CENTRAL ELECTRICITY REGULATORY COMMISSION
NEW DELHI

Petition No. 65/MP/2014

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

Date of Order: 13th of February, 2017

In the matter of

Petition under Regulation 4 Part-7 of the Central Electricity Regulatory Commission (Indian Electricity Grid Code) Regulations, 2010 read with Regulation 111 of the Central Electricity Regulatory Commission (Conduct of Business) Regulations, 1999 seeking relaxation of Regulation 5.2 (f) (iv) regarding requirement of implementing FGMO for certain units of NTPC.

And
In the matter of

NTPC Limited
Core-7, SCOPE Complex,
7 Institutional Area, Lodhi Road,
New Delhi-110 003 **……Petitioner**

Vs

National Load Despatch Centre
B-9, Qutab Institutional Area,
Katwaria Sarai, New Delhi-110 066

Northern Regional Load Despatch Centre
18-A, Shaheed Jeet Sigh, Sansanwal Marg,
Katwaria Sarai, New Delhi-110 066

Western Regional Load Despatch Centre
F – 3, M.I.D.C. Area, Marol, Andheri (East),
Mumbai – 400093

Eastern Regional Load Despatch Centre
14, Golf Club Road, Tollygunge, Kolkata-700 033

Southern Regional Load Despatch Centre
29, Race Course Cross Road,
Bangalore-560 009

North-Eastern Regional Load Despatch Centrwe
Dongtieh, Lower Nongrah, Lapalang,
Shillong-793 006. **……..Respondents**

Following were present:

Shri Alok Gupta, NTPC
Shri Ajay Dua, NPTC
Shri P.B.Venkatesh, NTPC
Shri Uday Shankar, NTPC
Shri S.S.Barpanda, NLDC
Ms Pragya Singh, NLDC
Ms. Abiha Azidi, NLDC

ORDER

The petitioner, NTPC Limited, has filed the present petition seeking relaxation of Regulation 5.2 (f) (iv) of the Central Electricity Regulatory Commission (Indian Electricity Grid Code) Regulations, 2010 (hereinafter referred "Grid Code") in respect of implementation of Free Governor Mode Operation in certain units of the generating stations.

2. Regulation 5.2.(f) of the Grid Code provides that all thermal generating units of 200 MW and above and all hydro units of 10 MW and above which are synchronized with the grid, irrespective of their ownership, shall be required to have their governors in operation at all time in accordance with the provisions in sub-clauses (i) to (iii). The provision in the Grid Code in regard to governor action is extracted as under:-

"**Governor Action** (i) Following Thermal and hydro (except those with up to three hours pondage) generating units shall be operated under restricted governor mode of operation with effect from the date given below:

(a) 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 10 MW and above: 1.8.2010

(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 50.2 Hz. (for example if grid frequency changes from 49.3 to 49.4 Hz. then there shall not be any reduction in generation). Whereas for any fall in grid frequency, generation from the unit should increase by 5% limited to 105 % of the MCR of the unit subject 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 stabilisation 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 up to 3 hours Gas turbine/Combined Cycle Power Plants, 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."

3. The Commission, vide its order dated 20.8.2009 in Petition No. 12/2004, directed the generating companies to implement RGMO in various types of thermal and hydro units as per the following schedule.

"41. Based on the above and having specific regard to the prevailing condition of shortage, we direct the implementation of only restricted governor operation in various types of thermal and hydro units as per the following schedule:

(a) KWU & LMZ turbines for thermal sets of 200 MW and above:
(i) Software based EHG system: 1.3.2010
(ii) Hardware based EHG system where boiler controls are in “auto”: 1.6.2010
(b) Hydro units of 10 MW and above 1.3.2010.

42. All the generating companies are directed to place before the Commission, within a month, their action plan in line with the above schedule and furnish monthly progress reports to the Commission in this regard."

4. In the above backdrop, the petitioner has filed the present petition seeking relaxation for implementing FGMO in its certain units of the generating stations. The petitioner has submitted that the following facts have led to filing of this petition:

(a) As on 28.3.2014, NTPC is having generating station at different regions in the country with installed capacity of 42964 MW which includes JV capacity. The capacity includes units of various size 200/210 MW unit size which are old design and have been commissioned long back. Presently, NTPC operates 43 number of 500 MW units and 33 number of 200/210 MW units (excluding Badarpur, Tanda and TTPS). Out of 43 nos. of 500 MW units, 31 units have been commissioned before 2009 which includes around 20-25 years old twelve units. As on date, the average age of 33 number units of 200/210 MW is around 24 years.

(b) Subsequent to the enactment of Grid Code, the petitioner`s various units having Electro-hydraulic Governors were made compliant to the RGMO requirements by engineers at the generating stations. Even in the case of machines with electronic governors, the changes to meet the said requirements could be made by the petitioner`s engineers with varying degree of difficulty

depending on the technology and scheme of realizing the governor control, in that particular make of machine.

(c) Units of Old Vintage: Number of 200 / 210 MW thermal units are in service in NTPC and are equipped with purely mechanical governors, namely (i) 2 units of 210 MW each at Badarpur Stage-II commissioned during 1979-81, (ii) 5 units of 200 MW each at Singrauli Stage-I commissioned during 1982-84, 6 units of 210 MW each at Vindhyachal Stage-I commissioned during 1987-91, 4 units of 210 MW each at Kehalgaon Stage-I commissioned during 1992-96. The above units equipped with purely mechanical governors are not amenable to introduce RGMO and the same can be met only in the electronics of Electro Hydraulic Governor. Recognizing the fact, the Commission in the Grid Code permitted such units to remain out of the purview of the requirements of RGMO. Though units of Ramagundam Stage-I (3 x 200 MW) are equipped with electrical governors, their retrofit was not possible as the electronics are of very early vintage and are not amenable to retrofit. As per amended provisions of the Grid Code, these units are also required to be operated on Free Governor Mode Operation, with manual intervention to realize the requirements of RGMO. As per the provisions of the Grid Code, 210 MW units of NTPC installed at Korba, Farakka, Unchahar and Dadri stations and all 500 MW units are equipped with RGMO Control Scheme

(d) Difficulties in case of Mechanical Governors: The difficulties with governor control, applicable to units with mechanical governors, in realizing requirements specified in the Grid Code are as under:

(i) The reduction in load due to governor action cannot be limited to any desired quantum, unlike the electronic governors. If the frequency increases by 1Hz, the machine will unload by 50% (4% governor droop).

(ii) These machines do not have HP/LP steam bypass system which can operate in parallel to the turbine steam flow. Therefore, such large changes cannot be accommodated and the unit can trip out due to water/steam side disturbance.

(iii) These units cannot be provided with any slow automatic return logic. Any correction will have to be made manually by the operator. Since, the frequency changes in power system being perpetual in nature, the operator will have to be continuously modifying the set point of the control system, to continuously change its speed reference and the same is not physically / practically possible for the operator, who has to manage several other equipments / systems also, at the same time.

(iv) Continuous and unrestricted modulation of control valves will result in large fluctuations in Main and Reheat steam parameters adversely affecting the health of the machine.

(v) If the machines are put on FGMO with manual intervention, there will be frequent and large quantum load fluctuations due to governor action. The resultant process disturbances will also be frequent, large and beyond the capability of the relevant control system to manage. Such a situation would lead to frequent outages on process violation.

(e) Gird Code specifies the following requirements with regard to RGMO:

(i) If the absolute value of frequency is below 50.50 Hz and the frequency changes to a lower value, the machine must load (must increase output) according to its speed regulation (Droop) limited to a maximum of 5% of its MCR;

(ii) If frequency increases while its absolute value is less than 50.05 Hz, the machine should not be upload as per its droop;

(iii) If frequency rises and is above 50.05 Hz, the machine to unload as per droop, limited to 5% MCR, though there is no explicit stipulation in the Grid Code in this regard;

(iv) Once the machine has picked up load, it may continue to operate at the new level or return to the original level at the rate of 1% per minute in case continued operation at increased level is not sustainable. If boiler firing is not changed, the machine will have to be returned to the original load at a faster rate as the steam parameters deteriorate;

(v) Picking up of additional load as above, must happen, irrespective of whether the machine is operating at part load or full load. It is presumed that the machine has a 5% capacity marring above its rated capacity.

(f) In case of Ramagundam Stage-I (3 x 200 MW) Units, the petitioner is facing the following difficulties:

(i) Machines of Ramagundam Stage-I are of generic GE design and are equipped with Electrical Governors supplied by M/s Ansaldo, Italy which are always active and do act almost perpetually. Stable load on the machines is achieved by the supplementary Steam Pressure Control.

(ii) If the Steam Pressure Control were to be not available, the machine would be operating on FGMO and will suffer from all the difficulties projected above, in the context of mechanical governed machines. Therefore, such an operation is not possible unless the grid frequency is controlled constant.

(iii) Though these machines are equipped with Electrical Governors, the electronics involved are of very old vintage and it was found impossible to modify the control logic to meet the prescription of restricted governor mode of operation.

(iv) The petitioner has been making sincere efforts to provide its machines with RGMO retrofits. Accordingly, on various occasions, these concerted efforts have been informed to RLDCs, RPCs and the Commission.

(v) Retrofits like the one used in the case of Korba (3 x 200 MW) were made possible since these machines were supplied by BHEL. However, the same was not possible to be applied for Ramagundam-I machines.

(vi) After completion of the major R&M work on the machines, appropriate modifications to meet the requirements of restricted governor mode of operation would be possible.

(g) Operational difficulties in units where RGMO is in service**:** RGMO in all the generating stations of the petitioner, except the above units, is normally in operation and have shown response from time to time. However, in certain cases, the response of units generally has been less than desired during grid disturbances. Since, the units are often operating at maximum load with most of the parameters in the limiting value, response becomes less than desired. Due to poor coal quality and other operational limitations such as widely varying frequency leading to boiler parameter variation, there are operational constraints.

(h) Requirement for Secondary Control with Constant Grid Frequency Operation: The primary or Governor Control can bring constancy of frequency (at a target frequency of say 50Hz) along with secondary control which is not present in Indian power system. Primary (Governor) Control and Secondary (Restorative) control are mutually complimentary. During the slow changes in load / frequency, the Secondary Control will control the frequency within the Governor dead band (0.06% as per the Grid Code) and prevent the Primary Control from "being called". Therefore, the Primary Control remains always active but does not act. When large/sudden changes in frequency occur, the secondary Control (inherently a slow control) becomes ineffective and the Governor dead band is breached and the Governor Control acts to deliver large generation quantum quickly and globally. Being a proportional control, this will not restore frequency to the constant target. As the slow acting Secondary Control restores the frequency to the target, the Governor Control margin delivered gets automatically withdrawn and these machines remain active for delivery in the

next event. In the absence of Secondary Control, Governor Control responds to the continuously changing frequency and do not have the required control margin when its real service becomes necessary. Therefore, secondary control with constant frequency needs to be considered for implementation to achieve meaningful and workable solution. With regard to introduction of secondary control, the Commission should engage a suitable international consultant to study the control strategy and make appropriate recommendations for its implementation.

5. In the above background, the petitioner has made the following prayers:

"(a) The Hon`ble Commission to grant exemption from compliance o the last proviso of Regulation 5.2 (f) of the Grid Code of units of Badarpur Stage-II, Singrauli State-I, Vindhyachal Stage-I, Khalgaon Stage-I and Ramagundam Stage-I units of NTPC;

(b) The Hon`ble Commission to order engagement of an international consultant to study and recommend the road map for introduction of constant frequency operation/Secondary Control."

6. The matter was heard on 19.6.2014, notices were issued to the respondents to file their replies. Reply to the petition has been filed by National Load Despatch Centre.

7. National Load Despatch Centre (NLDC) in its reply dated 18.7.2014 has submitted as under:

(a) As per Regulation 5.2 (m) of the Grid Code, All users, SEBs, SLDCs, RLDCs and NLDC are required to take all possible measures to ensure that the grid frequency always remains within 49.90-50.05 Hz band. Frequency can be

maintained within a narrow ban only if the generators are operating in FGMO/RGMO;

(b) The petitioner has sought the exemption for seventeen units due to certain reasons. However, the response of remaining generators as per RGMO is not yet demonstrated or observed at any of the LRDLCs or at NLDC. Therefore, it is a matter of concern that the generators are not providing satisfactory response for any large load/generation loss in the system.

(c) NTPC's generation is close to 24-25% of the All India energy generation and considering the thermal generation base of NTPC, its capacity on bar at any instant would be of the order of 30% of the All India grid capacity on bar.

(d) If the petitioner is not able to meet the requirement of RGMO in 17 nos of units in Badarpur Stage-II, Singrauli Stage-I, Vindhyachal Stage-I & Kahalgaon Stage-I, then machines can be put on FGMO with manual intervention, as per provisions of Grid Code.

(e) The response from Korba and Sipat generating stations are not satisfactory even though there was margin for going up to 105% of the Maximum Continuous Rating (MCR).

(f) The petitioner`s assumption that even while unloading of the unit above 50.05 Hz, the same would be limited to 5% of MCR, is appears to be unreasonable as it can be catastrophic in case of islanding of a part of the system which is surplus. A limit on overloading is understandable considering the capability of the system

but a limit of 5% while unloading can be disastrous. The Commission can clarify that there is no such restriction while unloading of the unit.

(g) With regard to the petitioner`s contention that if the frequency increases by 1 Hz, the machine will unload by 50% (4% governor droop), it is that from May, 2013 to till June, 2014, 23 incidents involving large load/generation loss have occurred, where NLDC calculated region-wise and generator-wise FRC and maximum frequency change was observed during the incident of tripping of CGPL Mundra on 12.3.2014 (3800 MW Generation loss), which led to frequency dip of 0.6 Hz. Frequency change for a load/generation loss involving 1000 Mw is of the order of 0.1-0.2Hz. For this increase in frequency, a 210 MW machine having droop 4%, will unload the machine by 11-21 MW. Frequency vs. Generator Output in respect of NTPC` generating stations in Eastern Region have been plotted, where generators of Farakka, Kahalgaon, Talcher units responded within 4-8 MW (Kahalgaon U#5, 6 being maximum-22, 37 MW) whereas a few units did not respond or aggravated the situation.

(h) The generators are providing inadequate response to frequency fluctuations. Summary of response of NTPC`s generating stations during grid incidents involving large load/generation loss is given as Annexure-10.

(i) The need of the hour is primary response to Indian grid in order to obtain a stable frequency regime. With new frequency band i.e. 49.90-50.05 Hz and having such a lower FVI value, all the machines can be on RGMO or else on FGMO with manual intervention, where RGMO is not possible, to support Grid

Frequency. Secondary response is also required and has to be implemented in due course of time. The Commission should specify a roadmap to introduce Secondary response in India along with further tightening the Deviation Settlement Mechanism (DSM) Regulations as ability to hold on to the scheduled value of interchange with the grid by all control areas is the key.

8. The petitioner, vide Record for Proceedings for the hearing dated 19.6.2014, was directed to file the following information:

(a) Unit-wise, technical difficulties in operation of these units in FGMO.

(b) The difficulty/problem in carrying out the desired modification for complying with the provisions of the Grid Code.

(c) Difficulty, if any, in operating these units as per scheme adopted at Nasik Power Station in Maharashtra based on recommendations of CEA in its report.

(d) Details of similar units of same vintage operating in States and their operation on FGMO/RGMO.

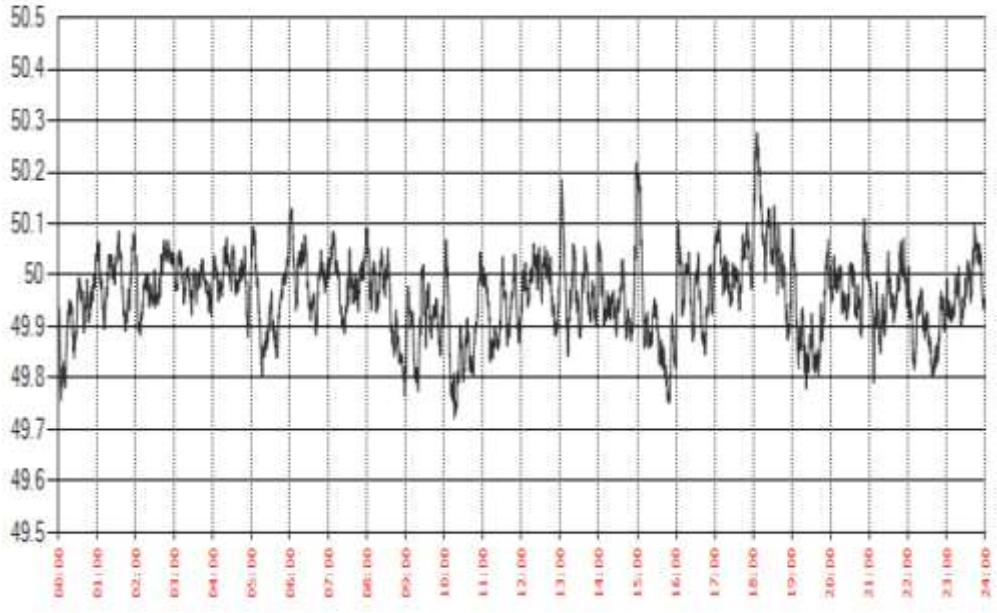
9. The petitioner, vide its affidavit dated 3.8.2014, has submitted as under:

(a) With regard to Unit-wise, technical difficulties in operation of these units in FGMO, the petitioner has submitted that it is seeking exemption of application of the proviso 5.2 (f) of the Grid Code in all units of 5 x 200MW units at NTPC Singrauli, 6 x 210 MW units at NTPC Vindhyachal, 4 x 210MW units at NTPC Kahalgaon, 2 x 210 MW units at NTPC Badarpur and 3 x 200MW units at NTPC Ramagundam. In all, exemption is being sought for 20 units of 210/200MW capacity. Out of 20 units, 17 units, excluding three units at Ramagundam

generating station are of Russian design, LMW (Z) type. All these units are equipped with “Nozzle Governing”, Mechanical Hydraulic Governors (MHG) with fixed droop of 4%. For a 4% change in frequency, i.e. ±2.0Hz, these machines will unload/load by 100%. In other words, for an increase in system frequency of 1Hz, these machines will unload by ≈100MW. In free Governor Mode, the only way these machines can be prevented from wild load fluctuations is to keep frequency constant (within the Governor dead band of 0.06%). Since all these machines are identical, as far as Governor Control is concerned, irrespective of whether BHEL or Russian make, the petitioner is facing the following difficulties in operating in FGMO:

(i) The reduction in load due to Governor Action cannot be limited to any desired quantum, unlike the Electronic Governors. If the frequency increases by 1Hz, the machine will unload by 50% (4% governor droop). Even though the gap between the maximum and minimum frequency of the Grid may have reduced over a period of time but the fluctuations in frequency are still large. The details of the frequency variations of a typical day in the month of April are as under:

Frequency Plot for a typical day in April 2014



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The above variations are to the tune of 0.50 Hz which occurs frequently.

(ii) Continuous and unrestricted modulation of Control Valves will result in large fluctuations in main and reheat steam parameters adversely affecting the health of the machine, in the longer term.

(iii) If these machines are put on FGMO, there will be frequent and large quantum load fluctuations due to governor action. The resultant process disturbances will also be frequent and large, and beyond the capability of the relevant control system to manage. Such a situation will lead to frequent outages on process parameter violation.

(iv) During the initial period of operation, when the control equipments were new, these machines had been operated on Governor Control, with supplementary initial steam pressure control continuously altering the speeder gear set point, to counter act the governor corrections. Such an arrangement resulted in continuous opening and closing of the HPCV # 4. In Nozzle Governing machines, the control valve opening with load is sequentially controlled and the last control valve alone remains in the modulating mode, with the rest fully open. On several occasions these valves had failed and the machine had to be operated with HPCV # 4 jammed in its open position. This is a potentially very dangerous mode of operation which can result in uncontrolled over-speeding and possible disintegration of the turbo-generator rotor, in the event of a stop valve closing failure during tripping. In view of these failures, a mode of operating the unit with speeder gear in maximum position (all 4 valves wide open) was resorted to, where governor control will only commence at a frequency well above the normal operating frequency.

(v) These units cannot be provided with any slow automatic 'return to original load' logic. Any correction will have to be made by the operator, by physically changing the Governor set point. The frequency changes being perpetual in nature in the system, the operator will have to be continuously re-positioning the "Speeder Gear" to change its speed reference set point, offsetting the Governor Action.

(vi) In view of the above, it is physically not possible for the operator to implement FGMO with manual intervention as prescribed in the Grid Code, as it has to monitor interrelated operational parameters of several other equipments being operated simultaneously.

(vii) 3x200 MW machines at NTPC Ramagundam stage-I are of generic GE design and are equipped with Electrical Governors supplied by M/s Ansaldo, Italy. These Governors are always active and do act almost perpetually. Stable load on the machines is achieved by the supplementary Steam Pressure Control. If the Initial Steam pressure control were to be defeated, the machine would be operating on FGMO and would suffer from all the above difficulties, in the context of mechanical governed machines. Such an operation is not possible unless the grid frequency is controlled constant (within the dead band of governor).

(viii) Though these machines are equipped with Electrical Governors, the electronics involved are of very old vintage and it was found impossible to modify the control logic to meet the prescription of restricted governor mode of operation.

(ix) Control valves of these machines saturate when full load demand is set in CMC and the governor response becomes inoperative in the loading direction.

(b) With regard to difficulty/problem in carrying out the desired modification for complying with the provisions of the Grid Code, the petitioner has submitted that the classical governing scheme applicable to all steam turbine units are as

stipulated in Regulation 45.1 of the Grid Code. This is a simple proportional control with a characteristic defined as "Speed Regulation" (Droop), expressed as a percentage speed rise for which the generated power will change by 100%. While this control is realized in every turbine generator (in fact in all rotating generating units), the "restricted governor mode of operation" envisages considerable changes in the control scheme. Since FGMO was not feasible in the present grid conditions, RGMO was thought off. However, changes for achieving RGMO characteristics cannot be made in the mechanical/hydraulic control system, but are feasible in electronic control. To make these machines capable of complying with the present requirements of RGMO Scheme, the entire MHG has to be replaced with EHG for these machines which involves as under:

(i) MHG consists of the classical arrangement of speed sensing, a spring restrained fly-ball device, the position of which is hydraulically converted to an oil pressure signal, amplified and used on the servo motor piston to operate the valve drive shaft. The operation of this drive shaft opens and closes the control valves. These machines do not have a need for a reliable electrical speed sensor system which is required in EHG. For the purpose of speed (rpm) indications, only shaft driven tachometer is provided.

(ii) EHG consists of a highly reliable triple redundant electrical speed sensor, output of which is processed to determine the desired load on the machine as per the "Droop" characteristic, in a comparator and finally to convert the

electrical signal output to a hydraulic pressure in an 'Electro Hydraulic Converter', which operates the control valve servo motor.

(iii) Retrofit of EHG would require mounting of an appropriate speed sensing mechanism (a toothed wheel in the case of electrical induction type sensors or a disc carrying a number of magnetic strips around the periphery in the case of 'Hall Effect' sensors) on the rotor and corresponding sensor receptors. The pulse train obtained in the stationery sensors will have a certain number of pulses in unit time which is proportional to the speed. A number of such sensors are used in a voting system to determine the speed measurement to be used in the electronics. The speed so measured is then converted to a voltage or current signal and used in the control processor. Entire control processing then takes place in the electronic platform up to an electro hydraulic converter, which would replace the entire original hydraulic control system.

(iv) The present provisions of RGMO have been adopted in view of the frequent and large variations in the frequency in the Indian Grid and is not a standard fitment. Though the retrofit of these machines from MHG to EHG to achieve RGMO will be very expensive and time consuming, in 3 units of 200 MW capacity at Ramagundam, the retrofitting of governing system to make it FGMO/RGMO compliant is being carried out under R&M package, the efficacy of which can be seen once the modifications are carried out. The units of other 200/210 MW LMZ units at Badarpur, Singrauli, Vindhyachal and

Kahalgaon are of LMZ design and having hydro-mechanical governor with cam and roller arrangement. The conversion of existing hydro mechanical governor to Electro hydraulic governor was attempted recently at OBRA TPS by BHEL/Siemens. However, it was not functional at the time of vesting. LMZ who is the OEM have not carried out complete conversion of existing hydro-mechanical governors into Electro hydraulic governing system. The market survey for other Suppliers/OEMs to carry out the job has also carried out and found only one Chinese vendor who has carried out complete conversion of existing hydro-mechanical governors into Electro hydraulic governing system in China for which information is not available. Since the retrofit carried out at Obra by BHEL was yet to be operated for sustainable period and not proven anywhere else, conversion of governing system at these stations is not being attempted so far under R&M of LMZ machines.

(c) With regard to difficulty, if any, in operating these units as per scheme adopted at Nasik Power Station in Maharashtra based on recommendations of CEA in its report, the petitioner has submitted that the scheme realized in the new DCS of Nashik (Maharashtra) Unit # 4, in 2005-06 and had been tested, was a variant of the 'initial steam pressure control'. In this case, the machine is operated in Governor Control and if the initial steam pressure deviates by more than ±2kgcm-2, timed pulse commands are issued to the Speeder Gear motor to change the governor speed reference to correct the steam pressure. The scheme tried in Nashik was not conforming to the requirements of RGMO as specified in the Grid Code. As per the information available, this scheme is

presently not in operation. For Unit # 3 & Unit # 5 of the Nashik power station, Maharashtra State Power Generation Company Ltd had filed a petition before the Commission (150/MP/2012) for grant of time for operation in RGMO. The petitioner has no knowledge regarding RGMO scheme being considered by Maharashtra State Power Generation Company Ltd for their other similar thermal units.

(d) With regard to details of similar units of same vintage operating in States and their operation on FGMO/RGMO, the petitioner has submitted that there are 67 nos. of LMZ/LMW turbines of 210/200MW in operation in India. Out of these, 57 nos. are supplied by BHEL and 10 imported directly from erstwhile Soviet Union. 7 nos. of BHEL make and all 10 nos. of imported units are with NTPC. All these machines are identical in terms of Governing System. The unit supplied by BHEL have been provided with HP/LP bypass (30%) system. The imported units have been provided with slow opening bypass (motor operated) system. The Imported and Indian units otherwise differ with respect to its LP Turbine and its steam exhaust arrangement.

(e) None of the 17 nos. of NTPC owned units mentioned above are being operated in compliance of RGMO as specified in the Grid Code. The provisions regarding FGMO with manual intervention to operate in the manner required under restricted governor mode operation is physically not possible. None of the other thermal machines in India owned by other entities are also operated in FGMO with manual intervention to operate in the manner required under RGMO. Certain machines with initial pressure controller mode can be occasionally

showing response during frequency changes. However, initial pressure control mode will quickly negate the governor action thereby defeating the RGMO philosophy.

(f) The Commission in Staff Paper on "Introduction of Ancillary Services in Indian Electricity Market" in April 2013 recognized the requirement of constant frequency / secondary control. Government of India has constituted a committee consisting of POSOCO, CEA and NTPC for introduction of Secondary Control in Indian Grid. The Commission has progressively tightened the frequency band and time has come for introduction of constant grid frequency through introduction of secondary control as is practiced world-wide. Therefore, the Commission should initiate a debate on roadmap of introduction of constant frequency along with introduction of secondary control.

10. During the course of the hearing on 28.8.2014, the representative of the petitioner submitted that the capacity of the LMZ machines for which relaxation is being sought constitute 7% of the installed capacity of NTPC. These units have been equipped with Mechanical Hydraulic Governors and if put on FGMO with droop setting of 4%, unload by 50% on frequency rise of 1 Hz. The representative of the petitioner further submitted that though with the tightening of frequency band, the variation in the frequency has come down but still the frequency varies by 0.5 Hz over a day causing unloading of the machines by 25%. The resultant process disturbances will also be frequent and large, and beyond the capability of the relevant control system to manage. Such a situation would lead to frequent outages on process parameter violation. The

only way these machines can be prevented from wild load fluctuations is to keep frequency constant (within the Governor dead band of 0.06%). The representative of the petitioner submitted that it is physically not possible for the operator to implement FGMO with manual intervention as prescribed in the Grid Code, as he has to monitor interrelated operational parameters of several other equipments being operated simultaneously.

11. The representative of NLDC submitted that with regard to the petitioner`s apprehension that the machines will unload by 50% on frequency rise of 1 Hz, it is clarified that frequency change of a load/generation loss involving 1000 MW is of the order of 0.01-0.2 Hz. For this increase in frequency, a 210 MW machine having droop 4%, will unload the machine only 11-21 MW. The representative of NLDC further submitted that after the tightening of frequency band, on 12.3.2014, maximum frequency change was observed during the incident of tripping of CGPL Mundra (3800 MW generation loss), led to frequency dip of 0.6 Hz which is a very rare case. For this instance frequency vs generator output in respect of the petitioner`s stations in Eastern Region have been plotted, where generators of Farakka, Kahalgaon, Talcher units responded within 408 MW (Kahalgaon U#5, 6 being maximum-22,32 MW), whereas a few units did not respond or aggravated the situation.

Analysis and Decision:

12. We have considered the submissions of the petitioner and the respondent and perused documents available on record. The issue for our consideration is that the

petitioner is seeking exemption for compliance of the provisions of the Regulation 5.2 of Grid Code on sufficient grounds. The petitioner has contended that the capacity of the LMZ machines for which relaxation is being sought constitute 7% of the installed capacity of NTPC. These units have been equipped with Mechanical Hydraulic Governors and if put on FGMO with droop setting of 4%, unload by 50% on frequency rise of 1 Hz. Initially, LMZ machines were left out of the prescribed RGMO. However, considering the facts that certain generators were facing difficulties in implementing RGMO and overall desired primary response was not coming, the Commission by way of an amendment notified the following proviso to Regulation 5.2 (f) of the Grid Code:

> "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."

13. Subsequent to the above amendment, the petitioner and certain other utilities filed petitions before the Commission for exemption of some of their LMZ units and other units not fitted with EHG from FGMO with manual intervention. In view of the difficulties expressed by the generators, the Commission vide office order dated 24.9.2014 constituted a Committee under the Chairmanship of Sh. A. Velayutham, Ex-Member, MERC consisting of representatives from CEA, the Commission, POSOCO, ISTS generating stations, 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 recommendation to facilitate FGMO/RGMO operation.

14. With regard to primary response from LMZ machines, the Committee has recommended that these units shall provide mandated Grid Code response either through replacement/retrofitting of MHG governors with/to EHG governors or through FGMO with Manual Intervention. The generators have been given the option to decide the course of action based on vintage of these units. Relevant portion of the report of the Committee is extracted as under:

> "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."

15. The petitioner has sought exemption for the followings units:

Generating Station	Unit	Unit Size (MW)	COD of units	Governor Type
Badarpur Stage-II	i)	210	2.12.1978	Mechanical Governor
	ii)	210	25.12.1981	
Singrauli Stage-I	i)	200	1.6.1982	
	ii)	200	1.2.1983	
	iii)	200	1.7.1983	
	iv	200	1.1.1984	
	v)	200	1.6.1984	
Vidyachal Stage-I	i)	210	1.9.1988	
	ii)	210	1.1.1989	
	iii)	210	1.2.1990	
	iv	210	1.9.1990	
	v)	210	1.4.1991	
	vi	210	1.2.1992	
Kahalgaon Stage-I	i)	210	1.8.1996	
	ii)	210	1.2.1996	
	iii)	210	1.4.1995	
	iv	210	1.1.1995	
Ramagundam Stage-I	i)	200	1.3.1984	Electrical Governor
	ii)	200	1.11.1984	
	iii)	200	1.5.1985	

16. As per the report of the Committee, LMZ machines can be operated on FGMO with manual intervention. The petitioner has agreed to the fact that primary response can be provided by manual intervention though the same requires constant engagement of the operator. Considering the importance of primary response in the Indian Power System, we are not inclined to grant exemption for the LMZ units from operation under RGMO/FGMO. The petitioner is directed to either go for replacement/retrofit or adopt FGMO with MI for providing mandated response as per the provisions of the Grid Code. It is noted that most of the units (15 out of 20 units), the petitioner's generating stations for which exemption has been sought by the petitioner have already outlived their useful life of 25 years as specified in the Central Electricity Regulatory Commission (Terms and Condition of Tariff) Regulations issued from time to time. Since, these units are either being allowed R&M expenditure or special allowance (Rs.7.50 lakh/MW) in lieu of R& M, we direct the petitioner to replace the existing governors with latest state of art EHG governors, in all units which have outlived their useful life and expenditure on such replacement shall be met from special compensation allowance. With regard to units which are expected to complete their useful life, petitioner is directed to either meet the requirements of Grid Code by operating units on FGMO with manual intervention or to go in for replacement/ retrofitting of existing governors with latest state of art EHG governors. Expenditure on such replacement/ retrofitting shall be considered by the Commission in additional capital expenditure subject to suitable adjustment of R&M expenditure/ special compensation allowance to be allowed post expiry of useful life. The petitioner is directed to comply with the provisions of the Grid Code with manual intervention pending replacement/retrofitting.

17. The petitioner in the next prayer has requested for engagement of an international consultant to study and to recommend the road map for introduction of constant frequency operation/ secondary Control. It is noted that the Commission vide order dated 13.10.2015 in Petition No. 11/SM/2015 has prescribed a "Roadmap to operationalize Reserves in the Country". The Commission through Central Electricity Regulatory Commission (Ancillary Services Operations) Regulations, 2015, which have been effective w.e.f 1.4.2016, has introduced the Reserves Regulation Ancillary Services (RRAS) utilizing URS power of the generating stations regulated by CERC. Subsequently, NLDC has prepared the 'Detailed Procedure for Reserves Regulation Ancillary Services Operation' as a part of above Regulation. A detailed analysis of RRAS operation for the past 6 months has been submitted by the NLDC in November, 2016 and the same is under consideration of the Commission. Based on the experience gained from RRAS operations, POSOCO is expected to submit a detailed procedure for implementation of Spinning Reserve of about 3600 MW as per the recommendation of the Committee on Spinning Reserve. Hence, in our view, there is no requirement to engage an international consultant to study and recommend the road map for introduction of constant frequency operation/secondary control.

18. The petition is disposed of with the above.

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