CENTRAL ELECTRICITY REGULATORY COMMISSION
NEW DELHI

Petition No. 84/MP/2015
Along with I.A. No.8/2016

Coram:

Shri Gireesh B. Pradhan, Chairperson
Shri A. K. Singhal, Member
Shri A.S. Bakshi, Member
Dr. M.K. Iyer, Member

Date of Order: 31st of July, 2017

In the matter of

Endangering the secured grid operation of All India electricity grid through inadequate/non-performance of Free Governor Mode Operation (FGMO) with Manual Intervention by the generators and non-compliance of Regulation 5.2 (f), (g), (h), (i) of Indian Electricity Grid Code read with Regulations 24 and 111 of Central Electricity Regulatory Commission (Conduct of Business) Regulations, 1999.

And
In the matter of

National Load Despatch Centre (NLDC)
B-9 (1st Floor), Qutub Institutional Area,
Katwaria Sarai, New Delhi-110016 **…Petitioner**

Vs

1) General Manager, Delhi Transco Limited,
Delhi-SLDC 33 kV, sub-station Building,
Minto Road, New Delhi -110002.

2) Haryana Vidyut Prasaran Nigam Limited,
Haryana-SLDC, Sewah Panipat,
XEN/LD & PC, SLDC Complex,
Sewah Panipat -132103.

3) Himachal Pradesh State Electricity Board,
HP-SLDC, HP Load Despatch Society,
SLDC complex, Totu, Shimla -171011.

4) Jammu & Kashmir Power Development Department,
J&K-SLDC, SLDC Building,
220 kV Grid Station Narwal, Jammu -180007.

5) Punjab State Transmission Corporation Limited,
Punjab-SLDC, Ablowal, Patiala,
SLDC Building, near 220KV Grid Substation,
PSTCL, Ablowal, Patiala -147001

6) Chief engineer(LD),
Rajasthan Rajya Vidyut Prasaran Nigam Limited,
Rajasthan-SLDC, State Load Despatch Centre,
Rajasthan Rajya Vidyut Prasaran Nigam Limited,
Ajmer Road, Heerapura, Jaipur -302024

7) Uttar Pradesh Power Transmission Corporation Limited,
SLDC-UP, Power System, 5th Floor,
Shakti Bhawan, 14 Ashok Marg,
Lucknow -226001

8) Power Transmission Corporation of Uttarakhand Limited,
SLDC-Uttarakhand, 400 KV Sub-station,
Veerbhadra, Rishikesh -249202

9) General Manager,
Singrauli Super Thermal Power Station,
Shakti Nagar, UP-231222

10) General Manager,
Rihand Super Thermal Power Station-I,
Rihand Nagar, UP-231223

11) General Manager,
Rihand Super Thermal Power Station-II,
Rihand Nagar, UP-231223

12) General Manager,
Rihand Super Thermal Power Station-III,
NTPC Rihand, Dist-Sonbhadra, UP - 231223

13) General Manager, Dadri,
National Capital Power Project,
Dadri Dhaulana Road,
Distt.Gautam Buddh Nagar,
UP-201008

14) General Manager,
Dadri - Stage - II,
National Capital Power Project,
Dadri Dhaulana Road,
Distt.Gautam Buddh Nagar, UP-201008

15) General Manager,

Firoz Gandhi Unchahar Thermal Power Project-I,
Unchahar, Distt. Raibareilly, UP

16) General Manager,
Firoz Gandhi Unchahar Thermal Power Project-II,
Unchahar, Distt. Raibareilly, UP

17) General Manager,
Firoz Gandhi Unchahar Thermal Power Project-III,
Unchahar, Distt. Raibareilly, UP

18) General Manager,
Dadri Gas Power Project,
Dhaulana Road, Distt.Gautam Buddh Nagar,
UP-201008

19) General Manager,
Auraiya Gas Power Project
(Gas Fired, RLNG Fired, Liquid Fired),
Dibiyapur, Distt Etawah, UP-206244

20) General Manager,
Anta Gas Power Project
(Gas Fired, RLNG Fired, Liquid Fired),
Distt. Baran, Rajasthan-325209

21) Station Director,
Narora Atomic Power Station,
Narora, Distt. Bulandsahar, UP-202389

22) Station Director,
Rajasthan Atomic Power Station-B,
Anu Shakti Vihar, Kota, Rajasthan-323303

23) Station Director,
Rajasthan Atomic Power Station-C,
(RAPS-5&6) PO-Anushakti,
Kota, Rajasthan-323304

24) General Manager,
Bairasiul Hydro Electric Project,
NHPC Ltd., Surangini,
Distt.Chamba, HP-176317

25) General Manager,
Salal Hydro Electric Project,
NHPC Ltd, Jyotipuram, Distt. Udhampur,
J&K-182312

26) General Manager,
Tanakpur Hydro Electric Project,
NHPC Ltd., Banbassa, Distt. Champawa,
Uttrakhand-262310

27) General Manager,
Chamera-I Hydro Electric Project,
NHPC Ltd., Khairi, Distt. Chamba,
HP-176310

28) General Manager,
Uri Hydro Electric Project,
NHPC Ltd., Mohra, Distt. Baramulla,
J&K-193122

29) General Manager,
Chamera-II Hydro Electric Project,
NHPC Ltd., Karian, Distt. Chamba, HP-176310

30) General Manager,
Chamera-III Hydro Electric Project,
NHPC Ltd., Dharwala, Distt.-Chamba,
HP-176311

31) General Manager,
Dhauliganga Hydro Electric Project,
NHPC Ltd., Tapovan, Dharchula,
Pithoragarh, Uttrakhand-262545

32) General Manager,
Dulhasti Hydro Electric Project,
NHPC Ltd., Chenab Nagar, Distt. Kishtwar,
J&K-182206

33) General Manager,
Satluj Jal Vidyut Nigam Ltd. Power Project, Jhakri,
Rampur, Distt. Shimla, HP-172201

34) General Manager,
Tehri Hydro Development Corporation Ltd.,
Pragatipuram, Rishikesh, Uttrakhand-249201

35) General Manager,
Uri 2 Hydro Electric Project,
NHPC Ltd., Nowpura, Distt. Baramulla,
J&K-193123

36) General Manager,
Sewa-II Power Station, Mashke,
P.O-Khari,Tahsil-Dalhausie , Dist-Chamba,

HP-176325

37) General Manager,
Koteshwar HEP, THDCIL,
Koteshwerpuram, Tehri Garwal-249002

38) General Manager,
ADHPL Prini, Tehsil Manali,
Distt- Kullu (H.P) India.

39) General Manager,
Indra Gandhi Super Thermal Power Project
VPO -Jharli, Tahsil Matanhail,
Dist Jhajjar (Haryana)-124125

40) General Manager,
Karcham Wangtoo HEP,
Jaiprakash Power House Ventures Limited
Baspa -II Hydro -Electric Project Sholtu Colony,
PO- Tapti Dist Kinnaur, -172104 (HP)

41) Plant In Charge,
Shree Cement Thermal Power Project Bangurnagar,
Beawar , Dist Ajmer , Rajasthan -305901

42) Lanco Budhil HPS Ltd,
Plot # 404-405,Phase-3,
Udyog Vihar, Gurgaon-122016,India

43) SLDC, Airoli, Navi Mumbai, Airoli,
Thane-Belapur Road,
Navi Mumbai -400708.

44) State Load Despatch Centre,
MPPTCL, Jabalpur, O/o Chief Engineer (SLDC),
MPPTCL, Nayagaon, Jabalpur

45) SLDC Gotri Vadodara,
Gujarat, 132kV Gotri s/s compound,
Opposite Kalpvrux Complex, Gotri Road, Vadodara

46) Chhattisgarh State Load Despatch Centre,
C.E(LD),State Load Despatch Centre,
CSPTCL, Daganiya-HQ, Raipur, Chhattisgarh

47) General Manager,
Korba STPS STG (I& II),
National Thermal Power Corporation,
P.O. Vikas Bhavan, Jamnipali,
Korba(Dist), Chhattisgarh-495 450.

48) General Manager,
Korba STPS STG (III),
National Thermal Power Corporation,
P.O. Vikas Bhavan, Jamnipali, Korba(Dist),
Chhattisgarh-495 450.

49)General Manager,
STAGE-I, Vindhayachal STPS,
National Thermal Power Corporation of India Ltd,
P.O Vindhyanagar, Sidhi (Dist), Madhya Pradesh - 486 885

50) General Manager,
STAGE-II, Vindhayachal STPS,
National Thermal Power Corporation of India Ltd
P.O Vindhyanagar, Sidhi(Dist),
Madhya Pradesh - 486 885

51) General Manager,
STAGE-III, Vindhayachal STPS,
National Thermal Power Corporation of India Ltd,
P.O Vindhyanagar, Sidhi(Dist),Madhya Pradesh - 486 885

52) General Manager,
STAGE-IV, Vindhayachal STPS,
National Thermal Power Corporation of India Ltd,
P.O Vindhyanagar, Sidhi(Dist),Madhya Pradesh - 486 885

53) General Manager,
Kawas Gas Power Project,
National Thermal Power Corporation of India Ltd ,
P.O. Aditya Nagar, Surat- 394 516

54) General Manager,
Gandhar Gas Power Project,
National Thermal Power Corporation of India Ltd,
P.O.NTPC Township, Bharuch(Dist), Gujarat- 392215

55) General Manager,
SIPAT TPS Stg-I,
National Thermal Power Corporation of India Ltd,
SIPAT, Chhattisgarh.

56) General Manager,
SIPAT TPS Stg-II,
National Thermal Power Corporation of India Ltd,
SIPAT, Chhattisgarh.

57) General Manager,
Mouda STPP, NTPC Ltd,

Mouda Ramtek Road, P.O.Mouda,
Nagpur (Dist), Maharashtra

58) General Manager ,
2 X 135 MW Kasaipali Thermal Power Project,
ACB (India) Ltd. District - Korba
Chhattisgarh Chakabura 495445

59) General Manager,
Bharat Aluminum Co. Ltd,
Captive Power plant-II, BALCO Nagar
Chhattisgarh Korba 495684

60) Executive Director,
Costal Gujarat Power Ltd,
Tunda Vandh Road, Tunda Village,
Mundra, Gujarat Kutch 370435

61) Executive Director,
DB Power, Village - Baradarha,
Post - Kanwali, Dist - Janjgir,
Champa, Chhattisgarh Baradarha 495695

62) Executive Director
Jindal Power Ltd. Stg-I,
OP Jindal STPP, PO-Tamnar,
Gjarghoda Tehsil, Chhattisgarh District-Raigarh, 496107

63) Executive Director
Jindal Power Ltd. Stg-II,
OP Jindal STPP, PO-Tamnar,
Gjarghoda Tehsil,
Chhattisgarh District - Raigarh, 496107

64) Executive Director,
Plot No Z-9, Dahej SEZ Area (Eastern side),
At Dahej, Taluka-Vagra,
Gujarat Dist-Bharuch-392130

65) Executive Director,
EMCO Power Ltd, Plot No B-l,
Mohabala MIDC Growth Center
Post Tehsil - Warora, Dist Chandrapur
Maharashtra Chandrapur-442907

66) Executive Director,
ESSAR POWER MP LTD.
Village Bandhora, Post Karsualal,
Tehsil Mada, Madhya Pradesh Distt. Singrauli- 486886

67) General Manager,
GMR CHHATTISGARH ENERGY LTD
Skip House, 25/1, Museum Road Karnataka
Bangalore 560025

68) Managing Director,
Jaypee Nigri Super Thermal Power Project,
Nigri District, Madhya Pradesh
Singrauli-486668

69) Executive Director,
DCPP, OP Jindal STPP,
PO-Tamnar, Gjarghoda Tehsil,
Chhattisgarh District Raigarh- 496107

70) Station Director,
Nuclear Power Corporation of India ltd,
Kakrapara Atomic Power Station,
PO - via Vyara, Gujarat Dist – Surat- 395651

71) Station Director,
Tarapur Atomic Power Station 1&2,
Nuclear Power Corporation of India Ltd,
P.O. TAPP, Thane (Dist), Maharashtra- 401 504

72) Station Director,
Tarapur Atomic Power Station 3&4,
Nuclear Power Corporation of India Ltd,
P.O. TAPP, Thane (Dist), Maharashtra- 401 504

73) Managing Director,
Korba West Power Co. Ltd.,
Village –Chhote Bhandar, P.O. - Bade Bhnadar,
Tehsil - Pussore, District -Raigarh,
Chhattisgarh Raigarh-496100

74) Managing Director,
KSK Mahanadhi , 8-2-293/82/A/431/A,
Road No 22 Jubilee Hills Andhra Pradesh
Hyderabad- 500033

75) General Manager,
LANCO Power Ltd, Plot No - 397,
phase -III, UdyogVihar, Haryana Gurgaon-122016

76) General Manager,
NTPC-SAIL Power Company Private Ltd,
Puranena Village, Chhattisgarh Dist - Durg,
Bhilai 490021

77) General Manager,
Ratnagiri Gas & Power Pvt. Ltd,
2nd Floor, Block-2, IGL Complex,
Sector-126, Expressway, Uttar Pradesh, Noida-201304

78) Managing Director,
Sasan Power Ltd, DAKC, I Block,
2nd Floor, North Wing,
Thane Belapur Road, Koparkhairana
Maharashtra, New Mumbai-400710

79) Managing Director,
Vandana Vidyut Bhavan,
M. G. Road, Chhattisgarh, Raipur- 492001

80) State Load Despatch Center,
GRIDCO Colony, Po-Mancheswar
Railway Colony, BBSR
Bhubaneshwar -751070

81) State Load Despatch Center,
Jharkhand State Electricity Board,
Kushai Colony, Doranda, Ranchi-834002

82) SLDC, BSEB,
Patna, Bihar State Electricity Board,
Vidyut Bhawan, Jawaharlal Nehru Marg,
Patna-800021

83) SLDC, West Bengal,
P.O. Danesh Seikh Lane, Andul Road,
Howrah -711109

84) Damodar Valley Corporation,
DVC Tower, VIP Road,
Kolkata, WB 700054

85) Energy and Power Deptt,
Govt, of Sikkim, Kazi Road,
Gangtok 737 201

86) General Manager,
Farakka Super Thermal Power Plant-I&II,
NTPC Ltd., Farakka, WB 742236

87) General Manager,
Kahalgaon Super Thermal Power
Plant-I NTPC Ltd, Bhagalpur, Bihar- 813214

88) General Manager,

Kahalgaon Super Thermal Power Plant-II
NTPC Ltd, Bhagalpur, Bihar-813214

89) Executive Director,
Talcher Super Thermal Power station-I
NTPC Ltd, Nayapalli, Odisha 751012

90) Chief Engineer (Elect),
Teesta V HEP, NHPC,
Singtam, East Sikkim-737134

91) Chief Engineer,
Rangit Hydro Electric Project NHPC,
P.O. Rangit Nagar South Sikkim 737111

92) General Manager,
Farakka Super Thermal Power Plant-III,
NTPC Ltd., Farakka, WB-742236

93) Sr. VP, Sterlite Energy Limited
1st. Floor, City Mart Complex,
Baramunda, Odisha-751023

94) CEO, Maithon Power Limited
MA-5, Gogna Colony, P.O: Maithon,
Dhanbad, Jharkhand-828027

95) Additional General Manager,
National Thermal Power Corporation Limited,
BARH Thermal Power Station, Patna, Bihar 803213

96) Chairman, GATI Infrastructure Ltd,
268, Udyog Vihar, Phase-IV,
Gurgaon, Haryana 122001

97) DGM (Electrical),
Adhunik Power & Natural Resource Limited Village:
Padampur, PS: Kandra Tata-Seraikela Road,
Jharkhand 832105

98) Andhra Pradesh State Load Dispatch Centre,
Room No. 611, 6th Floor,
A Block APTRANSCO, Vidyut Soudha,
Khairatabad.

99) SLDC, KPTCL,
28, Race course Cross Road,
Bangalore -560009

100) State Load Despatch Centre,

Kalamassery, Executive Engineer
O/o Chief Engineer, (Transmission), System Operation,
Kalamassery -683503

101) System Control Centre,
Electricity Department, Puducherry,
137, Nethaji Subhash Chandra Bose Salai,
Electricity Department-605001

102) TANTRANSCO, SLDC,
MLDC Block, 144 Anna Salai,
Chennai-600002

103) Telangana SLDC,
Chief Engineer, Room No 611
A Block, SLDC of the State of Telangana (TSSLDC),
TSTRANSCO, Vidyut Soudha, Khairtabad,
Hyderabad-500082

104) AGM, National Thermal Power Corporation Ltd.,
SR Headquarters II & V Floors,
MCH Complex, R.P.Road, Secunderabad-500 003,
Andhra Pradesh

105) AGM , National Thermal Power Corporation Ltd.,,
SR Headquarters II & V Floors,
MCH Complex, R.P.Road, Secunderabad-500 003,
Andhra Pradesh

106) AGM, National Thermal Power Corporation Ltd.,,
SR Headquarters II & V Floors,
MCH Complex, R.P.Road, Secunderabad-500
003, Andhra Pradesh

107) The Deputy General Manager,
Neyveli Lignite Corporation Ltd., Corporate Office,
Block-01, P.O. Neyveli, PIN: 607 801, Cuddalore Dist,
Tamil Nadu.

108) The Deputy General Manager,
Neyveli Lignite Corporation Ltd.,
Corporate Office, Block-01, P.O. Neyvel-
Cuddalore Dist., Tamil Nadu-607 801.

109) The Deputy General Manager,
Neyveli Lignite Corporation Ltd.,
Corporate Office, Block-01, P.O.Neyveli- 607 801,
Cuddalore Dist., Tamil Nadu.

110) The Deputy General Manager,

Neyveli Lignite Corporation Ltd.,
Corporate Office, Block-01, P.O.Neyveli- 607 801,
Cuddalore Dist., Tamil Nadu.

111) The Station Director,
Madras Atomic Power Station,
Nuclear Power Corpn. of India Ltd.,
Kalpakkam - 603 102, Tamil Nadu

112) The Deputy General Manager ,
Kaiga Generating Station,
Nuclear Power Corpn. of India Ltd.,
P.O.Kaiga, Via Karwar, Karnataka -581400,
Karnataka.

113) The Deputy General Manager,
Kaiga Generating Station,
Nuclear Power Corpn.of India Ltd.,
P.O.Kaiga, Via Karwar, Karnataka -581400 ,
Karnataka.

114) The Station Director,
Kudankulam Nuclear Power Project,
Nuclear Power Corporation of India Ltd.,
P.O. Kudankulam, Radhapuram Taluk,
Tirunelveli District, Tamil Nadu - 627 106

115) The Chief Operating Officer,
LANCO-Kondapalli Power Ltd.,
Plot No.4, Software Units Layout,
Hitech City, Madhapur, Hyderabad-500 081.
Andhra Pradesh

116) The Chief Operating Officer,
LANCO-Kondapalli Power Ltd.,
Plot No.4, Software Units Layout,
Hitech City, Madhapur, Hyderabad-500 081
Andhra Pradesh

117) General Manager (O&M),
NTPC Tamil Nadu Energy Company Ltd.,
Vallur Thermal Power Project,
Vellivoyalchavadi P.O., Ponneri Taluk,
Tiruvallur Dist., Chennai - 600103,
Tamil Nadu

118) The General Manager (Projects),
Simhapuri Energy Pvt. Ltd.,
Madhucon Greenlands, 6-3-866/2,
3rd Floor, Begumpet, Hyderabad-500016.

119) Sr. Vice President,
Meenakshi Energy Pvt. Ltd.,
Meenakshi, Plot No: 119, Road No: 10,
Jubliee Hills, Hyderabad-500 033.

120) Managing Director,
Coastal Energen Pvt. Ltd, 7th Floor,
Buhari Towers, 4, Moores Road,
Chennai, PIN: 600006,
Tamil Nadu.

121) The Chief Executive Officer,
NLC Tamil Nadu Limited, 2X500,
MW JV Thermal Power Project, Harbour Estate,
Tuticorin, Pin: 628004, Tamil Nadu

122) State Load Despatch Centre,
Agartala, 79 tilla, Kunjaban,
Agartala, Tripura (West)

123) Department of Power,
Government of Nagaland,
SLDC Nagaland,

124) Electricity Colony,
Full Nagarjan Dimapur,
Nagaland

125) Mizoram State Load Despatch Centre,
Tuikhuahtlang,
Aizawl -796001

126) State Load Despatch Centre,
Assam, SLDC, AEGCL,
Near 132kv Grid Sub Station,
Kahilipara, Guwahati

127) General Manager,
Doyang HEP, NEEPCO,
Wokha, Nagaland

128) General Manager,
Ranganadi HEP, NEEPCO,
P.O.Ranganadi Proj. Dist. Subansiri,
Ar. Pradesh-791121

129) General Manager,
AGBPP, NEEPCO,
Kathalguri, Tinsukia,

Assam

130) General Manager,
AGTPP, NEEPCO, Ramchandranagar,
Agartala, Tripura

131) General Manager,
KHANDONG HEP, NEEPCO,
Umrangsoo, N.C. Hills, Assam

132) General Manager,
KOPILI HEP, NEEPCO,
Umrangsoo, N.C.Hills, Assam

133) General Manager,
KOPILI-2 HEP, NEEPCO, Umrangsoo,
N.C.Hills, Assam

134) Chief Engineer,
NHPC Loktak HEP
Leimatak-795124, Manipur

135) Managing Director,
ONGC Tripura Power Company Ltd,
6th Floor, A Wing, IFCI Tower-61,
Nehru Place, New Delhi, 110019 ……**Respondents**

Parties Present:

Shri S. R. Narashimhan, NLDC
Ms. Abiha Zaidi, NLDC
Shri Rahul Shukla, NLDC
Shri Anil Raghuwanshi, THDC
Shri D.S. Chauhan, THDC
Shri Rahul Srivastava, Advocate, UPSLDC
Shri Zahir Ahmad, UPSLDC
Shri M.K.Gupta, UPSLDC
Shri Aashish Bernard, Advocate, SLDC, M.P.
Shri Darshan Singh, SLDC Delhi
Shri S. Sutradhar, SLDC Delhi
Shri K. Nayak, NHPC
Shri A.K.Arya, RRVPNL
Shri V.K.Gupta, RRVPNL
Ms. Swapna Seshadri, Advocate, KPTCL and KSK Mahanadi
Shri Anand K. Ganesan, Advocate, KPTCL and KSK Mahanadi
Shri Ajay Dua, NTPC
Shri V.K.Jain, NTPC
Shri Romesh Kapoor, SJVN Ltd.
Shri Sanjeev Sood, SJVN Ltd.

Shri Rajeev Agarwal, SJVN Ltd.
Shri K.K. Gupta, SJVN Ltd.
Shri Sheikh Salim, UPRVUNL
Shri G.K. Mishra, UPRVUNL
Shri F.E. Kharshing, MeECL
Shri Girish Gupta, CSPTCL
Shri Pankaj Kocay, CSPTCL
Shri R.A. Sharma, MPPTCL
Shri Sanjiv R. Saxena, Advocate, HVPNL
Shri R. Mishra, Advocate, HVPNL
Shri Amit Kumar Saini, HVPNL
Shri Ravi Sher Singh, HVPNL

ORDER

The Petitioner, National Load Despatch Centre, has filed the present petition seeking direction to the Respondents to comply with the provisions of Regulation 5.2 (f), (g), (h) and (i) of the Central Electricity Regulatory Commission (Indian Electricity Grid Code) (hereinafter referred to as "Grid Code"). The Petitioner has made the following prayers:

> "(i) Direct all utilities to provide primary response compulsorily as provided for in the IEGC in sections 5.2 (f), (g), (h) and (i).
>
> (ii) Any other directions as deemed fit in the interest of power system security"

2. The Petitioner has submitted as under:

(a) The necessity for a responsive governing system on the generators has been underlined by the Commission since approval of the Grid Code in December 1999. As per the provisions of the Grid Code as amended from time to time, during fall in grid frequency, generation from the units of the generating stations is required to increase by 5% by way of governor response.

(b) The frequency profile has improved considerably over the years, particularly in the year 2014 with the synchronization of Southern grid with the rest of the

country, implementation of the amendments in the Grid Code w.e.f. 17.2.2014 and introduction of the Deviation Settlement Mechanism Regulations. The scatter plots of the maximum, minimum and average frequency have been given in Annexure-I of the Petition. The earlier variation of the order of 4-5 Hz on daily basis between1998-2002 has now come down to the order of 0.50-0.70 Hz.

(c) In the context of synchronization of Southern Grid with the NEW Grid in December, 2013, operation of large Grid without adequate Primary Response makes the system vulnerable in case of large contingencies in the grid, particularly if there is part separation of any part of the grid.

(d) The issue of primary response gains further importance in view of increasing penetration of renewable generation in the system. Various measures are being taken to narrow the variations in frequency. However, large efforts are required in narrowing the variations further. Therefore, it has become essential to ensure primary response through governor action from all the generators. In order to assess/monitor the implementation of primary response, the Commission vide order dated 3.5.2013 in Petition Nos. 47-52 of 2012 has mandated computation of frequency response of all control areas of the grid and all the generating stations. The Commission had notified the procedure for 'Assessment of Frequency Response Characteristic (FRC) of control areas in Indian power system' for periodic monitoring of control area frequency response vis-a-vis ideal frequency response for large events. The Commission directed NLDC/RLDCs/SLDCs to report Frequency Response characteristics (FRC), on control area basis, for large events in the grid. Accordingly, NLDC has been evaluating frequency response of the regions and grid entities for large events and it has been constantly submitting

quarterly feedback to the Commission (alongwith calculations).

(e) The Commission in order dated 31.12.2012 in Petition No. 191/SM/2011 directed NLDC to implement a pilot project for testing governor response. After the approval of the terms of reference for testing by a Task Force constituted by CEA for the purpose and placement of order by the CTU, the pilot project tests were completed between October, 2014 to January, 2015. The Commission had been apprised of the test details on 27.1.2015 where the vendor involved in the tests, M/s Solvina also gave a presentation.

(f) Meanwhile, on 24.9.2014, the Commission constituted a Committee headed by Shri A Velayutham, ex-Member, MERC for implementation of Free Governor Mode of Operation (FGMO) or primary response. However, primary response remains elusive.

(g) On 14.1.2015, in case of tripping of one 1000 MW unit at Kudankulam nuclear power station at 1920 hours, the FRC of control areas as well as generators was calculated as per the procedure validated by the Commission.

(h) NLDC has compiled FRC for major generating stations and the constituents of all the regions, for Kudankulam generation outage event. Since, the generating stations, connected to the grid, are expected to increase their output during contingencies involving loss of generation (resulting in decline in frequency), it is understood that the generating station with highest -negative value of FRC is contributing maximum to frequency response and the generating station with highest positive value of FRC is aggravating the frequency deviation. On the other hand, the constituent with highest positive value of FRC contributes maximum to

frequency response and that with highest-negative value severely aggravates the frequency deviation.

(i) As per the table 3 and 4 of the Annexure-IV of the Petition, the control areas like Bihar, UP, Chhattisgarh, MP, Gujarat, OPTCL, etc. had very low or negative frequency response in the event and not supporting attest of the frequency fall. Similarly, many generating stations like Vindhyachal, Ramagundam, Singrauli, etc. have shown positive or very small Frequency Response thereby aggravating the frequency deviation in the event. All the generating stations have not provided adequate frequency response.

(j) The overall FRC on an all India basis for this event which has occurred during the evening peak hours is of the order of 6000 MW/Hz. During this period, the number of the generating units on bar is maximum and the capacity on bar would be typically 130-140 GW which should have provided a much higher frequency response (50000-55000 MW/Hz ideally assuming 5% governor droop). While such an ideal response is rarely available practically, a response of 15000-20000 MW/Hz is still desirable as a complete 4000 MW generating station outage is a credible contingency. It is desirable that the frequency fall in such cases is contained within 49.70-49.80 Hz to avoid any inadvertent tripping in the system such as on account of over-fluxing of transformers in any part of the grid. In this regard, the Petitioner has placed on record the voltage and frequency scatter plots of important generating stations as Annexure-V of the Petition. It would be seen from these plots that operation in second quadrant (high voltage and frequency much less than 50 Hz) can lead to problems of over-fluxing and tripping of transformers.

(k) On 12.3.2014 at 1922 hours, Mundra UMPP had tripped leading to loss of 4100 MW generation. During the period, FRC was 4200 MW/Hz and the frequency fall from 49.93 Hz to 49.28 Hz had led to reduction in power order on HVDC Bheramara feeding Bangladesh by 150 MW (as part of System Protection Scheme). The fall in frequency for a similar loss during off peak hours could very well be imagined when the system size is of the order of 100 GW only and FRC would be much lower during this period.

(l) Improvement in the all India FRC is required to protect the system during major contingencies and aiding frequency stabilization.

3. Notices were issued to the respondents to file their replies. Replies to the Petition have been filed by SLDC, Delhi, SLDC, Rajasthan, SLDC, UP, NTPC, NHPC, SJVNL, THDC, SLDC, Madhya Pradesh, SLDC, Gujarat, SLDCs Andhra Pradesh and Telangana and NTPC Tamil Nadu Energy Ltd.

4. During the course of hearing, the representative of the Petitioner submitted that during the earthquake in Nepal on 25.4.2015 at around 11:43 hrs, adequate frequency response was not provided by the constituents and there was demand reduction of approx. 3500 MW within 3-4 minutes due to trippings/manual load shedding especially in Northern Region and Eastern Region. The frequency went up to 50.50 Hz from 49.95 Hz i.e. variation of 0.55 Hz was observed in few minutes. In this event, adequate frequency response was again missing in number of control areas, particularly in the NEW Grid which led to high voltages in the system, large angular variation among nodes in Grid, etc. The most alarming outcome of the event was sudden flow change in 765 kV Sholapur-Raichur D/C (AC Lines between NEW Grid and SR Grid) by approx.1000 MW due to better frequency response from Southern Region generating units leading to

generation reduction in the region. The impact was also observed on 400 kV Wardha-Parli D/C transmission line on which loading increased to such high levels that triggering of System Protection Scheme (SPS) missed by a narrow margin. The Representative of the Petitioner submitted that SPS action of load shedding associated with the line would have again caused frequency to rise to a higher value. Frequency rise to 50.50 Hz and above was also dangerous considering the likely increase in Distributed Generation resources such as solar PV. The Representative of the Petitioner submitted that the CEA Grid Standards Regulations prescribe disconnection of Solar PV at 50.50 Hz and above (or lower depending on agreement with the licensee).

5. The Representative of POSOCO submitted that the performance of FGMO/ RGMO is far below expected level. SLDCs are yet to take-it-up seriously at appropriate management level/SERC for ensuring effective governor performance. The Representative of THDC submitted that THDC is not able to implement the FGMO as THDC is a multi-purpose project.

6. The Petitioner was directed to upload a copy of the petition on the website of POSOCO and RLDCs so that it is easily accessible by all the respondents. The Petitioner, vide Record of Proceedings for the hearing dated 5.5.2014, was directed to file the following information/clarification:

(a) FRC report for the Earthquake in Nepal on 25th April, 2015.

(b) The ISGSs, who have given poor response or no response and justification for poor response or negative response with reference to Grid Code during both frequency excursions.

7. SLDCs were directed to file the following details/clarifications:

(a) FRC report of their respective control areas including reasons for poor/negative response from their control areas clearly bringing out the generator-wise response in MWs, in percentage of ideal response and scheduled MW during both the frequency excursions for all the generators of the State.

(b) Seek the reasons from the generators who have shown poor or no response as per their respective Grid Code or negative response to the frequency excursions.

8. It was observed during the hearing that while reporting the Frequency Response of demand areas, it would be required to know "net system Demand met after the event". Accordingly, the Petitioner and SLDCs were directed to submit the same for both events. It was further observed that ideal response has been calculated based on governor droop of 5% which requires generation to be increased by 40% for a frequency fall of 1 Hz. Accordingly, frequency dip of 0.17 Hz in the case of tripping of one unit (1000MW) at Kudankulam Nuclear Power Station on 14.1.2015 at 1920 hours as indicated by the Petitioner, requires generation increase of 6. 8%. However, as per provisions of the Grid Code, the maximum increase has been limited to 5% considering limited thermal reserve available in thermal units. Accordingly, the Petitioner vide RoP of the hearing dated 22.5.2015 was directed to indicate whether the FRC procedure requires to be modified to take into account the above aspect.

9. The Petitioner, vide Record of Proceedings for the hearing dated 14.7.2015, was directed to reconcile the data with the SLDCs and to submit the list of ISGSs which have not provided the adequate response in the events submitted by the petitioner. The Petitioner vide its affidavit dated 7.9.2015 has filed the information called for.

10. The Petitioner has filed the IA No.36/2015 reporting the FRC of various control

areas and the generators during the earthquake in Afghanistan on 26.10.2015 during which there was a load crash of 1300 MW.

11. UP Rajya Vidyut Utpadan Nigam Limited (UPRVUNL) has filed the I A No. 8/2016 listing all the efforts made by it for implementation of FGMO/RGMO as per Regulation 5.2 (f), (g), (h) and (i) of the Grid Code to provide the primary response. UPRVUNL in the said IA has prayed to keep in abeyance the provisions of the Grid Code as the responses at certain generating stations are inadequate. During the hearing of IA, it was observed that IA would be considered and disposed of in the light of decision of the Commission on the report of the Committee constituted to examine the issues with regard to implementation of FGMO/RGMO.

12. The replies and rejoinders filed by the respondents and the Petitioner have been discussed briefly as under:

(a) SLDC, Delhi has submitted that all the generators within Delhi except unit 4 and 5 of Badarpur Thermal Power Station (BTPS) are exempted from RGMO/FGMO stipulations. As per Regulation 5.2 of the Grid Code, thermal power plant below 200 MW and Gas Turbines Stations are exempted from FGMO. The units of BTPS were commissioned on 2.12.1978 and 25.12.1981 and are having mechanical governors. SLDC, Delhi has further submitted that in line with the Grid Code, FRC for control area Delhi has not been reported for any major event. SLDC has submitted that the calculated FRC in case of tripping of Kudankulam unit, comes out to be 37.1% of ideal response. However, as per NLDC calculations, it is coming to 12.4%. SLDC, Delhi has submitted that it supports the contention of the Petitioner that improvement in the all India FRC is very much required to protect the system during

major contingencies and aiding frequency stabilization.

(b) The Petitioner in its rejoinder has submitted that tripping of Kudankulam unit may be attributed to difference in change in net interchange value, between the NLDC and Delhi, SLDC`s calculation sheets. With regard to SLDC, Delhi contention that similarly for Nepal Earthquake incident, FRC response as per SLDC, Delhi comes out to be (–)33 % while as per the calculation of NLDC, it is coming out to be +2.4 %, the petitioner has submitted that this may be due to the difference in load throw off value between two calculations. The Petitioner has submitted that SLDC, Delhi appreciates the role of primary response in maintaining all India Frequency but at the same time cites inability to provide primary response.

(c) SLDC, Rajasthan has submitted that on both the events i.e on 14.1.2015 at 19.20 hrs and 25.4.2015 at 11.43 hrs at Kudankulum and Nepal respectively, since, the system operate in Rajasthan control area was within operating frequency range and drawl from the grid was also within limit, no action was taken to curb the drawl or improve with the State generation. SLDC, Rajasthan has placed on record the report regarding over drawl and under drawal dated 14.1.2015 and 25.4.2015 at 19.20 hrs and 11.43 hrs respectively. SLDC, Rajasthan has submitted that the FGMO and RGMO schemes are in operation in the Rajasthan control area by the generators and FRC is found in line. FRC is contributing maximum to frequency response.

(d) The Petitioner in its rejoinder has submitted that for the Kudankulum incident on 14.1.2015 at 19:20 hours, SLDC, Rajasthan has calculated the FRC for Rajasthan Control Area as 96.67% of the ideal response. However, as per NLDC's calculations, the Rajasthan's response was merely 18.4%. The Petitioner has

submitted that while checking the calculation, NLDC observed that change in frequency is calculated as -0.06 Hz, which is incorrect since the frequency dip, as shown by the SLDC, Rajasthan in the Annexure to the reply, was from 50.08 Hz to 49.86 Hz. Therefore, the change in frequency was (-) 0.22 Hz and there appears to be certain ambiguity in frequency settling point selection in FRC calculation by the SLDC, Rajasthan. The Petitioner has submitted that for the incident on 25.4.2015 at 11:43 hours, SLDC, Rajasthan has calculated the frequency response of Rajasthan Control Area as (-) 30.57% of the ideal response i.e. SLDC, Rajasthan has aggravated the frequency deviation. However, as per NLDC calculations, Rajasthan's response was 13.4% i.e. SLDC, Rajasthan has countered the frequency rise to this extent. The Petitioner has submitted that while checking the calculation, NLDC observed that change in frequency is again calculated as 0.05 Hz, which is incorrect since the frequency rise, as shown by SLDC, Rajasthan in Annexure to its reply, was from 49.99 Hz to 50.50 Hz. Therefore, the change in frequency was 0.51 Hz.

(e) SLDC, Uttar Pradesh in its reply has placed on record the status of implementation of FGMO/RGMO in its control area. SLDC, Uttar Pradesh has submitted that out of 5 units at Anpara TPS, three 200 MW units are operating with locked/in-operative governor. At Obra TPS, out of 5 units, 4 units are operating with locked/inoperative governor. Paricha TPS and Harduaganj TPS have implemented RGMO as per design. SLDC, Uttar Pradesh has submitted that for IPPs generating stations, RGMO has been implemented on all the generating units of Roza TPS and Anpara C TPS (LANCO). SLDC, Uttar Pradesh has submitted that SLDC vide its letter dated 16.4.2016 requested all the generating stations and IPPs to submit the

report regarding operation of RGMO which is still awaited.

(f) The Petitioner in its rejoinder has submitted that the implementation of RGMO is not the end of the Grid Code adherence but required response is also required to be achieved by the generators. The Petitioner has submitted that NLDC has received the report from the generating stations, namely (i) Parichha unit nos 3, 4, 5 and 6, (ii) Harduaganj unit nos. 8 and 9, (iii) Anpara unit nos. 1, 3, 4 and 5, (iv) Obra unit-9, (v) Anpara-C, unit-1 and 2 (vi) Rosa unit-1 and 3. The Petitioner has submitted that no response from the generators was received at the time of tripping of first unit of Kudankulam on 14.1.2015.

(g) NTPC in reply has submitted as under:

(i) The Petitioner has calculated the FRC considering FGMO with 5% droop where as the Grid Code stipulates RGMO with 5% droop limited to +/- 5% of generation capacity. The secondary response shall be in place for sustainable primary response.

(ii) Normal changes in renewable generation would have to be handled through flexing of conventional generation.

(iii) A reference to the primary response testing done by the Petitioner is not related to the present petition.

(iv) Based on the UCTE guidelines, an all India FRC of the order of 20,000 MW/Hz (15,200 MW/Hz due to generator response and 4,800 MW/Hz due to load) shall be desirable. This would require 38,000 MW machines to provide primary response with 5% droop. However, considering carrying cost of Primary Control Reserve, permissible frequency drop of (-)

0.4 Hz for Indian conditions shall be considered in place of (-) 0.2 Hz quasi steady State drop specified by UCTE. This would reduce the capacity of the units to be put under primary response to 13,000 MW with 5% droop.

(v) The events like momentary decline in frequency from 49.93 Hz to 49.28 Hz for Mundra UMPP tripping should not be a cause of concern. As per UCTE guidelines, this momentary dip of 0.80 Hz is acceptable.

(vi) Since, certain units are giving poor response, NTPC has filed the petition for exemption due to the reasons such as mechanical governor and electric governor not amenable to RGMO retrofit.

(vii) There is no mechanism in the generating stations to show a negative response.

(h) The Petitioner in its rejoinder has submitted as under:

(i) Notwithstanding the provisions in the Grid Code, all the computations are pertaining to FGMO. Regulation 5.2 (f) of the Grid Code provides that after stabilization of frequency around 50 Hz, the Commission may review the above provision regarding the restricted governor mode of operation and free governor mode of operation may be introduced. With regard to limit of +/-5%, it is not clear as to how the NTPC is concluding that the Grid Code restricts the maximum response from machines to ±5% corresponding to a frequency change of ±0.125 Hz. Since, Regulation 5.2 (f)(i)(a) of the Grid Code specifically stipulates a 5% limit for generation increase, there is no restriction in respect of generation reduction.

(ii) Since, the secondary control is necessary to maintain frequency at a

constant value, a request has been made to the Commission to initiate deliberations in this area as the same is going to be intricate task. However, this in no way undermines the importance of primary control.

(iii) NTPC agrees that normal changes in renewable generation would have to be handled through flexing conventional generation. However, a major quantum of renewable generation, particularly wind, is without features like Low Voltage Ride Through (LVRT) characteristics. The same is provided only in machines installed after 15.4.2014. This has led to a situation where a fault in the system (not cleared in time) has led to a large quantum of wind generation going off the grid. Primary control becomes important in such situations.

(iv) The pilot project execution was done in line with the order dated 31.12. 2012 in Petition No. 191/2011.

(v) A presentation was made on 16.3.2015 by M/s Solvina, the agency, before the Committee constituted by the Commission on FGMO implementation where the issues listed by NTPC in Para 9a to 9d were highlighted by the agency.

(vii) The computations indicated by NTPC based on the UCTE standards are in order from steps 1 to 6 leading to an all India FRC of the order of 20,000 MW/Hz (15,200 MW/Hz due to generator response and 4,800 MW/Hz due to load). However, NTPC is now bringing out the cost of carrying Primary Control Reserve as a reason for going to a lower frequency drop of (-) 0.4 Hz rather than the quasi steady state instead of (-) 0.2 Hz specified by UCTE. The cited cost is not much in case of primary response.

Regulation 5.2 (h) of the Grid Code provides that thermal generating units of 200 MW and above and hydro units of 10 MW and above operating at or upto 100% of their Maximum Continuous Rating (MCR) shall normally be capable of (and shall not normally be prevented from) instantaneously picking up 105% and 110% of their MCR, respectively, when frequency falls suddenly. One would ordinarily expect a 200 MW unit to operate at 200 MW and not at 210 MW continuously. So the 200 – 210 MW range should be available for contingencies in the normal course for which the stakeholders are already carrying the cost in terms of fixed charges. With regard to a related issue with the UCTE stipulation of 0.2 Hz drop in quasi steady state, it is clarified that the generator loading would actually increase by 8% considering 5% droop. Therefore, if NTPC feels that the increase in generation must be restricted to 5%, the frequency drop in quasi steady state would have to be restricted to 0.125 Hz giving FRC of 4000 MW/ 0.125 Hz or 32,000 MW/Hz which would mean 68,000 MW capacity at 5% speed droop instead of 38,000 MW computed by NTPC as per the UCTE guidelines.

(vii) The real issue of cost carrying would come with secondary control indicated by NTPC as this reserve has to be carried all the time. Further, limited primary response in the system would lead to a situation where any separation or islanding of part of a system can lead to a dangerous situation and collapse of the islanded system.

(viii) The issue of over-fluxing of transformers becomes a possibility considering that the voltage at certain nodes goes to 430-435 kV range also where a frequency level of 49.40 Hz might be enough to cause over-fluxing

of transformers and consequential tripping.

(ix) With regard to UCTE, the frequency recovers to at least 49.80 Hz, the quasi steady state acceptable frequency quickly through primary response in less than a minute. However, in the example of Mundra UMPP, this was not the case and the frequency recovery was mainly through some df/dt relay actions in Western Region and operation of the System Protection Scheme (SPS) of Bangladesh HVDC.

(x) NLDC agrees that there is no mechanism in the generating stations to show a negative response. However, it may be appreciated that in case the governor control valves position remain unchanged, and frequency rises or falls, the auxiliary drives such as boiler feed pumps, primary heat transfer pumps in a nuclear unit start or air compressors on the same gas turbine shaft consume less or more power depending on low or high frequency.

(i) NHPC in its reply has submitted as under:

(i) Out of 12 generating stations, 7 generating stations being ROR or Pondage type stations with capacity up to three hours, are exempted from RGMO/FGMO. RGMO/FGMO can be better realized when compared to injection schedule. During the incidence of Nepal Earthquake, the injection schedule in respect of all the generating stations (except Dhauliganga, Teesta-V & Loktak) was reduced in the time block 78 to time block 79. Therefore, required unit's response i.e. reduction of generation by primary response to the incidence of frequency rise, got mixed with the reduction of injection schedule.

(ii) As per NLDC calculations, Chamera-I has shown only -3% of ideal response but 'Primary Frequency Response' test carried out by M/s Solvina International shows consistent response in RGMO mode of operation. During Kudankulam incidence, since, the generation of Loktak Power Station was manually increased by plant operator, response can be seen.

(iii) With regard to Teesta-V machines, for 0.12 Hz variation in frequency, as per 5% droop setting, the generation should vary around 16 MW and for 6% droop, the generation shall vary around 13.5 MW. Teesta-V increased the generation by 11.5 MW keeping in mind the generation at the time of incident as 351.5 MW.

(j) The Petitioner in its rejoinder has submitted as under:

(i) NHPC has contended that with changing schedules, correct frequency response cannot be ascertained as actions for reducing and closing down generation are also being taken by the plant. However, in para 7, NHPC suddenly casts certain doubt on the data at NLDC available through SCADA. In this connection, it is clarified that the SCADA data at NLDC with an up-dation time of 10-20 seconds can be relied upon in number of cases.

(ii) The sheet provided by NHPC in Annexure to the reply talks about the changes in terms of 15-minute time blocks while the SCADA data is updated every 10-20 seconds. So possibly, the operator has increased the generation manually after the fall in frequency.

(iii) The recommended rate for changing the governor setting for all the generating units is 1% per minute as stipulated in Regulation 5.2 (i) of the Grid

Code refers to secondary control. The procedure for calculation by Teesta shows that 105% of MCR shall be taken as limit. This issue has been addressed by NLDC in Para 13 of its submission dated 11.6.2015.

(k) SJVNL in its reply has submitted that Nathpa Jhakri HPS is under successful operation in FGMO with a droop setting of 6% with inherent dead band of 0.03 Hz as per the Grid Code. Rampur Hydro Power Station operates in tandem with Nathpa Jhakri HPS and it follows the governor of NJHPS as its master. However, FRC calculations of both the generating stations for both incidents were not possible due to non-availability of data at SJVNL end.

(l) The Petitioner in its rejoinder has stated that since real time data at NLDC from NJHPS was not updated on both the incidents, 0% response was coming from calculations. However, in case of Rampur HPS, during earthquake incident, the response was coming to be -3.8 % of ideal response. Since, the generating stations operate in tandem, the response of NJHPS would also be in this range. Hydro machines of such high capacity should provide good response for controlling the frequency deviation.

m) THDC in its reply has submitted as under:

(i) The primary response and secondary response have not been well defined in the Grid Code. However, the machines at Tehri and Koteshwar are kept in RGMO. This has been tested by M/s Solvina during Pilot study at Tehri. The RGMO response at Koteshwar was tested by M/s BHEL during internal testing and was found to be as expected. There has been no notification

regarding compliance with FGMO in accordance with Regulation 5.2(f) (d) of the Grid Code.

(ii) Tehri and Koteshwar HEPs are obligated to supply drinking water to the States of UP and Delhi and irrigation water for UP at a higher priority to power generation. Therefore, the control of machine generation based on system frequency alone is not justifiable for THDC. During monsoon season, the increase in inflow limits the possibility of generation reduction at Tehri and Koteshwar since the discharge of Tehri becomes the inflow at Koteshwar.

(iii) Tehri and Koteshwar should be exempted from FGMO response as and when notified. FGMO is not likely to be effective in its present form. Additional generation resources or load shedding may be resorted to for frequency control.

(iv) On the day of earthquake in Nepal, Tehri Unit 1 was already under stop sequence as per injection schedule and the generation in the only other running unit (Unit # 3) was reduced from 168.60 MW to 137.40 MW. Therefore, total reduction of 60.60 MW was achieved though the unit-1 reduction was on account of shut down sequence. Similarly, Koteshwar generation was around 99.81 MW and it got reduced to 98.37 MW.

(n) The Petitioner in its rejoinder has submitted that FGMO response is essential to secure grid operation. During the nine months of low hydro (October to May), THDC can easily provide primary response fully honouring its commitment of water release. During the three months of high hydro, water overflow or spillage could restrict provision of primary response as the units might already be utilizing

the available overload capability. The Petitioner has submitted that as per NLDC`s calculation, the response was (-) 4.7% of ideal response i.e. helping the system frequency though far inadequate.

(o) SLDC, Madhya Pradesh in its reply has submitted that since historical data was not available, response could not be calculated for the event of 14.1.2015. Out of the 14 generating stations, only 4 have shown certain response for the incidence of Nepal earthquake. SLDC, MP had sought reply from the MP Power Generating Co. Ltd and Jaypee Bina TPS on the poor response or no response as per Grid Code by the generating units. In response, MP Power Generating Co. Ltd has cited several reasons for non-performance of frequency response by its units. In certain cases such as unit Nos. 6, 7, 8 and 9 of Sarni, it has filed Petition in the Commission for exemption in RGMO on these units while in certain cases where RGMO is in service and adequate response was not obtained, it has taken necessary actions to rectify the discrepancies. Jaypee Bina TPS has stated that it has found insignificant response by its units on the date of incident on 25.4.2015. Jaypee Bina TPS has submitted that Jaypee Bina contacted OEM for checking functionality of FGMO in machines who has agreed in this regard.

(p) The Petitioner in its rejoinder has submitted that the overall response by the generators appears inadequate to the frequency rise during the incident.

(q) SLDC, Gujarat in its reply has submitted that **o**ut of total conventional generation installed capacity of 16465 MW under the control area of SLDC, Gujarat, only 7290 MW capacity is available with RGMO in service. SLDC has further submitted that calculated response of the generators in its control area

have shown poor frequency response. While some have shown no response and certain have shown negative response causing aggravation in frequency deviation. SLDC has submitted that during the tripping of Kudankulam unit on 14.1.2015, there was festival celebration in the State of Gujarat and there was anticipated drop in demand of 2500 MW from previous day. Therefore, number of the generating units was under reserve shutdown. Since, 600 MW unit of M/s EPGCL-Vadinar and 3960 MW capacity from M/s APL-Mundra TPS complex were commissioned few years back, they have low inertia constant compared to older units. Therefore, their contribution to frequency response might not be to the desired level. 1000 MW of Gujarat demand was being catered using wind energy, which ultimately led to poor frequency response. SLDC has submitted that during the earthquake in Nepal incident, GTPS Unit 3, APL Units 1, 4 & 7 and EPGL Unit 1 have not responded at all while APL Units 2, 3 & 5 have responded negatively. In this incident also out of the total demand being met by Gujarat of 13100 MW, nearly 1175 MW was from RE sources. Out of the 7290 MW capacity of RGMO eligible generators, only 6480 MW was on bar. Further, 5220 MW of the 6480 MW generation consists of newer and larger sized machines which have lower inertia constant. SLDC has stated that since, the response from older machines at WTPS and GTPS also coincides with scheduled generation reduction, it is not known for sure whether the good response is due to RGMO or coincidental manual generation backing. SLDC has submitted that it has been consistently pursuing the matter with all RGMO eligible generators in the State.

(r) The Petitioner in its rejoinder has submitted that keeping approx. 5000 MW of generation out of primary response is a threat to system operation. The response from these units would have surely improved the response appreciably.

Regarding new units with low inertia, the Petitioner has submitted that primary response is an independent parameter and has little or no relation to inertia constant. In fact, worldwide, even wind turbines are providing frequency response during high frequency conditions.

(s) SLDC, Andhra Pradesh and Telangana have submitted that on the day of earthquake, NTTPS and RTTPS machines were operating at technical minimum due to dispatch instructions. SLDC Andhra Pradesh has submitted that positive response was obtained from the units except NTTPS-I & II. Since, these units were operating at technical minimum, they could not reduce their load any further. Therefore, no frequency response could be obtained from them. SLDC, Telangana has placed on record a table indicating the response of RGMO/FGMO in its generating units. SLDC, Telangana has submitted that the overall response of Telangana as a constituent for 25.4.2015 comes out to be 19.51% due to poor operation of few units being poor coal quality and wide valve open operation in units. SLDC, Telangana has submitted that as per Srisailem Left Bank Units, details of primary response could not be furnished due to loss of data.

(t) The Petitioner in its rejoinders has submitted that the explanation given by SLDC, Andhra Pradesh appears to be unconvincing. However, **SLDC, Andhra Pradesh** has not provided the response for tripping of Kudankulam unit on 14.1.2015. The Petitioner has submitted that the overall response of Telangana comes out to be mere 5.7% of ideal response as against the calculation of 19.51% by SLDC, Telangana. Out of 4 nos. of thermal units at KTPS, only two have shown slight response supporting the frequency while one unit has shown response in a way to aggravate the frequency deviation. SLDC Telengana has citied the reasons

for poor operation of few units as poor coal quality and wide valve open operation in units. However, the application appears unconvincing considering that the 500 MW units were operating at a level of 350 MW/360 MW and wide valve opening at such low generation levels appears unconvincing. Further, on 25.4.2015, a generation reduction was actually required rather than increase and valve wide operation creates a constraint only for generation increase.

(u) NTPC Tamil Nadu Energy in its reply has submitted that on 14.1.2015, Unit-I and II of VTPS responded by contributing maximum to frequency response. RGMO is fully functional in all units of VTPS. Unit-I & II of VTPS performed well on the event of 25.4.2015 and RGMO status has been extended to SRLDC by NTPC Tamil Nadu.

(v) The Petitioner in its rejoinder has submitted that it is difficult to make out the response from the graphs enclosed from the Data Acquisition System (DAS) with black background. During the earthquake in Nepal on 25.4.215, VTPS units showed a response of -10.5% (as per the petitioner's calculations) which means responding in a way to improve the frequency. However, NTPC Tamil Nadu Energy has not produced any records from the plant for this incident.

Analysis and decision:

13. We have considered the submissions of the Petitioner and the Respondents and perused the documents on record**.**

14. The Grid Code lays down the rules, guidelines and standards to be followed by various participants in the system to plan, develop, maintain and operate the power

system, in most secure, reliable, economic and efficient manner, while facilitating healthy competition in the generation and supply of electricity. The Grid Code facilitates the optimal operation of the grid, facilitation of coordinated and optimal maintenance planning of the grid and facilitation of development and planning of economic and reliable National/Regional grid.

15. Regulations 5.2 (f), (g), (h) and (i) of the Grid Code provides as under:

> "(f) All Coal/lignite based thermal generating units of 200 MW and above, Open Cycle Gas Turbine/Combined Cycle generating stations having gas turbines of capacity more than 50 MW each and all hydro units of 25 MW and above, which are synchronized with the grid, irrespective of their ownership, shall have their governors in operation at all times in accordance with the following provisions:
>
> **Governor Action**
> i) Following Thermal and hydro (except those with upto three hours pondage) generating units shall be operated under restricted governor mode of operation with effect from the date given below:
>
> (a) Coal/lignite based thermal generating units of 200 MW and above,
> (1) Software based Electro Hydraulic Governor (EHG) system: 1.8.2010
> (2) Hardware based EHG system : 1.8.2010
> (b) Hydro units of 25 MW and above : 1.8.2010
>
> (c) Open Cycle Gas Turbine/Combined Cycle generating stations having gas turbines of capacity more than 50 MW each: with effect from 1.1.2017
>
> ii) The restricted governor mode of operation shall essentially have the following features:
>
> a) There should not be any reduction in generation in case of improvement in grid frequency below 50.05 Hz (for example, if grid frequency changes from 49.9 to 49.99 Hz, there shall not be any reduction in generation). For any fall in grid frequency, generation from the unit should increase as per generator droop upto a maximum of 5% of the generation subject to ceiling limit of 105% of the MCR of the unit having regard to machine capability .
>
> b) Ripple filter of +/- 0.03 Hz. shall be provided so that small changes in frequency are ignored for load correction, in order to prevent governor hunting.
>
> c) If any of these generating units is required to be operated without its governor in operation as specified above, the RLDC shall be immediately advised about the reason and duration of such operation. All governors shall have a droop setting of between 3% and 6%.

d) After stablisation of frequency around 50 Hz, the CERC may review the above provision regarding the restricted governor mode of operation and free governor mode of operation may be introduced.

iii) All other generating units including the pondage upto 3 hours, wind and solar generators and Nuclear Power Stations shall be exempted from Sections 5.2 (f), 5.2 (g), 5.2 (h) and 5.2 (i) till the Commission reviews the situation:

Provided that if a generating unit cannot be operated under restricted governor mode operation, then it shall be operated in free governor mode operation with manual intervention to operate in the manner required under restricted governor mode operation.

(g) Facilities available with/in load limiters, Automatic Turbine Run-up System (ATRS), Turbine supervisory control, coordinated control system, etc., shall not be used to suppress the normal governor action in any manner and no dead bands and/or time delays shall be deliberately introduced except as specified in para 5.2(f) above:

Provided that periodic checkups by third party should be conducted at regular interval once in two years through independent agencies selected by RLDCs or SLDCs as the case may be. The cost of such test s shall be recovered by the RLDCs or SLDCs from the Generators. I f deemed necessary by RLDCs/SLDCs, the test may be conducted more than once in two years.

(h) All coal/lignite based thermal generating units of 200 MW and above, Open Cycle Gas Turbine/Combined Cycle generating stations have gas turbines of more than 50 MW each and all hydro units of 25 MW and above operating at or up to 100% of their Maximum Continuous Rating (MCR) shall have the capability of (and shall not in any way be prevented from) instant onerously picking up to 105%, 105% and 110% of their MCR, respectively, when the frequency falls suddenly.

For the purpose of ensuring primary response, RLDCs/SLDCs shall not schedule the generating stat ion or unit (s) thereof beyond ex-bus generation corresponding to 100% of the Installed capacity of the generating stat ion or unit (s) thereof. The generating stat ion shall not resort to Valve Wide Open (VWO) operation of unit s whether running on full load or part load, and shall ensure that there is margin available for providing Governor act ion as primary response. In case of gas/liquid fuel based units, suitable adjustment in Installed Capacity should be made by RLDCs/SLDCs for scheduling in due consideration of prevailing ambient conditions on which installed capacity of the generating station or unit (s) thereof have been specified:

Provided that scheduling of hydro stat ions shall not be reduced during high inflow period in order to avoid spillage:

Provided further that the VWO margin shall not be used by RLDC to schedule Ancillary Services.

(i) The recommended rate for changing the governor setting, i.e., supplementary control for increasing or decreasing the output (generation level) for all generating units, irrespective of their type and size, would be one (1.0) per cent per minute or as per manufacturer's limits."

As per the above provisions, all coal based /lignite based thermal generating units of 200 MW, Gas Turbine/Combined cycle generating stations having gas turbines of more than 50 MW each and above and all hydro units of 25 MW and above which are synchronized with the Grid, irrespective of their ownership, are required to have their governors in operation at all time in accordance with the provisions of sub-clauses (i) to (iii) of Clause (f) of Regulation 5.2 the Grid Code. Also, the generators on the pretext of technical constraints cannot be allowed to avoid the said provisions of the Grid Code.

16. The Petitioner has submitted that on 14.1.2015 at 1920 hrs, one unit (1000 MW) of Kudankulam Nuclear Power Station tripped and the frequency fell to 48.87 Hz from 50.04 Hz. The Petitioner has submitted that the overall FRC on an All India Basis for this event which occurred during the evening peak hours was of the order of 6023.5 MW Hz. The Petitioner has submitted that during this period, the number of generating units on bar is maximum and they should have provided a much higher frequency response (assuming 5% governor droop). It is noted that among the control areas, Kerala has shown highest response of 70%. However, BSEB control area has shown negative response (has aggravated the situation) of (-) 54.2%. During the period, Sipat has been highest response of (-) 35% whereas the generating stations such as Sterlite and Adhunik have shown positive response (deteriorated the situation) of 57.90% and 54.20%. The following generating stations have worsened the situation by way of reduction in generation instead of increase in generation:

(a) Northern Region: Singraulli (0.3%), Dehar (0.9%), Salaal (1.2%),Dadri-Gas (2.4%), Anta (2.7%), Sri-Cement(5.4%), Jhajjar-PG (5.8%), Bhakara (6.4%), Bairasul (9.9%) and Pong (17.8%),

(b) Western Region: UMPP-Mundra (6.%), Vindhyanchal (2.55), KSK

Mahanadi (4.1%), NTPC SAIL (8.2%), SSP (9.8%) and Mouda (25.3%).

(c) Eastern Region: Kahalgaon (2.4%), TSTPS-I (5.4%), MPL (9.1%), Adhunik (54.2%) and Sterlite (57.9%).

(d) Southern Region: MAPS (3.2%).

(e) North Eastern Region: Loktak (2.8%), Doyang (3.7%) and Ranganadi (3.8%)

17. The Petitioner has submitted that during the earthquake in Nepal on 25.4.2015 at around 11:43 hrs, there was demand reduction of approximately 3500 MW within 3-4 minutes due to tripping/manual load shedding especially Northern Region and Eastern Region. The Petitioner has submitted that in this event, adequate frequency response was missing in a number of control areas, particularly in the NEW Grid which led to high voltages in the system and large angular variation among nodes in the grid, etc. The Petitioner has contended that during the event, FRC of NEWS Grid was 4043 MW/Hz and the control areas of Assam (-340%), Andhra Pradesh (-149%), DNH (-77.9%), Bihar (-41.7%) have aggravated the situation. The Petitioner has submitted that the Tehri Hydro Development Corporation has shown the maximum desired response of (-)180.50%. Other hydro generating stations like Karcham (-88.2%), Chamera-1 (-75.3%), Chamera-3 (-30.9%), Rangit (-173.4%), Teesta (-95.6%), Chukha (-89%) have shown high desired response. According to the Petitioner, Thermal Generating Stations, namely Singrauli (-58.2%), GMR (-122%), Niyveli (-30.6%) and Barh (-925.5%) have shown high desired response. The generating stations of Jindal (48.9%), BALCO (31.1%), Tanmar (14.3%) and Kakrapara (13.2%) have aggravated the situation by increasing the generation instead of decreasing the same.

18. The following is observed from the submissions of the Petitioner, the Respondents and SLDCs:

(a) Time duration window chosen for the tripping of the unit of Kudankulam was one minute thirty seconds and for Nepal earthquake, it was three minutes fifty seconds. Therefore, the primary response of the units to frequency excursion shall be measured after 30 to 60 seconds of the frequency excursion event.

(b) The input data for FRC calculation as indicated by NLDC in its calculations is at variance with the input data of SLDCs. The mismatch is to such a great extent that in certain cases the outcome gets totally reversed e.g in one case NLDC declares that the control area (Rajasthan) has helped the grid to some extent where as the SLDC, Rajasthan has explained that the control area has aggravated the situation. In view of the above facts, POSOCO shall guide SLDCs with regard to FRC calculations.

(c) Certain inadvertent mismatch of data/discrepancies has been observed in the FRC calculations submitted by the Petitioner i.e. “Net system Demand Met Before the Event” for Eastern Region has been indicated as 15484 MW at “FRC calculation for All India”, whereas the same has been shown as 14994 MW at “FRC calculation for Eastern Region”. Similarly, there is a mismatch of data in respect of “Internal Generation before the Event” at “FRC calculation for All India” and “FRC calculation for Regions”. POSOCO shall look into such discrepancies and remove them in consultation with staff of the Commission.

(d) Notwithstanding mismatch of data in certain cases, it can be concluded from the results of the two events, namely tripping of one unit of Kudankulam and Earthquake in Nepal on 14.1.2015 and 25.4.2015, respectively that the desired response has not

been provided by the ISGS and intra-State generators as per the provisions of the Grid Code. Certain generating stations have been reported to aggravate the situation.

19. The role of primary response to contain frequency excursions through governor action is of utmost importance for operation of grid in safe and secure manner. Accordingly, the Commission vide office order dated 24.9.2014 constituted a Committee under the Chairmanship of Shri A. Velayutham, ex-Member, MERC consisting of representatives from CEA, CERC, POSOCO, ISTS generating station, BHEL and Alstom to look into the problems of the generating units in implementing FGMO with manual intervention, to suggest measures for implementation of FGMO with suitable modification/amendments in certain Regulations/Grid Code and any other recommendations to facilitate FGMO/RGMO operation. The Committee has recommended as under:

(a) It is highly desirable that urgent steps are taken for introducing the secondary control at the earliest to make primary response more effective. However, in the meantime, the primary control through RGMO/FGMO with manual intervention may continue for dealing with large frequency variations through collective efforts of the generators.

(b) The secondary and tertiary control may be introduced through operationalising Automatic Generation Control (AGC), Ancillary Support Services and Demand Response.

(c) It would not be advisable to do away with RGMO stipulations at present till the time secondary and tertiary controls are in place. The Commission may review switching over to FGMO after a period of one year.

(d) The Committee feels that there is no need for granting any exemption for the LMZ units from operation under RGMO/FGMO with manual intervention. The generator may decide on their own whether to go for retrofit for adopting RGMO features or continue with FGMO with manual intervention.

(e) The inadequate primary response should be dealt with through seeking strict compliance by way of regulatory measures such as imposing penalty for non-compliance. In this regard, the Committee recommends that periodic checkups to ensure desired RGMO/FGMO response be made mandatory and should be conducted at regular intervals, through independent third parties selected by POSOCO/SLDCs. The cost of such tests should be recovered by the RLDCs/SLDCs as part of RLDC/SLDC Fee and Charges.

(f) The unit may not be scheduled by RLDC/SLDC beyond ex-bus generation corresponding to 100% of the installed capacity. Further, units should not be allowed to operate with their valves wide open. However, these stipulations would require necessary amendment in the Grid Code. In case of gas/liquid fuel based units, adequate margins while scheduling should be kept by RLDCs/SLDCs in due consideration of prevailing ambient conditions of temperature and pressure vis-a-vis. site ambient conditions on which installed capacity of these units have been specified.

(g) The Commission may review Deviation Settlement Mechanism (DSM) so that units are incentivized to provide primary response.

(i) Gas/Liquid fuel based generating stations, which are currently exempted from RGMO/FGMO stipulations, shall be included in the list of eligible units capable of providing primary response and should be mandated accordingly by way of amendment to the Grid Code.

(j) 200 MW and above units of thermal captive power plants, which are connected to the grid, should also be explicitly brought under the relevant regulation of primary response.

(k) For widening the scope of RGMO/FGMO, the Commission should initiate discussions with stakeholders for including units of nuclear generating stations and renewable energy based generating stations.

(l) HVDC systems available in the country should also be asked to provide frequency response.

(m) The current lower limit of 10 MW for hydro generating stations for providing primary response through FGMO/RGMO should be increased to 25 MW.

20. Some of the above recommendations e.g. bringing gas based generating stations under the list of generating stations required to provide primary response, keeping over load margins by not scheduling units beyond 100% of MCR and periodic checkups of the generating stations through independent third parties selected by POSOCO/SLDCs to ensure desired RGMO/FGMO response, etc. have been put into practice by way of the Central Electricity Regulatory Commission (Indian Electricity Grid Code) (Fifth Amendment) Regulations, 2017. The Committee has recommended that there is no need for granting any exemption for the LMZ units from operation under RGMO/FGMO with manual intervention. This issue has already been dealt with by the Commission vide order dated 13.2.2017 in Petition No. 65/MP/2014 filed by NTPC.

21. The Commission through the Central Electricity Regulatory Commission (Ancillary Services Operations) Regulations, 2015 which have been effective w.e.f 1.4.2016, has already introduced Ancillary services in Indian Grid to stabilize the frequency of the grid

within the desired band of 49.90 to 50.05 Hz and is in the process of introducing the concept of "Spinning Reserves' through Automated Generation Control. In our view, the above measures would ensure that the primary response of the generators to frequency excursions would increase. Further, Ancillary Services and "Spinning Reserves" through Automated Generation Control would ensure that spent up primary reserve of the units after providing the primary response gets re-cooped for further frequency excursion eventuality.

22. In view of the above new developments during the proceeding of the instant petition, we are not taking any punitive action for the present against the generators who have not provided the desired response for the frequency excursion events during the year 2015 as reported by the Petitioner.

23. The Petitioner has prayed to direct all utilities to provide primary response compulsorily as per Regulation 5.2 (f), (g), (h) and (i) of the Grid Code. In this regard, the following is directed:

(a) Considering the fact that further measures have been put in place to facilitate desirable primary response, the Commission, starting from the month of September, 2017 shall be closely watching the primary response of ISGSs as reported by POSOCO/NLDCs. At the State level, SLDCs shall report the frequency response of intra-State generators to the concerned SERCs.

(b) NLDCs and SLDCs through the assistance of POSOCO shall start the process of selecting independent third parties capable of undertaking periodic checkups to monitor the RGMO/FGMO response. To start with selected independent third parties shall be sent to the generating stations which are not providing the desired RGMO/FGMO response. Independent Third Parties shall ensure that the

generator has not, in any way, prevented/disabled the governor from providing the desired response. In case, even after enabling the governors, units are not able to provide the desired response as per the provisions of the Grid Code, third parties, based on the submissions of the generators, shall bring out the technical constraints, if any, which limit the primary response of the units.

c). All ISGSs are directed to provide primary response compulsorily in terms of Regulation 5.2 (f), (g), (h) and (i) of the Grid Code failing which we would not hesitate in initiating action under Section 142 of Electricity Act, 2003 for not providing desired RGMO/FGMO response without any valid reasons.

24. With regard to the prayer of UPRVUNL in IA No. 36/2016 to keep in abeyance the provisions of the Grid Code as the response at certain generating stations are inadequate, we are of the view that UPRVUNL needs to understand the importance of the primary response for safe operation of the power system as it is the first line of defence to curtail the frequency deviation within safe limits. The Committee on FGMO has also observed that it is highly desirable that urgent steps are taken for introducing the secondary control at the earliest to make primary response more effective. However, in the mean time, the primary control through RGMO/FGMO with manual intervention may continue for dealing with large frequency variations through collective efforts of the generators. The Committee has also recommended that there is no requirement for granting any exemption even to LMZ units from operation under RGMO/FGMO with manual intervention and the generator should decide on its own whether to go for retrofit for adopting RGMO features or continue with FGMO with manual intervention. Therefore, UPRVUNL has the option of either expediting the R&M of old units which shall include installation of new EHG governors capable of providing adequate primary response or to

go in for retrofit of mechanical governors for adopting RGMO features or to operate on FGMO with manual intervention. In our view, there is no requirement to keep in abeyance the provisions of the Grid Code for the reason that certain old units of UPVRNL are not giving adequate primary response. Accordingly, the prayer of UPRVUNL in this regard is rejected.

25. The petition along with IA is disposed of in terms of the above.

Sd/-	sd/-	sd/-	sd/-
(Dr. M.K. Iyer)	**(A.S. Bakshi)**	**(A.K. Singhal)**	**(Gireesh B. Pradhan)**
Member	**Member**	**Member**	**Chairperson**