



# FLEXIBLISATION

## The Way Forward with BHEL

**November, 2022**

**Bharat Heavy Electricals Limited**  
Power Sector – Technical Services, Noida



## Presentation Agenda



- ✧ Requirement
- ✧ Key Challenges
- ✧ Basket of Solutions
- ✧ Why BHEL?
- ✧ Key Deliverables
- ✧ Implementation Plan
- ✧ Achievements





## Requirement



भारत सरकार  
Government of India  
विद्युतमंत्रालय  
Ministry of Power  
केन्द्रीय विद्युत प्राधिकरण  
Central Electricity Authority  
तापीय परियोजना नवीनीकरण एवं आधुनिकीकरण प्रभाग  
Thermal Project Renovation & Modernization Division

No: CEA/TPRM/Flexible Opn./2021

dated: 22.06.2021

To:

All thermal power generating plants/utilities (Central/State/Emile) as per attached list

Sub: Flexible thermal Generation - reed.

It is to apprise that CEA had disseminated information regarding the need for flexible operation of thermal power plants for integration of generation from 175 GW (2021-22) RES, estimating the quantum of flexible power needed in its report, "Flexible operation of thermal power plants for integration of renewable generation", January, 2019. As per the CEA report there will be requirement of around 104 GW flexible power (maximum) from the grid connected thermal units of 140 GW capacity in year 2021-22 when 175 GW RES capacity will be added and existing hydro, gas & nuclear plants operate in BAU scenario. In this scenario the thermal generating units have to be operated at as low as 26% load. This will be very difficult considering the high ash contained Indian coal. CEA has conducted studies to overcome this situation and finally suggested few steps to improve the minimum load operation of TPPs. Thereafter a low load operation target of 45% was suggested for the thermal generating units. In this scenario about 64 GW flexible thermal powers is required from 117 GW synchronized thermal capacity in the grid. The grid synchronized thermal capacity needs to be operated at technical minimum of 45% load on an average. Further, as per the report, 200-600 MW units are proposed to operate at 40-45% load and 660-800 MW units at 45-50% load. The required ramp rate shall be in the range of 1% per minute considering hourly generation data of renewable, thus the actual ramp rate may be slightly higher than the predicted figure. Few recommendations related to thermal power plant as suggested in the report as under:

- 200 MW to 600 MW size unit shall be run at lower load than bigger units
- Among the fleet of 200 MW, 500 MW, 660 MW and 880 MW units which have lower ECR shall be given preference in higher generation.
- Low load study/test shall be conducted before implementation of measures in thermal unit for improving flexibility in generation as measures are unit specific.
- Capacity building of thermal power plant operators becomes an important measure in the changing operational regime.
- Separate tariff for flexible thermal power - considering (a) Capex (measure to be implemented) (b) Opex (deterioration of net heat rate & increased O&M cost + markup).

It may be noted that the target of 175 GW RES may not be achieved by 2022 due to the current pandemic situation. However, it is expected that the target will be met in 2023. Thus, the flexible thermal power as projected may be needed in 2023. To make the coal units capable for flexing, it would need study/tests to be conducted as measures to be implemented are plant specific. The identified thermal units shall have to undergo the low load and ramp test to ascertain their capability, do gap analysis and carry out the modifications to make the units capable of flexing.

On the initiative of CEA, so far, 7 thermal generating units of central/state utilities have undergone the test/ pretest studies to validate their flexing capabilities at 40 to 50% load against the total requirement of 243 units by year 2023. The test requires the preparatory time for collecting data, preparation of test setup, clearance from RPC & RLDC/SLDC for schedule, analyzing the test data, preparation of recommendation. The whole exercise takes about 5 to 6 months' time. Further after the tests modifications may require implementation time of 6 to 12 months.

MOP's top most priority is to build up the flexible thermal power to accommodate the high penetration of renewable. Under this initiative the minimum load and ramp rates of operating units are required to be improved. In this regard, it is advised that each generating plant/utility may take necessary action for operation of all the generating units under their administrative control at 55% load and identify at least 50% of the capacity for further lowering the minimum load operation and initiate discussion with OEM to operate 200-600 MW size unit at 40-45% load and 660-800 MW size unit at 45-50% load & ramping test (2-3%) on urgent basis and take necessary action for implantation of measures as identified in the test.

  
(B.C. Mallick)  
Chief Engineer (TPRM)

Copy for information

- Secretary Power, MOP
- Additional Secretary (Thermal)
- Chairperson, CEA
- Member (Thermal), CEA
- Member (GO&D), CEA
- CMD, POSOCO
- Member Secretary, (NRPC/ERPC/SRPC/WRPC/NREPC)
- OEM (BHEL/GE/Siemens/Toshiba)

Rating	Ramp	MTL
Sub-Critical	2 to 3%	40-45%
Super-Critical	2 to 3%	45 to 50%



## Key Challenges



With existing plant configuration:

- Minimum threshold load for sustainable operation
- Ramp up rate (maximum and stable)
- Ramp down rate (maximum and stable)
- Excursion range of operating parameters
- Response of plant equipment, its auxiliaries and logics
- Higher life consumption of components
- Time required for unit startup in various modes



## Basket of Solutions



- Controls & Automation Package
- Condition monitoring systems/ Sensors
- Fuel Firing System Optimization
- Thermo-mechanical assessment
- Plant Optimizer
- Customized operating guidelines
- Advisory Services for Flexible Operation





## Why BHEL?



- Largest engineering and manufacturing company in thermal power sector in India
- Vast experience in design, engineering, construction, testing, commissioning and servicing for thermal power sector
- OEM for more than 400 utility sets in India for various ratings
- Successfully demonstrated low load during flexibilisation studies and **actual load ramps of 3% per minute in one of the plant.**
- Successfully demonstrated single stream operation for key auxiliaries during runback (as part of PG Test as per tender requirement for various customers)
- BHEL has conducted sufficient number of studies in each category of machines for flexibilisation and **executing commercial orders for it's valued customers.**
- Capability to provide end to end solutions for all Customer requirements such as flexibilisation
- Vast experience in dealing with Indian coal for boiler design and performance



### Key Deliverables



- Load Ramp Rate (maximum and stable): 3%/minute (within control load range) with operator intervention for mills cut in & cut out
- Low load 40 – 45% TMCR with focused supervision of operator with 1% ramp rate below control load range
- Primary Frequency Control capability of up to 5-6%TMCR of current running load
- Stable & reliable operation of Axial Fans during low load
- Stable & reliable operation of BFPs during low load
- Excursion range of operating parameters like steam temperature ,Drum level etc will be controlled within allowable limit.
- Online monitoring of equipment during flexible operation regime for residual life consumption



## Implementation Plan



### Implementation of following packages:

- ❖ **Control system optimization: Restricting the fluctuations in process parameters within acceptable limits**
- ❖ **Axial Fans Low Flow Operation Package**
- ❖ **BFP Low Flow Operation Package**
- ❖ **Mill Automation Package**
- ❖ **Thermo Mechanical Assessment**
- ❖ **Condition Monitoring Package – Boiler ,Turbine & Generator Critical components**
- ❖ **Turbine Vibration Monitoring Package**





## Implementation Plan



### Implementation of following packages:

- ❖ **Fuel Firing System Optimization Package: Advance coal Burner design, Mills Retrofitting ,Addition of Dynamic classifier**
- ❖ **Flue Gas Temperature Control Package**
- ❖ **Automatic Plant Startup Package:**
- ❖ **Plant Optimizer Package: Online efficiency monitoring, performance optimization based on Class II calculations/ principles**
- ❖ **Time cycle required 6 to 9 months for supply , Erection & Commissioning based on the requirement.**



## Achievements



yet again proves its

**TECHNICAL  
PROWESS!**

**Leading Indian power sector into a new era of synergy between coal-based power and renewable energy, BHEL has successfully demonstrated its indigenously developed flexible operation capability for coal-based power projects.**

**BHEL** has successfully implemented **indigenously developed** flexible operation solution at Adani REGL 1x600 MW, Raigarh. During flexible operation trials, BHEL achieved a **ramp rate of 3% per minute** keeping all major parameters within stable and deviation limits.

Flexible operation of thermal power plants is critical for absorbing intermittent renewable energy into national grid. With this feat, BHEL has not only **favourably positioned** itself for flexible operations business opportunities, but has also made **significant contribution** towards **achieving green energy** as committed by the nation.

**CONGRATULATIONS TO TEAM BHEL!**



# THANK YOU



Power Sector-Technical Services  
3<sup>rd</sup> floor KRIBCO Bhawan ,Sector-1,  
NOIDA,201301

