said that safe operation philosophy was not being adhered to by all agencies like SLDCs, RLDCs and NLDC. It is the function of NLDC to monitor and control the flow on inter-regional links.

The continuous power flow much above TTC also indicates that there is need to review both the process and periodicity of TTC-ATC computation and load generation balance assumption to carry out these studies. However, for real time system operation, the network security analysis based on real time data is an immediate requirement for safe and secure grid operation.

3. Another important issue which came to fore during the hearing is that System Operator was trying to reduce UI before curtailing the short term open access.

It was stated by the POSOCO that efforts were being made to curtail UI in accordance with the Regulation 6.4.12 of the IEGC. Regulation 6.4.12 is reproduced below:

"6.4.12*. However, notwithstanding the above, the RLDC may direct the SLDCs/ISGS/other regional entities to increase/decrease their drawal/generation in case of contingencies e.g. overloading of lines/transformers, abnormal voltages, threat to system security. Such directions shall immediately be acted upon. In case the situation does not call for very urgent action, and RLDC has some time for analysis, it shall be checked whether the situation has arisen due to deviations from schedules, pursuant to short-term open access. These shall be got terminated first, before an action, which would affect the scheduled supplies to the long term and medium term customers is initiated in accordance with Central Electricity Regulatory Commission (Grant of Connectivity, Long-term Access and Medium-term Open Access in inter-state Transmission and related matters) Regulations, 2009."*

It is clear from the above that this Regulation perceives two situations one is contingencies and another situation which does not call for very urgent action and RLDC has some time for analysis. Under this situation, it should be checked whether the situation has arisen due to deviation from schedule pursuant to short term open access.

The situation on 29th & 30th night falls into the category of contingency because it is not only the deviation from the schedule which was causing problem, but during the afternoon and evening of 29th July, 2012 important inter regional link between WR-NR at 400 kV and 200 kV level went into forced outage while two other links were under planned or extended planned outage. It was expected that in accordance with the provision of Regulation, RLDCs could have directed SLDCs/ISGS/other regional entities to increase/decrease their drawl/generation as it was a situation of contingency.

The operating procedure of Northern Region both in May, 2012 and May, 2013 version mention following procedure:

7. CURTAILMENT OF SCHEDULED TRANSACTIONS

The transactions already scheduled may be curtailed by NRLDC in the event of transmission constraints; congestion in the grid, or in the interest of grid security. In line with regulations 6.4.12, 6.5.28, 6.5.30 and 6.5.31of IEGC the transactions shall generally be curtailed in the following sequence
a. Unscheduled Interchanges
b. Short term bilateral transactions
c. Short term collective transactions
d. Medium term transactions
e. Long-term transactions
Amongst the customers of a particular category, curtailment shall be carried out on pro rata basis. NRLDC would curtail a transaction at the periphery of the Regional entities. SLDC (s) shall further incorporate the inter-se curtailment of intra State entities to implement the curtailment

It is pertinent to mention that Unscheduled inter changes are not scheduled transactions hence its curtailment is not possible by NRLDC; it can give only the message to respective SLDCs for curtailing UI.

In case unscheduled interchanges are not curtailed even after messages, the RLDCs should take action to open feeders in accordance with the Commission's order dated 30.7.2012 in petition no. 125/MP/2012.

In the event of transmission constraints and congestion which threatened the security of the system, the role of system operator is to take action which can be implemented quickly and are in his domain, so it is advised that based on system security analysis, RLDCs shall take action to curtail short term transaction irrespective of the fact that unscheduled transactions are brought to zero as system security may worsened if it try to achieve this condition of unscheduled interchange to zero.

(V) Role of Generators

62. Regulation 5.2 (f) of Grid Code provides that all thermal units on 200 MW and above and all Hydro units of 10 MW and above, which are synchronized with the grid, irrespective of their ownership, shall have their governors in operation. WRLDC has reported that that adequate response from one or more generating units of NTPC, Gujarat, Madhya Pradesh, Maharashtra, Chhattisgarh, Jindal Power Limited and LANCO was not obtained on 30.7.2012 and 31.7.2012. Moreover, NTPC's Sipat units did not reduce generation when asked to do so by WRLDC.

63. The responses of the generators are as under:

(a) NTPC, in its affidavit dated 26.11.2012, has submitted that Sipat Unit-3 was operating on trial run at 380 MW. On receipt of generation reduction message at 23:45 hours on 29.7.2012 from WRLDC, Sipat Unit-3 reduced generation to 350 MW which is the technical minimum. Further reduction could have made the supercritical 660 MW unit unstable and unit could have tripped. On insistence of WRLDC on further reduction, NTPC had offered reduction of generation from other operating units of Sipat generating station. However, WRLDC did not revise schedule for better grid operation as required under Regulation 6.5(20) and 6.5(27) of the Grid Code in the interest of grid security. NTPC has submitted that the focus of RLDC was more on ensuring commercial issues than ensuring grid security.

64. NTPC has submitted that their engineers at WRCC Mumbai had a conversation with WRLDC at 00:30 hours on 30th July 2012 and requested permission for taking the unit out of grid, which was not granted by WRLDC. Hence taking the unit out would have led to violation of the Grid Code (Regulation 5.2 (c) & 5.2 (j)). Alternatively, NTPC shift engineer offered to reduce generation from other units if rescheduled. This was also not agreed. WRLDC operator irrationally warned NTPC engineer that congestion charges shall be applicable, but were never applied. Further it is submitted that WRLDC did not grant the permission for tripping the Unit. Rather another message was sent to NTPC from WRLDC at 00:53 hrs requesting reduction of infirm generation from Sipat Unit-3 by 100 MW, citing TTC violation. WRLDC for reasons not known to NTPC, did not order shut down of the unit and in this message "emergency" was also not communicated so that NTPC could not take out the unit. At least by this time, when other lines in WR-NR corridor like Badod-Modak, Jetpur-Amreli and

Gwalior (MP) to Gwalior (PG) circuit 2 tripped, WRLDC should have asked NTPC to trip the unit rather than again asking to do the impossible. As stated above, further reducing load by "100 MW" was not possible due to technical difficulties since the unit was running well below technical minimum, Unit#3 is 660 MW unit with Supercritical technology which are unstable at low loads particularly since the unit was facing difficulties with feed water flow controls.

NTPC has submitted the transcript of telephonic discussion at 00:30 hours on 30.7.2012 between SCE of NTPC and WRLDC wherein problem of technical minimum is being discussed. NTPC proposes WRLDC gives in writing the unit can be withdrawn. However, WRLDC refuses to give in writing. NTPC offers a second option and suggest that if WRLDC can reduce the schedule of commercial units, NTPC can reduce generation in those units. However, WRLDC refuses this proposal also and do not give any clear cut instructions.

We find that system operators should be clear in giving instructions. They should have directed NTPC to trip the Sipat Unit-3 to avoid over injection in the region or should have revised the schedule of other units as suggested by NTPC. In our opinion NTPC offered certain alternatives in view of technical considerations and did not disobey the directions of WRLDC. In fact WRLDC did not give clear cut instructions which allowed over injection and aggravated the situation. We direct POSOCO to formulate a message guide clearly spelling out the actions required to be undertaken by the constituents. However, it is found that communication between NTPC & WRLDC was focusing on commercial issue instead of security aspect. Each entity is obligated to follow instructions of RLDC in real-time. These need to be followed immediately even if it results in possible commercial loss. The entity, if aggrieved by the instructions of RLDC, may approach the

Commission for dispute resolution. Protracted discussion during real- time operation is dangerous for security of the grid. NTPC's behavior is also not above board as it wants to shift the onus of decision of unit tripping on WRLDC but has itself not taken any action to shut down the unit. Thus, NTPC did not comply with instructions of WRLDC, which is contravention of section 29 of the Act.

(b) JPL in its affidavit dated 11.02.2013 has submitted that out of 4x250 MW units, one unit was under shut down. On 30.7.2012 at 02:15 hours, the plant was operated at 778 MW. When the grid frequency went up to 50.8 Hz, the station load was reduced to 714 MW by through RGMO and manual operations. On 31.7.2012, three units were running with load of 773 MW. At 1258 hrs, when frequency rose to 51.1 Hz, the station load was reduced to 708 MW through RGMO and manual operations.

(c) LANCO has vide submission dated 14.2.2013 submitted that RGMO was not available in its units due to technical problem but the generation was reduced manually after grid disturbance on both days.

65. It is noticed that RGMO operation is not effective in respect of machines of JPL. Considering a droop of 5% with rise of frequency of 1.1 Hz, the plant should have reduced a generation of about 330-340 MW but the actual reduction was 65 MW only. Also, RGMO was not operational in the machines of LANCO**.** In our view, JPL, LANCO and NTPC and other utilities in the States of Gujarat, MP, Maharashtra, Chhattisgarh in Western Region failed to comply with Regulation 5.2 (f) of the Grid Code and the directions of the Commission in this connection. However, WRLDC has not indicated the names of generating

stations not providing primary response during the disturbance. WRLDC is directed to submit the details of non-compliance by each of the eligible units, particularly when the frequency was increasing more than 50 Hz and the units were not decreasing their outputs.

66. Further, the Commission in its order dated 31.12.2012 in Petition No. 191/SM/2012 has observed on the issue of RGMO that a Task Force under the chairmanship of Member (Thermal), CEA has been constituted for conducting primary response test of certain thermal and hydro units. The Task Force has been directed to submit report by June 13 and NLDC would be nodal agency for the same. NLDC would apprise the commission within 2 months after the submission of the committee's report.

(VI) Violation by the users – non provision of telemetry

67. Regulation 6 (3) of the CEA (Technical Standards for Connectivity to the Grid) Regulations, 2007 and Regulation 4.6.2 of the Grid Code provide that the availability of real-time data at the State and Regional Load Despatch Centres is essential for real-time supervision and control of the dynamic power system grid. Real-time decision making is constrained due to insufficient visibility and situational awareness resulting from non-availability of data in real-time. Based on submission of NRLDC, we found that PSTCL (Punjab), HVPNL (Haryana), RRVPNL (Rajasthan), DTL (Delhi), UPPTCL (Uttar Pradesh), PTCUL (Uttarakhand), PDD, J&K (Jammu & Kashmir), HPSTCL (Himachal Pradesh), PGCIL, NHPC Ltd. and NLC failed to ensure compliance of Regulation 6(3) of

the CEA (Technical Standards for Connectivity to the Grid) Regulations, 2007 and Regulation 4.6.2 of Grid Code as given below:

"6 (3) The requester (person such as the generating company including captive generating plant or transmission licensees (excluding CTU and STU) or distribution licensee or bulk consumer, who is seeking connection of his new or expanded electrical plant to the grid at voltage level 33 kV and above") and user shall provide necessary facilities for voice and data communication and transfer of online operational data such as voltage, frequency, line flows and status of breaker and isolator position and other parameters as prescribed by the Appropriate load despatch centre"

And Regulation 4.6.2 of Grid Code

"4.6.2 Data and Communication Facilities
Reliable and efficient speech and data communication systems shall be provided to facilitate necessary communication and data exchange, and supervision/control of the grid by the RLDC, under normal and abnormal conditions. All Users, STUs and CTU shall provide Systems to telemeter power system parameter such as flow, voltage and status of switches/ transformer taps etc. in line with interface requirements and other guideline made available by RLDC. The associated communication system to facilitate data flow up to appropriate data collection point on CTU's system, shall also be established by the concerned User or STU as specified by CTU in the Connection Agreement. All Users/STUs in coordination with CTU shall provide the required facilities at their respective ends as specified in the Connection Agreement."

68. The Commission has already initiated action on the issue of telemetry and in order dated 9.10.2012 has directed as under:

"26. We also observe that many State Transmission Utilities, State Power Departments/Electricity Departments have not responded to our directions to submit a clear-cut action plan for the establishment of the communication system for the existing system and the time schedule for completion including the provisioning for integration of new generating stations and the substations coming in future. We direct all users to submit the information by 31.10.2012 to the NLDC. We direct NLDC to submit a report by 10.11.2012 about the status of implementation of the telemetry system. If any user does not comply with our directions, it will be construed as non-compliance of the order of the Commission and appropriate proceedings under Section 142 of the Electricity Act, 2003 shall be initiated against such users."

We are already considering the telemetry issue under suo-motu petition no 56/2012 and hence are not taking any action in the instant case for non-compliance of IEGC and CEA Technical standards.

(VII) Non-submission of sufficient information required for analysis of grid disturbance

69. Regulation 12 of the CEA (Grid Standards) Regulations, 2010, Regulation 5.2 (r) and 5.9.6 of the IEGC**)** provides as under:

12. Reporting of events affecting grid operation.- (1) Any tripping of generating unit or transmission element, along with relay indications, shall be promptly reported by the respective Entity to the Appropriate Load Despatch Centre in the reporting formats as devised by the Appropriate Load Despatch Centre.

(2) The Appropriate Load Despatch Centre shall promptly intimate the event to the Regional Load Despatch Centres and State Load Despatch Centres of the affected regions and States respectively which shall, in turn, take steps to disseminate this information further to all concerned.

5.2 (r) All the Users , STU/SLDC and CTU shall send information/data including disturbance recorder/sequential event recorder output to RLDC within one week for purpose of analysis of any grid disturbance/event. No User, SLDC/STU or CTU shall block any data/information required by the RLDC and RPC for maintaining reliability and security of the grid and for analysis of an event.

5.9.6 Reporting Procedure

(a) Written reporting of Events by Users, STU, CTU, and SLDC to RLDC: In the case of an event which was initially reported by a User, STU, CTU or a SLDC to RLDC orally, the User, STU, CTU, SLDC will give a written report to RLDC in accordance with this section. RLDC in turn give a report to NLDC.

NRLDC has submitted the status of information from regional entity generators and transmission licensees. It was found that complete information with respect to analysis report, DRs and logs of emanating lines from some generating stations were not made available. Similarly disturbance records and logs for the STU lines were not made available at NRLDC. Almost all the Constituents have not fully complied with the CEA Grid Standard and Grid Code.

(VIII) Other issues

70. ERLDC vide its submission dated 21.12.2012 has intimated that as per Regulation 5.8(b), mock trial run shall be carried out at least once in every 6 months under intimation to RLDC. ERLDC has been undertaking periodic mock drill of hydro stations having black straty facilities in the Eastern Region. The mock exercise had been done at Rengali HPS, Maithon HPS and Upper Indravati HPS. However, none of the plant could start the units successfully and extend start up power to nearby thermal plant station which resulted in considerable delay in restoration of eastern grid. IEGC Regulation 5.8 (b) relating to Recovery Procedure is reproduced below:

"5.8 Recovery Procedures

(b) Detailed plans and procedures for restoration after partial/total blackout of each User's/STU/CTU system within a Region will be finalized by the concerned User's/STU/CTU in coordination with the RLDC. The procedure will be reviewed, confirmed and/or revised once every subsequent year. Mock trial runs of the procedure for different subsystems shall be carried out by the Users/CTU/STU at least once every six months under intimation to the RLDC. Diesel Generator sets for black start would be tested on weekly basis and test report shall be sent to RLDC on quarterly basis."

71. ERLDC in its affidavit dated 21.12.2012 has intimated about the non-availability of black start at hydro stations of NHPC and DVC leading to delay in system restoration which is violation of Regulation 5.8 (b) of the Grid Code. NHPC in its affidavit dated 28.3.13 has submitted that it is operating two hydro power stations in the Eastern Region namely, Rangit (50 MW) and Teesta-V (510 MW) located in the State of Sikkim. NHPC claims that prior to grid disturbances on 30.7.2012 and 31.7.2012, Teesta-V station has successfully charged 400 kV Teesta-V-Binaguri Transmission line on several occasions. However, feeding of

load in isolation could not be tested due to non-identification of suitable loads by WBSEB. During the grid disturbance, the plant made its best efforts to provide black start support in coordination with ERLDC. The unit of Teesta-V successfully charged Teesta-V -Binaguri Transmission line but tripped due to operation of third harmonic under-voltage. Further, another attempt also failed due to over voltage direct tripp received from Binaguri sub-station and as timely loading was not done. Rangit power station did not participate in the restoration of grid as mock black start exercise was not planned before 30st & 31st July, 2012.

72. DVC in its submission dated 25.3.13 has stated that DVC tried to black start Maithon Hydel Station (capacity 3x20 MW) having black start facility. But in spite of several attempts it was not possible due to problem in unit auxiliary transformer and battery bank.

73. We have considered the submission and found that NHPC and DVC units could not provide black start. We direct RLDCs to ensure periodic mock black start exercise on all the eligible generating stations to maintain readiness under such conditions.

74. Voice Recording at Control rooms:

Voice recording at Control centre is required to prove the evidence that instructions were communicated to all concerned. The Commission in its order dated 16.1.2001 on the Grid disturbance on 2.1.2001, has directed as under:

10. The RLDC claims to have instructed the UPSLDC to back down Anpara power station owned by UP Generation Corporation at 0318 hrs. and again at 0418 hrs. However, UPPCL has denied receipt of the first communication by

Anpara or the SLDC. In the absence of definitive evidence, it is difficult for the Commission to take any action on what would otherwise have been a clear case of non-compliance of RLDC instructions. The Commission directs the CTU to immediately install tape recorders with timer facilities in the control rooms of the RLDCs, to record each telephonic conversation separately and reactivate them, if they are already in existence. The Commission also suggests to the SLDCs that they should do the same in their control rooms in their own interest. The Commission also directs the RLDC to ensure that any instructions given to the SLDC or any other party in the inter-state transmission system should be given only through the control room and not from any other part of the RLDC building. The Commission gives one month to the CTU to implement this system and suggests to the SLDCs that they may also do so within one month.

We note that the voice recording facility is available at all RLDCs.

75. However, as per information submitted to us, the voice recording facility is available only in SLDCs of MP and Gujarat. Grid operation has been becoming more and more complex and needs better coordination, monitoring, grievance redressal and training. Sound recording is a mandatory requirement of present day Grid operation. The Commission directs all SLDCs to install/activate sound recording system in their control rooms within three months from the date of issue of this order.

76. To sum up, the violations of the regulations of this Commission and the regulations of the CEA which precipitated the grid disturbance on 30.7.2012 and 31.7.2012 are as under:

(i) The control areas of Haryana, Punjab and Uttar Pradesh (UP) on 30.7.2012 and Haryana, Punjab and Rajasthan on 31.7.2012 persistently overdrew electricity from the Grid with respect to their schedules and failed to comply with the directions of NRLDC and thereby failed to comply with Section 29 of the Electricity Act, 2003 and Regulations 5.4.2 (a), (g), (h) & (i) of Grid Code.

(ii) In the Western Region, the demand was less than the generation prior to disturbance on 30.7.2012 as well as on 31.7.2012. The control areas of Maharashtra, Gujarat, Madhya Pradesh and Chhattisgarh were under-drawing electricity with respect to their schedule. WRLDC kept instructing these control areas to increase their drawal. If the same was not feasible, they could have reduced their own generation, which they did not do. On 30.7.2012, control areas of Maharashtra, Gujarat, Chhattisgarh and MP failed to comply with Section 29 of the Act and Regulation 6.4.12 of Grid Code. Similarly on 31.7.2012, the control areas of Gujarat, Maharashtra and Chhattisgarh failed to comply with Section 29 of the Electricity Act, 2003 and Regulation 6.4.12 of IEGC prior to Grid disturbances.

(iii) WRLDC needed to revise schedule of Inter-State Generating Stations (ISGS)/ other regional generators in the interest of better system operation as per Regulations 6.5.20 and 6.5.27 of Grid Code, which they did not do.

(iv) The utilities viz. PSTCL (Punjab), HVPNL (Haryana), RRVPNL, RRVUNL (Rajasthan), DTL (Delhi), UPPTCL (Uttar Pradesh), PTCUL (Uttarakhand), PDD J&K (Jammu & Kashmir), HPSTCL (Himachal Pradesh), POWERGRID, NHPC Ltd., JSW and NLC failed to ensure telemetry of data to control centers and thereby failed to comply with Regulation 6(3) of the

CEA (Technical Standards for Connectivity to the Grid) Regulations, 2007 and Regulation 4.6.2 of Grid Code.

(v) The load relief obtained from UFR and df/dt relays on 30.7.2012 and 31.7.2012 showed that inadequate load relief was provided by UFR operation by control areas of Odisha, Bihar and Jharkhand in Eastern Region and all the utilities of Northern Region. These utilities have failed to comply with Regulation 1 of part-IV of the Central Electricity Authority (Technical Standards for Connectivity to the Grid) Regulations, 2006 and Regulation 9 of the Central Electricity Authority (Grid Standards) Regulation, 2010 and Regulation 5.2 (n) of Grid Code. Though the State Utilities of Eastern Region were not made respondents in the instant petition, they are directed to comply with these regulations.

(vi) From the data submitted by POWERGRID, it was found that in the relay of 400 kV Bina-Gwalior lines, the setting of the resistive reach adopted for phase to phase fault was equal to that for phase to earth fault prior to these two incidents. No basis of calculation for the same was provided by POWERGRID, but it is clear that phase to phase resistive reach is generally smaller than phase to earth resistive reach. This setting caused tripping of 400 kV Bina-Gwalior line-I. However, it was an inadvertent error but POWERGRID did not bring it to the notice of the Enquiry Committee set up by the Ministry of Power, though they had changed the setting subsequent to Grid Disturbance. Further POWERGRID did not provide Power Swing blocking on the inter-regional transmission lines as per protection philosophy approved in RPC. Hence, POWERGRID violated provisions of Regulations 6(4)(a) of CEA (Technical Standards for

Connectivity to the Grid) Regulations, 2007, and Regulation 3 (e) of CEA (Grid Standard) Regulations, 2010. Further the system of protective relay coordination at the regional level needs to be strengthened and the compliance to Regulation 5.2 (l) of Grid Code needs to be enforced by all the entities.

(vii) As per Regulation 5.7.4 of Grid Code, RPC Secretariat is primarily responsible for finalization of the annual outage plan for the following financial year by 31st January of each year. The annual outage plan is to be reviewed by RPC Secretariat on quarterly and monthly basis in coordination with all parties concerned, and adjustments made wherever found to be necessary. The outage plan of transmission system is discussed in the OCC meetings regularly and approval is being granted for planned shutdown. POWERGRID availed shutdown of two important inter-regional links, namely, 400 kV Bina-Gwalior-II and Gwalior-Agra-II during the period of peak demand (July–August) in the Northern Region without due deliberation in the OCC forum where all the constituents are present. We find that just on the basis of an e-mail from POWERGRID, RLDCs permitted shutdown of an important inter-regional link for up-gradation of these lines from 400 kV to 765 kV, an activity which is not emergent; but is a planned activity. It has been brought to our notice that OCC of NRPC had authorized NRLDC to approve need based shut down. Even according to WRLDC, such practice can be allowed only in emergency/unforeseen shutdown indicating the nature of emergency. Thus, RLDC permitted POWERGRID to avail planned shutdown in the peak season without proper consultation. RLDC has over-stretched the authorization given by RPC for

allowing need based shutdown. We find that POWERGRID failed to comply with Regulation 5.7.4 (c) of the Grid Code. WRLDC and NRLDC failed to comply with Regulation 5.7.4 (g) (iv) of Grid Code relating to outage planning.

(viii) For operation of a complex grid like the one in our country with multiple players in the Centre, State as well as private sector, the need of an independent system operator cannot be over emphasized. We are given to understand that Ministry of Power is already contemplating separation of POSOCO from POWERGRID. We would like the Ministry to expedite this on priority basis.

(ix) JPL, LANCO and the generating plants of NTPC, Gujarat, Madhya Pradesh, Maharashtra, and Chhattisgarh in Western Region have not complied with Regulation 5.2 (f) of Grid Code relating to Governor Operation. The non-availability of RGMO is being considered in proceedings of our suo-motu Petition No. 191/2011 and shall be dealt with separately.

(x) With regard to submission of information to RLDCs after disturbances of 30th and 31st July, 2012, particularly the Regional Entity Generators namely Singrauli STPS, Rihand STPS, Unchahar STPS, Dadri GPS, Tehri HPS, Koteshwar HPS, NAPS/RAPS-B, Jhajjar IGSTPS, Malana-II HPS, Shree Cement have not submitted any information. Thus these entities have not complied with Regulation 4.6.3 and 5.2(r) of the Grid Code. The compliance by the inter-State transmission licensees namely, POWERGRID, Powerlink, BBMB, JPL and all STUs of Northern Region

were partial. Thus, there was contravention of Regulation 4.6.3 and 5.2 (r) of Grid Code by the aforementioned entities.

(xi) While the voice recording facility is available at all, the RLDCs, the same at the State level, as per information submitted to us, is available only in SLDCs of Madhya Pradesh and Gujarat. Grid operation has been becoming more and more complex and needs better coordination and monitoring. Voice recording is a mandatory requirement for real-time grid operation. We direct all SLDCs to install/activate voice recording system in their control rooms within three months from the date of issue of this order and keep them in continuous use.

(C) Actions Proposed

77. In the light of the foregoing discussion, we have come to the conclusion that there are some violations which are specific to this Grid Disturbance which need to be addressed here; other violations relating to UFRs, Telemetry, RGMO and non-submission of data are being addressed separately. Accordingly, we find that the SLDC of Haryana, Uttar Pradesh, Punjab, Rajasthan, Maharashtra, Gujarat, Madhya Pradesh, Chhattisgarh as well as POWERGRID, WRLDC, NRLDC and NTPC have failed to comply with provisions of the Electricity Act 2003 and various Regulations of the Commission and CEA as mentioned in the preceding paragraphs. Accordingly, we direct staff of the Commission to process the cases for issue of notice in accordance with provisions of Electricity Act, 2003.

(D) Consequential Directions:

Considering all the factors in totality, we are of considered view that the technical causes of grid disturbance on 30.7.2012 and 31.7.2012 have not been investigated in depth. The report of the Enquiry Committee constituted by the MoP was submitted hurriedly in very short time span of 15 days. Further, detailed analysis of the incidence needs to be deliberated for taking proper lessons for future. All aspects of this type of large scale black outs should be thoroughly examined, involving experts from all fields including academia. We direct National Power Committee (NPC) to constitute a task force consisting of representatives of CEA, Engg. division of CERC and others to conduct technical study in regard to Grid Stability covering pre-disturbance scenario, considering each contingency from 23-7-2012 to 31-7-2012, and impact of TTC violation on ER-WR and WR-NR corridors as well as simulation of cascade tripping after tripping of 400 Bina-Gwalior line. The Task Force shall submit the report to NPC within three months from the date of issue of this order, who shall thereafter submit the same to the Commission.

78. At present reliability assessment is focused on the declaration of ATC/TTC. The Commission is of the view that there is a need to make the process transparent for assessment of reliability of the system. For this, there is a requirement for making an institutional arrangement like National Reliability Council for which we have already given directions in Petition No. 188/SM/2012. Accordingly, the NPC may suggest a structure for National Reliability Council inter-alia with the object of computation of ATC/TTC, develop reliability standards, suggest optimum outage planning and congestion management mechanism, etc.

79. Petition No. 167/SM/2012 is disposed of in terms of the above.

Sd/-	sd/-
(M Deena Dayalan)	**(V S Verma)**
Member	**Member**