

Central Electricity Authority (Flexible operation of Thermal Power Plants) Regulations, 2022 [Draft]

CEA notified the draft Central Electricity Authority (Flexible operation of thermal power plants) Regulations, 2022. The summary of the Regulations is as follows:

- These Regulations shall apply to all coal and lignite based thermal power plants and load despatch centres.
- The power plant unit throughout their service life shall be considered for flexible operation.
- The suitability of units for start/stops and deep load following (Ramps) shall be assessed before performing these operations.
- All TPPs shall be capable of providing the required output as per the schedule for generation finalized by appropriate LDCs.
- The appropriate Load Despatch Centres shall schedule all coal based thermal power plants, up to the MPL of 55%, to support the operation of must run stations.
- The appropriate Load Despatch Centres may schedule all coal based thermal power plants, up to the MPL of 40%, to support the operation of must run stations.
- The minimum rate of loading or unloading for coal based thermal power plants shall be 3% per minute above the MPL. Provided that for supercritical and ultra-super-critical units, minimum rate of loading or unloading shall be 5% per minute above the MPL.
- The thermal power plants shall implement the necessary modifications to comply with these regulations in order to generate flexible power according to schedules finalized by appropriate LDCs.

Process for implementing Flexible Operation of the Thermal Power Plants:

Power plants should be implemented based on technical feasibility studies involving assessment of the following factors in consultation with the concerned Original Equipment Manufacturers/ Qualified Consultants:

- a. Rated Capacity and Minimum load Design rating with no oil support
- b. Design Ramp rate.
- c. Influence of low load operation on components and systems.
- d. Technical boundary conditions for flexible operation
- f. Combustion system optimization, co-ordination of mill and burner systems. TPPs may decide adoption of suitable modifications in consultation with concerned OEMs/ qualified consultants.

The document can be accessed [here](#).

CER Opinion

- 1. Necessity of Flexible Operation of Thermal Power Plant:** The increasing share of variable RE (VRE) places stress on the thermal generators, which need to respond to variability in demand as well as VRE generation. Adequate ramping capability, lower technical minimum, reduced start up and shutdown time of thermal generating units, particularly those based on coal and lignite, are crucial parameters for ensuring system security and stability amidst growing share of VRE.
- 2. Selection of TPPs for Investment to Enhance Flexible Operation:** Draft Clause No. 7 (i)

states “**All TPPs** shall be capable of providing the required output as per the schedule for generation finalized by appropriate Load Dispatch Centers. Based on the availability of must run stations, plants or units shall follow the variable load requirements”. (emphasis added)

The ‘flexibility’ in the power system can be contributed by various segments of supply as well as demand. The draft regulation aims to enhance flexibility of thermal plants. This would require investment in such power plants. It important to note that it may not be desirable to make investment in all thermal power plants across the merit order based on variable cost. Note that low cost power plants are generally not required to demonstrate and deliver significant ramping capability but be limited to those which fall at the margin of the merit order. The later kind of plants are expected to demonstrate greater flexibility amidst growing share of variable renewable energy. The need for investment should focus on such plants. Otherwise the proposal would have high cost implications for the final consumers.

It is further suggested that all new TPPs (COD not yet declared), if expected, should be mandated for implementation of measures for flexible operation of power plant. Existing power plants with high variable cost (VC), which are required to operate at levels less than their available capacity *i.e.*, at minimum power level and/or are required to have higher ramping capability for safe system operation may be targeted on priority for implementation of measures for flexible operation.

EAL analyzed that percentage of schedule with respect to the declared capacity for ISGS Rihand (low VC) and Dadri TPS (high VC) for the first week of February and July, 2022. It is evident that the schedule of Dadri TPS is changed more frequently as compared to that of Rihand TPS. Dadri TPS is scheduled at 55% of its declared capacity; whereas Rihand TPS (lower VC plant) is operated near to its declared capacity during the period considered. Thus, it may be inferred from this analysis that the thermal power plants with higher VC are required to be retrofitted with the necessary modifications for flexible operation as compared to plants with lower VC.

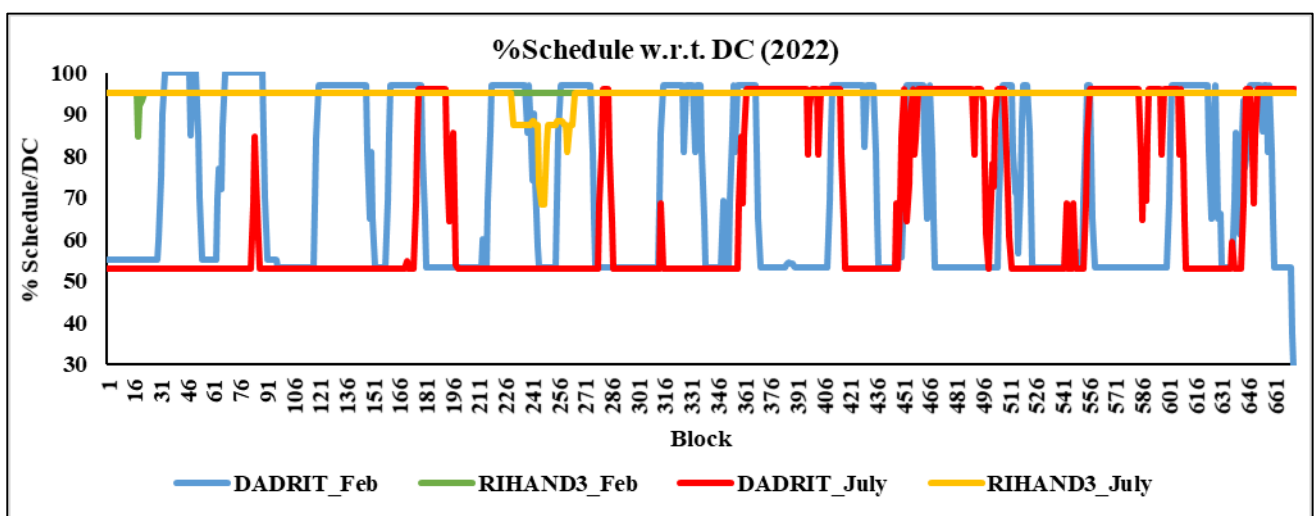


Figure 1: Comparison of Rihand (Low VC) and Dadri Thermal (High VC)

From the following figures (2 & 3) it is observed that power plants with low VC are scheduled at almost 100% of their Declared Capacity, with few blocks witnessing 70% schedule. As such, it may be inferred that these power plants may not require additional investment for further increment in ramp rate and decrease in minimum power levels (MPL)

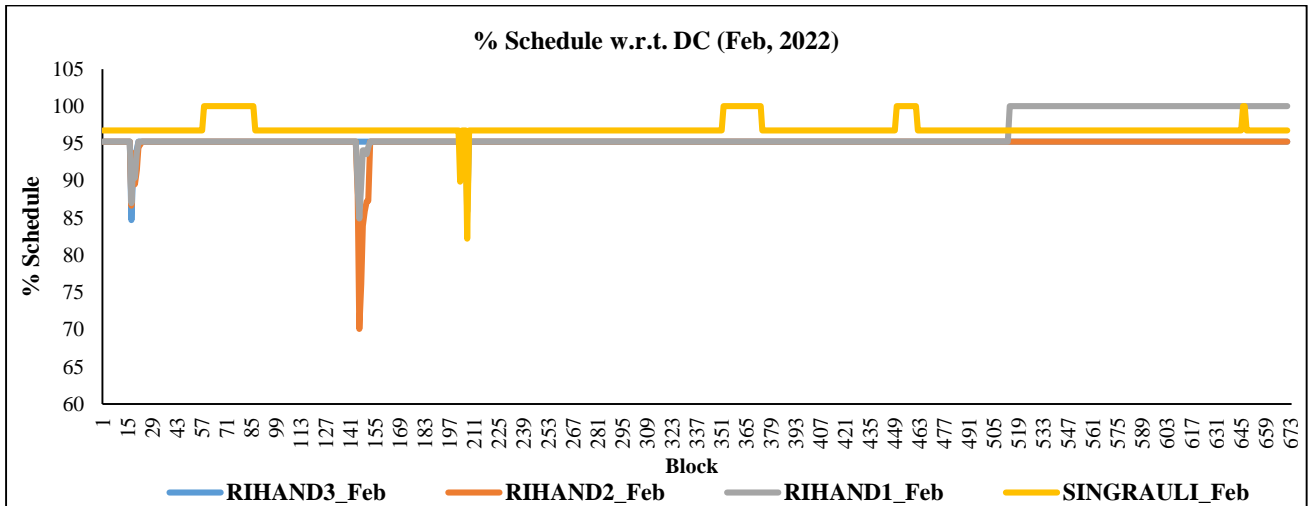


Figure 2: Scheduling of Low VC thermal power plant for February, 2022

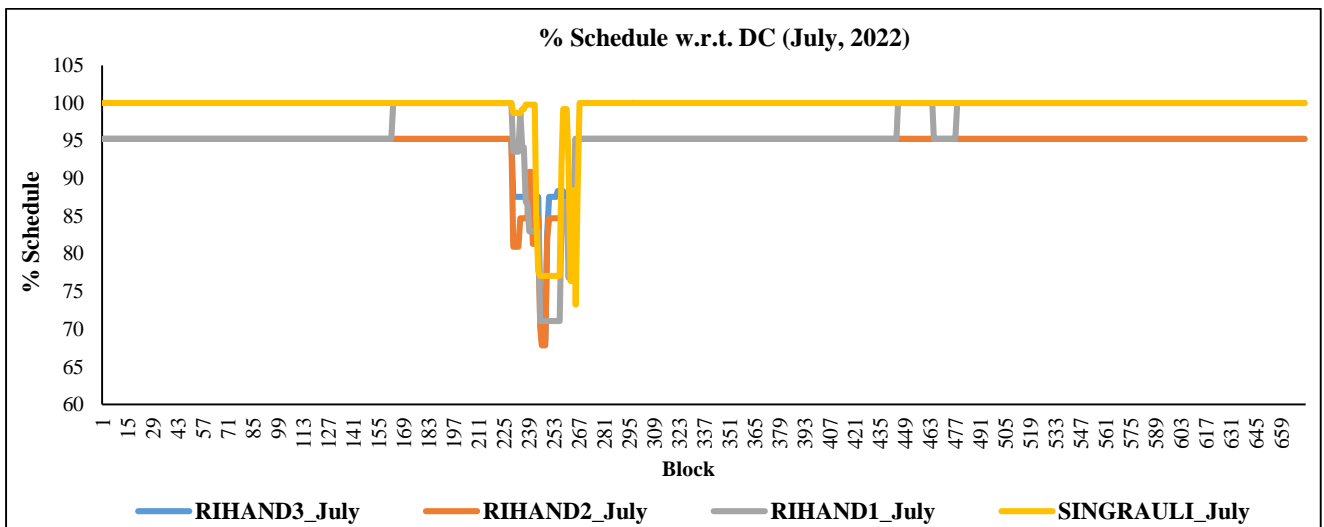


Figure 3: Scheduling of Low VC thermal power plant for July, 2022

- 3. Staggered Timeline for Investment in Flexibility:** The proposed timeline aims to mandate all TPPCs to be compliant with the regulations to achieve higher flexibility in a period of about three years. A staggered target should be adopted to avoid bunching of the plant shutdown for extended period of time for retrofitting/modification leading to significant drop in the available capacity of TPPs. Newer plants of recent vintage, which would be more amenable to such a transformation due to available design detailing, availability of parts and possible recent experience, may be identified under the first set of target. The others should be mandated to do necessary groundwork in the meantime. Central sector plants, with relatively faster decision-making process, may be a further subset for first batch of rollout of the plan.

- 4. Definition for Cold, Warm and Hot starts:** Clause No. 2 (1) (e) states ““Cold start”, in relation to steam turbine, means start up after a shutdown period exceeding 72 hours (turbine metal temperatures below approximately 40% of their full load values);”. Clause No. 2 (1) (h) states ““Hot start”, in relation to steam turbine, means start up after a shutdown period of less than 10 hours (turbine metal temperatures approximately 80% of their full load values)”, and Clause No. 2 (1) (u) states ““Warm start”, in relation to steam turbine, means start up after a shutdown period between 10 hours and 72 hours (turbine metal temperatures between approximately 40% and 80% of their full load values)”. It needs to be clarified if the additional characteristics added in the parenthesis are ‘additional’ or these are being mentioned for reference/clarification only.
- 5. Parameters for the Critical Point of Water:** Clause No. 2 (1) (p) states ““Sub-Critical Unit”, in relation to coal or lignite based thermal generating unit, means a unit designed for main steam pressure less than the critical pressure (225.56 kg/cm²) of water;” and Clause No. 2 (1) (q) states ““Super-Critical Unit”, in relation to coal or lignite based thermal generating unit, means a unit designed for main steam pressure more than the critical pressure (225.56 kg/cm²) of water”. Both these clauses mention the critical pressure of water at 225.56 kg/cm². The technical definition considers both critical pressure and temperature of water. Hence, it is suggested that the critical temperature of water at 374°C be included in the definition¹.
- 6. Characteristics of Flexibility:** The flexible operation of a power plant characteristics are described using in Fig. 1 under Clause No. 5. The terminology referred to in the figure differs from that in the draft Regulations. The definitions of “Minimum Power Levels (MPL)” and “Ramp Rate” mentioned on Clause No. 2 (1) (j) & Clause No. 2 (1) (l) are given w.r.t. ‘maximum rated capacity’, whereas the ramping capacity and the minimum load as illustrated in Fig. 1 is given w.r.t to ‘Normal Load’. As such, it is suggested that either the figure may be re-drawn for the explanation in the given context or the source of the original figure may be mentioned in these Regulations. Furthermore, it is suggested to provide the definition of ‘Normal Load’, or refer to it in case available in other relevant.
- 7. Incentives and Penalization based on RoE:** CERC’s (Terms and Conditions of Tariff) Regulations, 2019 provides for additional RoE for higher ramping capability while penalizing any short fall². POSOCO issued the detailed guidelines for assessment of ramping capability of ISGS in compliance of the above Regulations which indicated the provided the calculation for change in rate of RoE for achieving desired ramp rate.³

EAL's analysis of the Guidelines for Assessment of Ramping Capability of ISGS issued by POSOCO-NLDC points towards at least five instances of relaxations in the overall framework. For example, 15% relaxation in measuring the proportion of time blocks having attained the ramping target in spite of the exclusion of the blocks under exigencies, ramp rate

¹ Sarkar, Thermal Power Plant Design and Operation, Chapter 2 – Steam Generators, Pg 39-89 DOI: <http://dx.doi.org/10.1016/B978-0-12-801575-9.00002-0>

² Proviso (iii) to Clause 30 (2) of the CERC (Terms and Conditions of Tariff) Regulations, 2019 states the conditions for additional (reduced) RoE for achieving (failure to achieve) ramp rate of 1% min <https://cercind.gov.in/2019/regulation/145-Gaz.pdf>

³ POSOCO (Detailed Guidelines for Assessment of Ramping Capability of Inter State Generating Stations), 2020 https://posoco.in/wp-content/uploads/2020/01/Ramp_Assessment_detailed-guidelines_6Jan2020.pdf

tolerance of 10% only for under-achievement of ramping target, and a minimum of 60-90 blocks/month (2-3 blocks/day) required to demonstrate the ramping capability.⁴

The draft Regulations should relate the principle Tariff Regulations and Guidelines in terms of assessment of ramping capability and its relationship to the incentives and penalization based on RoE. Technical characteristics which are part of the original plant design should not attract any incentive for demonstrating a technical capability for which consumers are already paying the fixed charges.

The compensation for higher flexibility, if includes appropriate consideration for additional investment, should not attract additional incentive, but penalty in case such plants do not demonstrate the desired flexibility when required. It may also be suggested that the RoE incentives mechanism as per POSOCO Guidelines be revised in line with these regulations, which considering the inputs provided herein.

8. **Definition of ‘Retrofit’:** The term “*Retrofit*” defined under Clause No. 2 (1) (m) hasn’t been used anywhere in the draft Regulations apart from in the ‘*Definitions*’. This term may be used under Clause No. 7 (v) as ‘*The thermal power plants shall retrofit the plant with necessary modifications...*’. Alternatively, this term maybe omitted in case it is not required to be used.

9. **Cost Recovery of investment for flexible operation of TPP:** A limit on the expenditure for the upgradation of the TPPs to comply with the given conditions in the stipulated time may be provided through a norm to be decided by the CERC. As an alternative, international benchmark studies, appropriately adjust for the factors like relative inflation, vintage, technology etc be considered. International competitive bidding should be adopted to ensure hat cost of investment do not burden the final consumers.

⁴EAL Comments on “Detailed Guidelines for Assessment of Ramping Capability of Inter State Generating Stations (ISGS)”, Power Chronicle Volume 03 Issue 04 https://eal.iitk.ac.in/assets/docs/Power_Chronicle_Vol_03_Issue_04.pdf