Annexure – APP Comments on CEA Draft Flexible Operations Regulations 2022

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2(1)(g)	*"Flexible operation" means the ability of thermal plants to adjust the net power fed into the grid as per despatch schedules where must run power plants like renewable energy sources are taking part on meeting grid load demand.*	For the sake of abundant clarity, the following addition may be made to this clause: *'"Flexible operation" means the ability of thermal plants to adjust the net power fed into the grid* ***as per technical minimum capacity of the plant / unit and*** *as per despatch schedules where must run power plants like renewable energy sources are taking part on meeting grid load demand.'*
2(1)(j)	*"Minimum Power levels (MPL)" means the minimum output power at the generator terminals that the power plant can sustain continuously without oil support. It is expressed as percentage of maximum rated capacity.*	**There is huge variation in critical parameters such as GCV, Total Moisture, Volatile Matter etc., in the domestic coal supplied by CIL. Due to the variations in these factors at full load, it has been observed that for a 2x660 MW plant, the coal quantity fired in a day may rage from 390 T/hr to 470-480 T/hr. Such variation would also exist at part loads as well. In order to**

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		account for these variations, the definition may be modified as follows: *"Minimum Power levels (MPL)" means the minimum output power at the generator terminals that the power plant can sustain continuously without oil support* ***as per OEM's recommendations and the plant's experience with domestic coal supplies received from CIL****. It is expressed as percentage of maximum rated capacity.*
4(4)(1)	The Thermal Power Plants shall be designed to comply with requirements stipulated in : (a) Central Electricity Authority (Technical Standards for Connectivity to the Grid) Regulations, 2007 as amended time to time; (b) Indian Electricity Grid Code issued by Central Regulatory Commission (CERC);	**As mentioned above in our comments on Clause 4 (2), most of the power plants of IPP's are in operational phase. All efforts are being made by the utilities to comply with any amendment to CEA Standards / guidelines, Grid code revisions etc.** **However, critical aspects such as the recovery of expenditure involved** (capital expenditure, operating expenses in line with lower technical minimum, recovery of loss of residual life, etc)**, implementation timelines, shut down periods required and**

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	(c) Applicable State Grid Code issued by appropriate Regulatory Commission; (d) Central Electricity Authority (Technical Standards for Construction of Electrical Plants and Electric Lines) Regulations, 2010 as amended time to time; (e) Central Electricity Authority (Measures relating to Safety and Electricity Supply), Regulations, 2010 as amended time to time; (f) Central Electricity Authority (Safety Requirements for Construction, Operation and Maintenance of Electrical Plants and Electric Lines) Regulations, 2011 and; (g) Central Electricity Authority (Grid Standards) Regulations, 2010.	**recovery of fixed cost during the shut down period etc., need to be adequately covered under the Regulations.**

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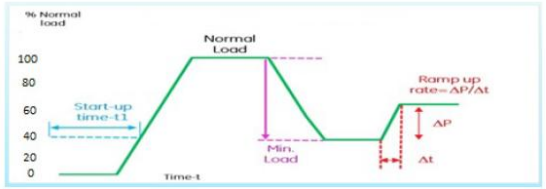
5	The flexible operation of a power plant shall refer to the characteristics indicating Fig 1.  Fig 1: Characteristics of Flexibility	1. The diagram (Fig 1) is only an indicative explanation of flexibility. It has not specified the time period involved either at minimum load or Normal load. 2. The number of load cycles in a day for which the Units have to be prepared, needs to be addressed / specified as this would lead to cyclic operation of the coal based units.
6 (i)	(i) The units throughout their service life shall be considered for flexible operation.	While the Draft Regulations provide for technical feasibility studies to be carried out, the financial feasibility aspects of upgrading/renovating old plants/small size units also needs to be covered in the Draft Regulations. Further, EPRI USA has carried out detailed and extensive analysis on this subject, prior to the year 2000. It was observed that when fossil fuel generators cycle on and off or ramp down to minimum generation, the components thermal and pressure transients can lead to fatigue, creep and creep fatigue interaction damage, **which**

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		results in increased maintenance, repair and capital expenditures. Allowances and compensation against these aspects have to be covered in the draft Regulations.
6 (ii)	(ii) The suitability of units for starts / stops and deep load following (Ramps) shall be assessed before hand	All OEMs of Turbines & Boilers design such critical equipment for a fixed number of start / stops, based on materials selected, creep & fatigue analysis, etc. Normally, component damages need to be analysed after about 10 to 15 years of operation, based on the operating practices adopted. RLA studies need to be carried out, to assess the conditions of critical components. **Such RLA studies would facilitate in assessing the suitability for such frequent start / stops and ramp up / ramp down operations on sustained basis.** **Further, feasibility studies should be conducted to undertake a cost-benefit analysis for smaller sized units as there would be marginal contribution of smaller unit running in flexible**

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		operation and huge capital expenditure would be required for making the unit flexible operation ready.
6 (iii)	(iii) The condition assessment of existing plant systems and its upgradation, if required, to accommodate operating requirements arising out of flexible operation shall be addressed before hand.	**Critical aspects such as the recovery of expenditure involved** (capital expenditure, operating expenses in line with lower technical minimum, recovery of loss of residual life, etc)**, shut down periods required and recovery of fixed cost during the shut down period etc., need to be adequately covered under the Regulations.**
7 (i)	(i) All TPP's shall be capable of providing the required output as per the schedule for generation finalized by appropriate Load Despatch Centres. Based on the availability of must run stations, plants or units shall follow the variable load requirements.	This can be implemented only for the plants which are deemed suitable for flexible operations under Clause 6(ii) and after the required upgradations/modifications are implemented as per Clause 6(iii).

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7 (ii)	(ii) The appropriate Load Despatch Centers shall schedule all coal based thermal power plants, upto the MPL of 55%, to support the operation of must run stations.	**In terms of IEGC / State grid code, the load to a particular power plant would depend upon the beneficiary / procurers of power from the said power plant. It is not clear how LDC's would be able to give schedule to a power plant to supply to different procurers / beneficiaries. Further, this sub-clause seems to entirely disregard PPA conditions/contract provisions, which would need to be suitably addressed.**
7 (v)	The thermal power plants shall implement the necessary modifications, if any, to achieve the requirements as specified in Sub-Clause (ii), (iii) and (iv) of this Clause to generate flexible power according to schedules finalized by appropriate LDC's.	As already mentioned above, implementation of sub-clause (ii), (iii) and (iv) would require, at the very least, the following activities to be undertaken: a. Detailed engineering analysis by OEM's which would involve RLA studies / health assessment analysis., etc. This may also require a shut down. b. It may also require trial tests to be conducted by the OEM's

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		c. Implementation of the modifications / rectifications / materials charges etc. in the Boiler, Turbine etc. as per the OEM's recommendations. d. Evaluation by OEM's along with the utilities during the implementation of the above clauses (ii), (iii) and (iv) and also in the post implementation period. e. About 2-3 years after the 1st capital overhauling of Boiler / turbine / Generators, a detailed condition assessment needs to be carried out of all the critical components with the guidance of OEM's / Expert Institutes. f. Based on analysis at (e) further corrective measures may be required to be planned and implemented. Further, with reference to sub-clause (ii), (iii) and (iv), the Draft Regulations have not factored in the critical aspects of expected cost/time and its implications. At the present time, when majority

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		of the IPPs are under stress and facing debt restructuring / insolvency, the financing of such additional expenses is very difficult. **These aspects need to be approved by the lenders/procurers and regulatory commissions need to provide mechanism for recovery of the additional expenses (capital expenditure, operating expenses in line with lower technical minimum, recovery of loss of residual life, etc). The developers/lenders/procurers also need to evaluate whether it is feasible to incur additional expenses for modification, depending upon the balance life of plant.**
7 (v)	Provided that the implementation of Sub-Clause (iii) and (iv) of this Clause would be completed by all thermal power units within three years from the date of notification of these Regulations, subject to the technical feasibility studies to be done in consultation with concerned OEMs or qualified	Condition assessment of existing plants would involve full fledged RLA studies of boiler, turbine, generator and other critical accessories involved in the power plant. Some of these studies would require a shutdown for conditioning monitoring analysis, and these studies could take anywhere between 6 to 8 months.

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	consultants with regard to the requirements mentioned at Clause 6 and Clause 8 of these regulations.	Subsequently an action plan would need to be prepared in association with the OEM's involved, for the upgradations/modifications/replacements required. The timeline for these works would depend on the extent of damages observed / replacements required / new materials, if any, required etc. and the manufacturing and supply lead time of equipment. A second shut down would also be required for the replacement / modifications to be carried out in the units of the individual plants. Further, once the modifications have been completed, and the units are put back in operation, the performance of the identified critical components needs to be monitored continuously till the first Capital Overhauling after implementation of flexible operation Regulations. During the 1st Capital Overhauling, condition assessment would need to be carried out for the identified critical components of Boiler, Turbine & Generator etc. of each of the units,

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		so that further corrective measures as required can be planned for implementation. **As the above process of implementation is likely to take some time, we feel that it is premature for the Draft Regulations to prescribe timelines for implementation at this stage when so many critical studies and activities need to be completed.** **Further, the cost estimates need to be approved by the states involved / the State Regulators for inclusion in Tariffs. The prior approvals are required as Lenders would need certainty on the recovery mechanism of expenditures incurred** (capital expenditure, operating expenses in line with lower technical minimum, recovery of loss of residual life, etc)**. There also have to be provisions for further expenditure, if any, involved after implementation of these Flexible operation guidelines particularly after the 1st capital overhauling of major equipment like Boiler / Turbine / Generators etc.**

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8	Process for implementing Flexible Operation of the Thermal Power Plants: Measures to lower minimum limits of power output, increase the ramp rates and optimize the start-up of the 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 b. Minimum load Design rating with no oil support c. Design Ramp rate d. Influence of low load operation on components and systems e. Technical boundary conditions for flexible operation f. Combustion system optimization, co-ordination of mill and burner systems.	**While the Draft Regulations provide for technical feasibility studies to be carried out, the financial feasibility aspects of upgrading/renovating old plants/small size units also needs to be covered in the Draft Regulations.** Further, during implementation of flexible operations in USA, detailed studies were conducted by EPRI and other bodies, which reported the following observations: (i) The operational impacts of Flexible Operation result in significantly increased occurrences of thermal transients in the material of critical high temperature boiler and turbine components. These transients and other operational factors associated with flexible operation, have the following effects on coal fired generating assets:- - Increased wear and tear of high temperature components - Increased wear and tear of balance of plant components

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		- Decreased thermal efficiency at low load (high turn down) - Increased fuel costs due to more frequent unit starts. - Difficulty in maintaining optimum steam chemistry (ii) Impacts on Environmental Control Equipment Load following and other modes of flexible operation can affect the performance and reliability of FGD equipments. The chemical processes involved in these systems require precise control of reaction conditions which are influenced by reagent flow, water flow and flue gas temperatures. (iii) Retrofitting the units with advanced control systems and enhanced design features will likely improve flexible operations and provide better monitoring of physical wear, but these upgrades are not trivial and are often expensive.

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		The draft Regulations must also provide for allowances and compensation against such above aspects which may be highlighted during the feasibility studies. Such observations arising out of the detailed studies would have a direct bearing on several aspects pertaining to flexible operations of TPPs, such as helping to identify suitable units for flexible operation, the technical limits and parameters of flexible operation, time period required for upgradation of equipment, estimation of costs involved so that suitable cost recovery mechanisms can be developed, etc. Therefore, it is suggested that the draft Regulations may be put on hold till the results of the technical feasibility studies are analyzed in detail.