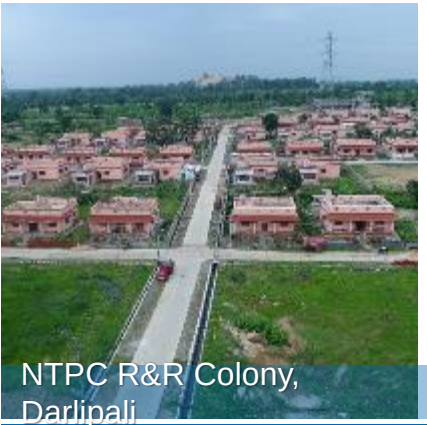

NTPC R&R Colony, Darlipali


NTPC Bhadla


NTPC Kudgi


NTPC Koldam

# "NTPC EXPERIENCE – FLEXIBLE OPERATIONS"

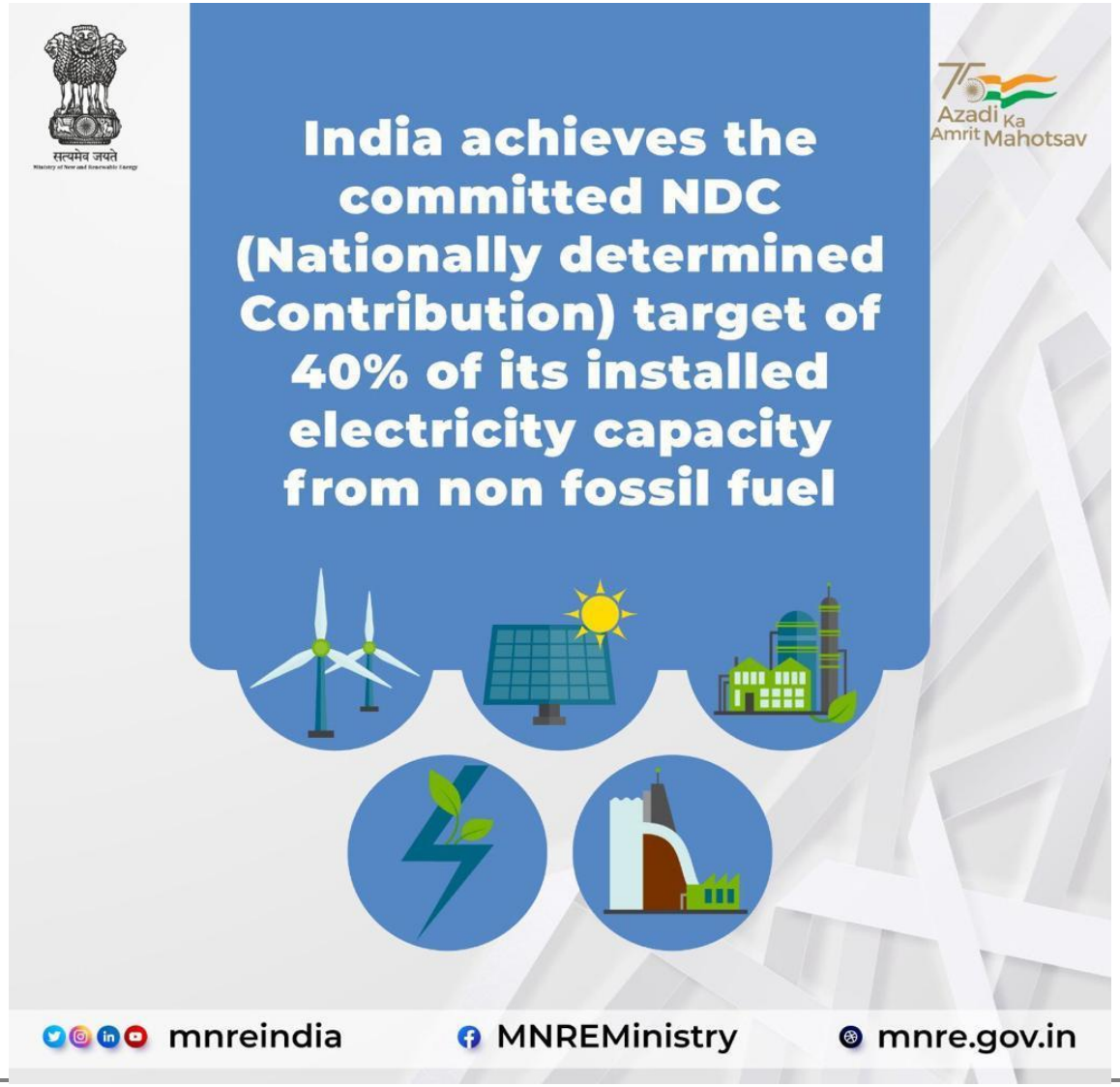

NTPC Simhadri


NTPC Rojmal

# Climate Commitment

## India’s Commitment in COP26

- India will bring its non-fossil energy capacity to 500 GW by 2030
- India will bring its economy's carbon intensity down to 45 per cent by 2030
- India will fulfil 50 per cent of its energy requirement through renewable energy by 2030
- Achieving Net zero Emission by 2070



# All India capacity of Today vs Projected upto 2029-30

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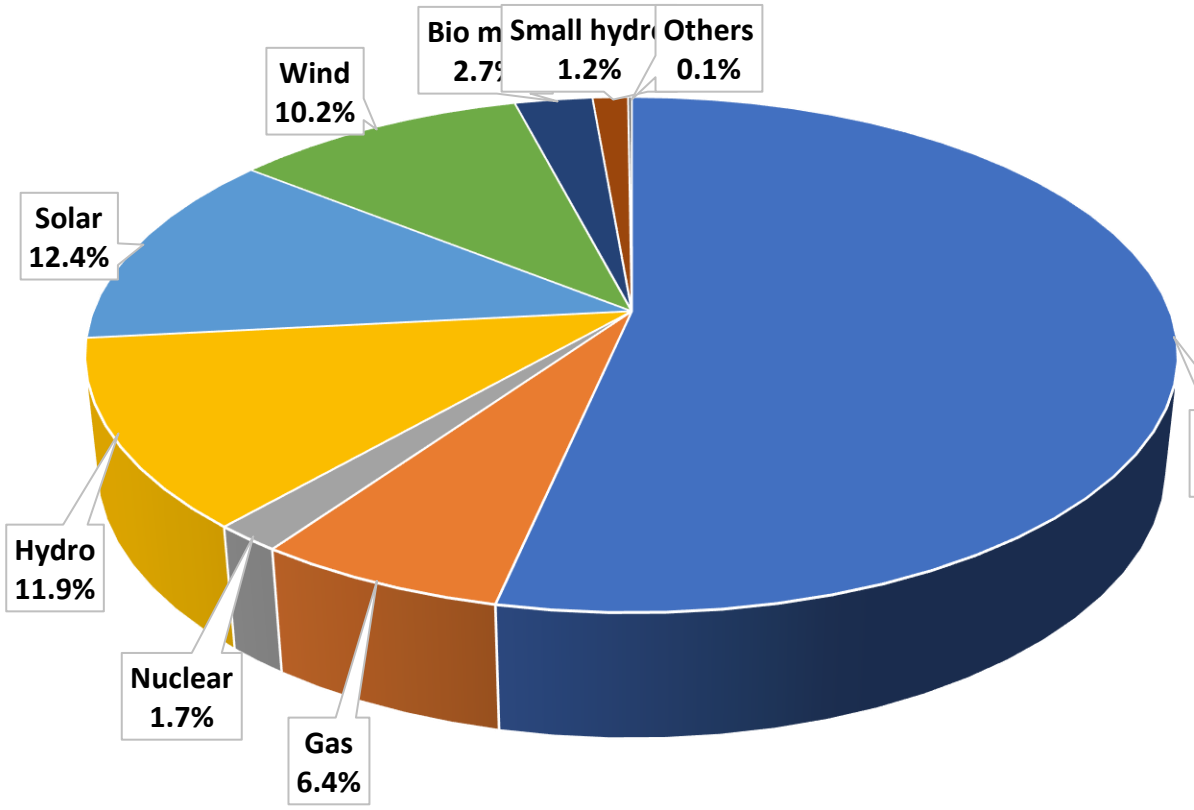
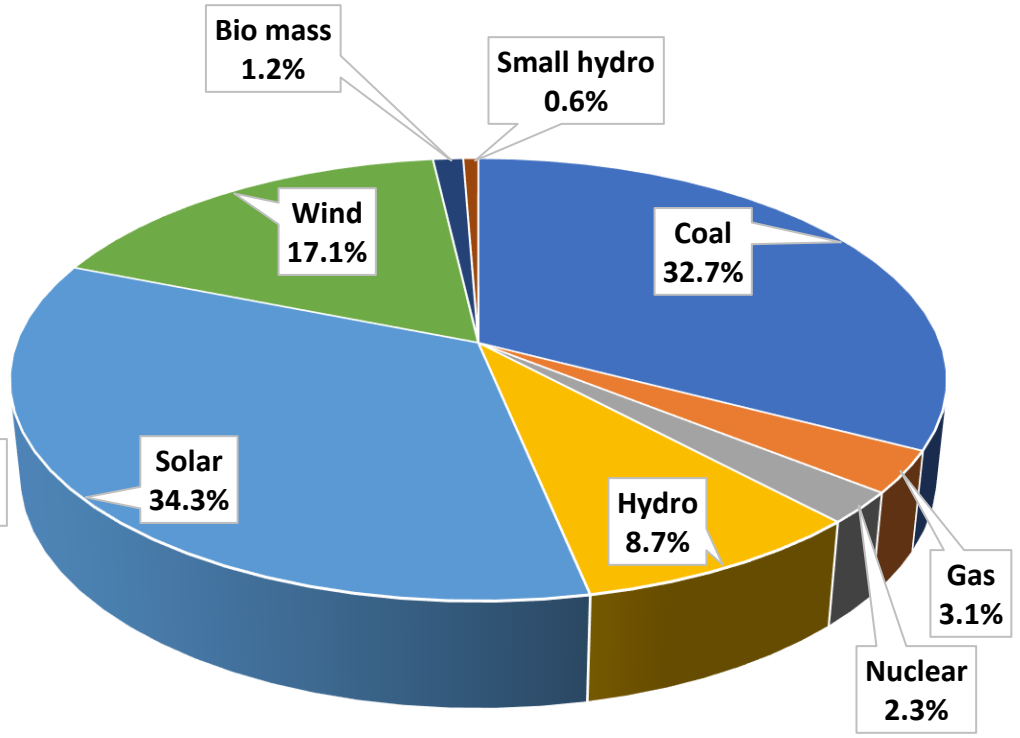
## As on 31.10.2022




**Total Capacity: 408714 MW**

## Projected in 2029-30




**Total Capacity: 817254 MW**

# CEA –Recommendation for Flexible Operation of Thermal Plants

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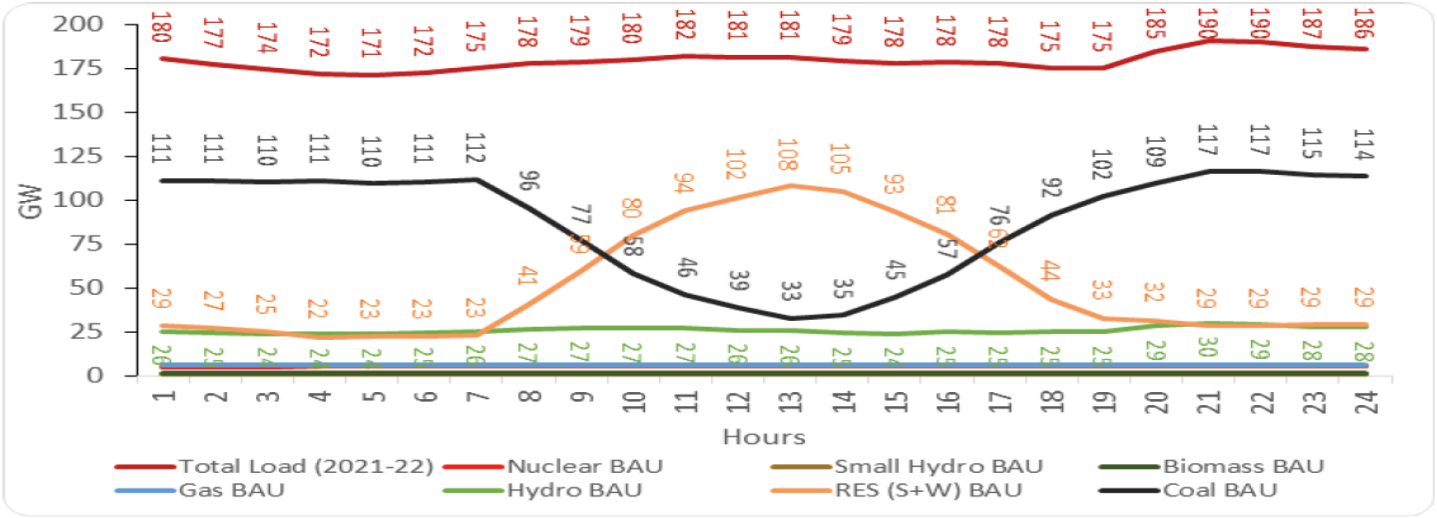
**Generation trends on a given sunny day**




Contribution from different fuel sources in meeting demand-2021-22

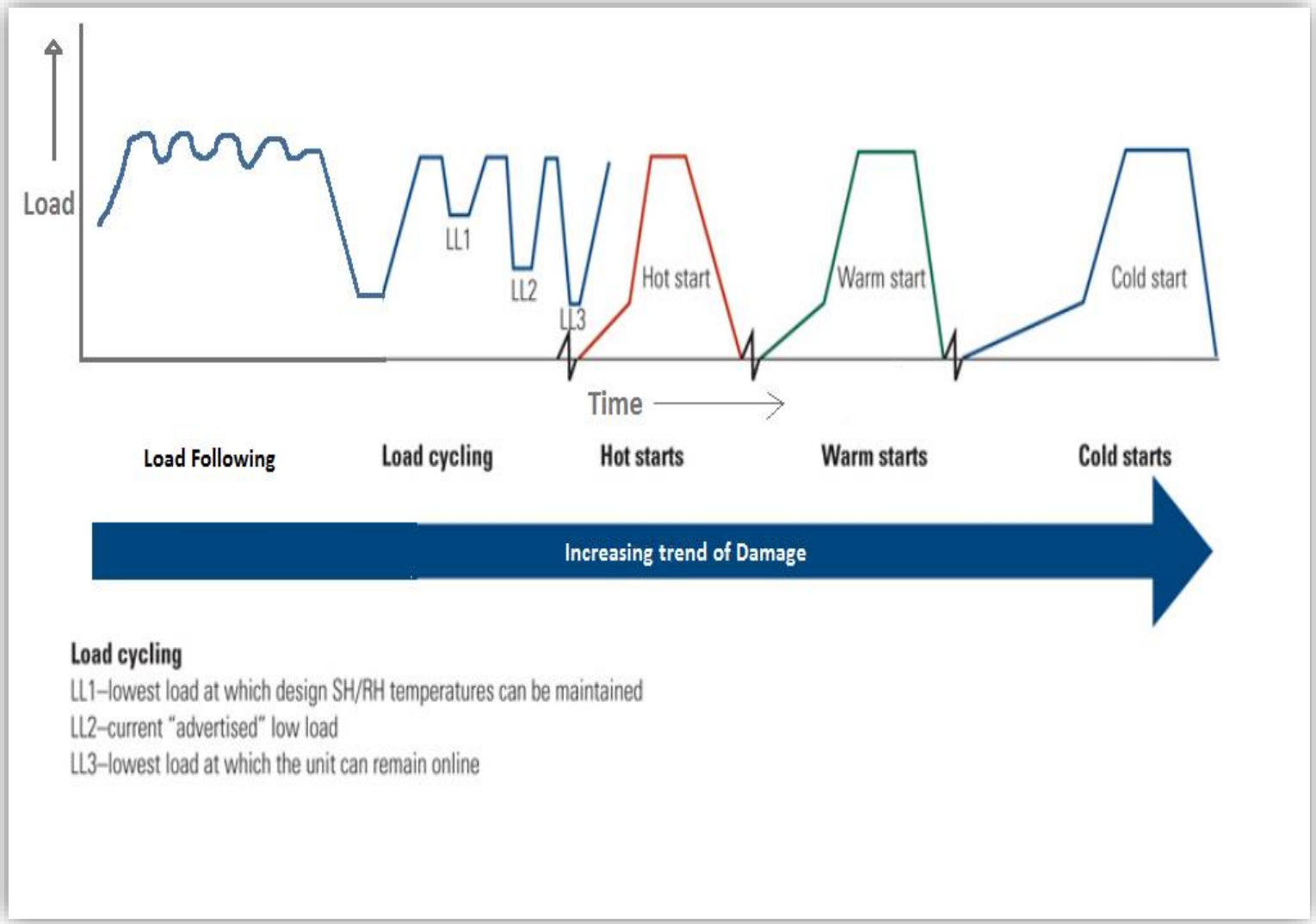
- Coal Units should have the capability of 1% ramping to take care of this integration
- Coal units are to be flexed upto 40% MTL. Plants <150 MW to be retired or subjected to 2 shift operation.
- Provision of 55% technical minimum load of thermal units.

# Flexibilization Types

## What is Cyclic operation ?

- Start up/Shut down (Hot/Warm/Cold)
- On load cycling (LL1,LL2,LL3)
- Higher ramp rate
- High frequency load variations (RGMO/AGC)

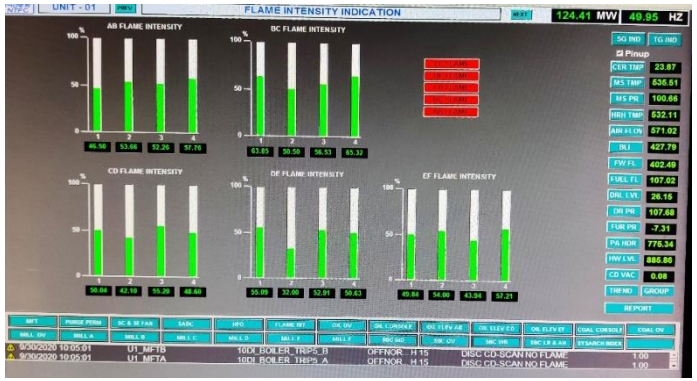
- Thermal fatigue combined with creep is the main cause of damage.
- Cyclic load variations within SH/RH temp. control range may be tolerable
- Start/stops are the severest in terms of life consumption



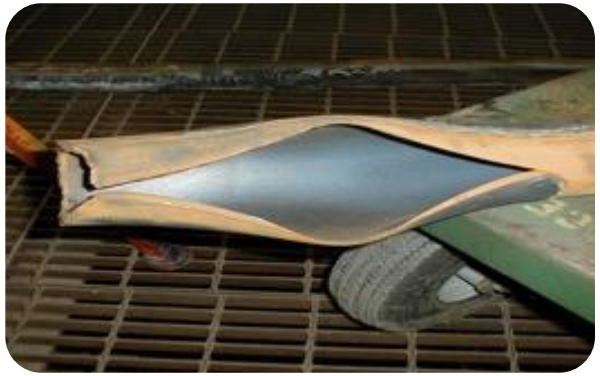
# Flexibility Studies with International Associates

| Associates | Plant | Study period | Scope |
|---|---|---|---|
| **IGEF/VGB, Germany** | Dadri Unit 6 (500MW) | Jan- Aug 2018 | MTL (40%) & 3% Ramping |
| **GE, USA** | Talcher-K Unit 1 (500 MW) | April-Aug 2018 | MTL (40%) |
| **USAID/BHEL** | Mauda Unit 2 (500 MW) | April-Aug 2019 | MTL (40%) |
| **J-Coal/TEPCO, Japan** | Vindhyachal Unit 11 (500 MW) Mauda Unit 3,4 | March–July 2019 | Minimum loading (55%) with 3% ramping. Efficiency at different part load condition |
| **EPRI, USA** | Solapur, Gadarwara, Simhadri, Bongaigaon, Farakka and Unchahar | Mar'20 onwards | Identifying gap in intended O&M practices to be followed in view of flexible operation of fleet |

# Challenges faced at min loading operation

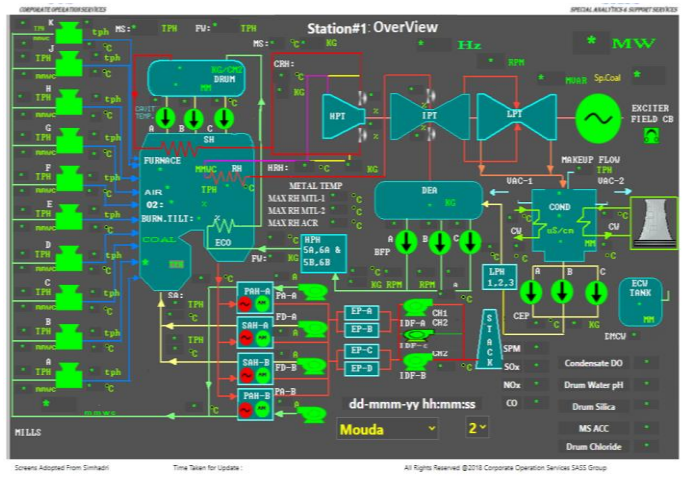



**Combustion and Flame Stability**



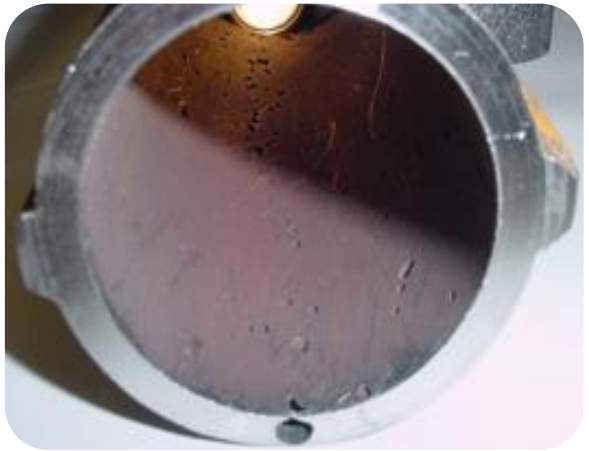
**Increased Boiler Tube Failures**

**Ash Deposition at Low Loads**




**Tuning - Process Control loops**

**Variations in coal quality**



**Thermal Fatigue - Failure of Thick walled components**

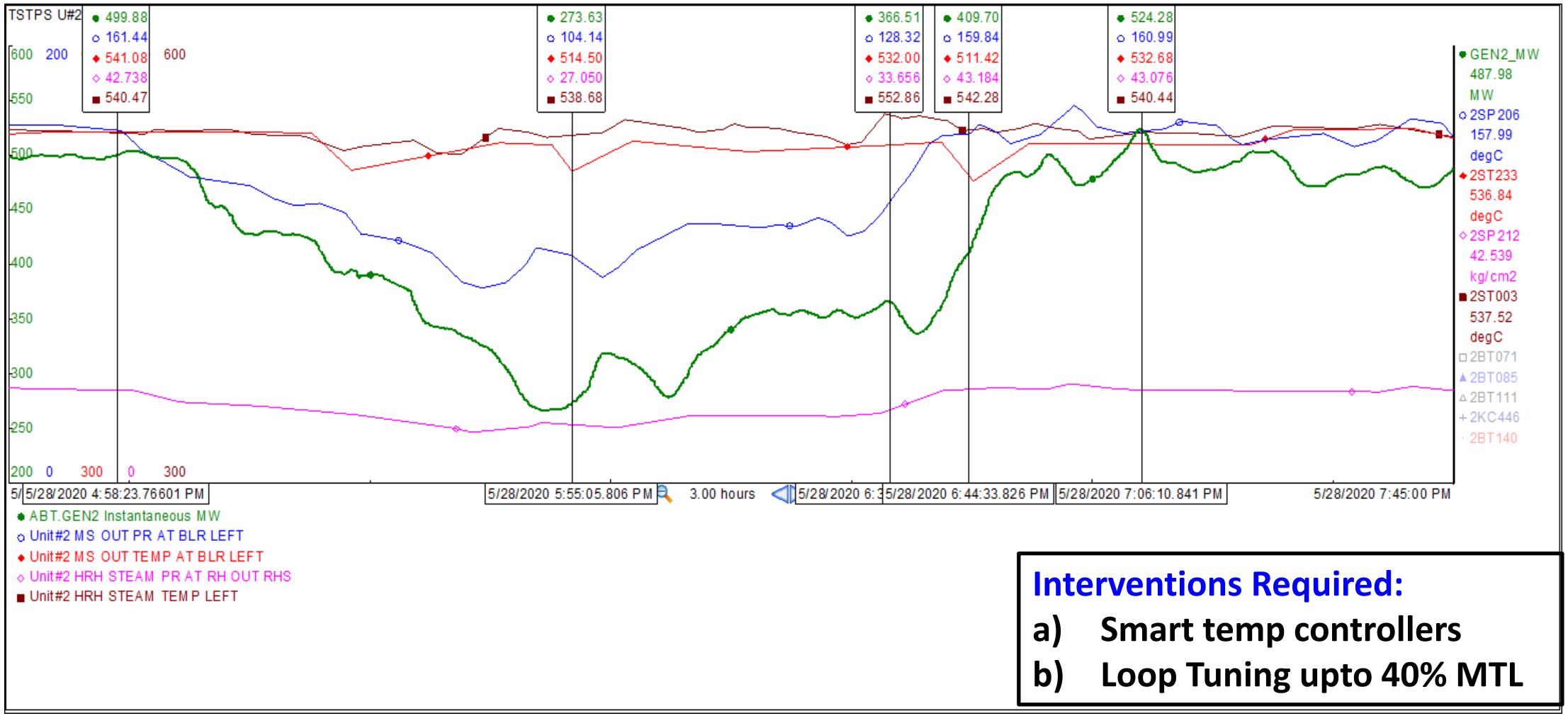
# Common Observations of the Pilot Studies

**In all the Studies, field tests were conducted in strictly controlled environment with good coal quality in presence of functional experts.**

**Minimum Technical Load of 40% for 2-4 hrs with following Technical issues**

- Excessive fluctuations in Steam temperatures
- High Drum level swings during ramping
- Flame disturbance during ramping and at MTL
- Occasional furnace pressurisation
- Stalling of PA fans at low load
- Low  boiler flue gas exit temperature, leading to acid corrosion
- With 3% ramp commands, actual ramp rate achieved in full load range was only 1.3-1.4% due to manual milling system operation.

# Typical MS and HRH steam temp fluctuation ~ 20-30 Deg C

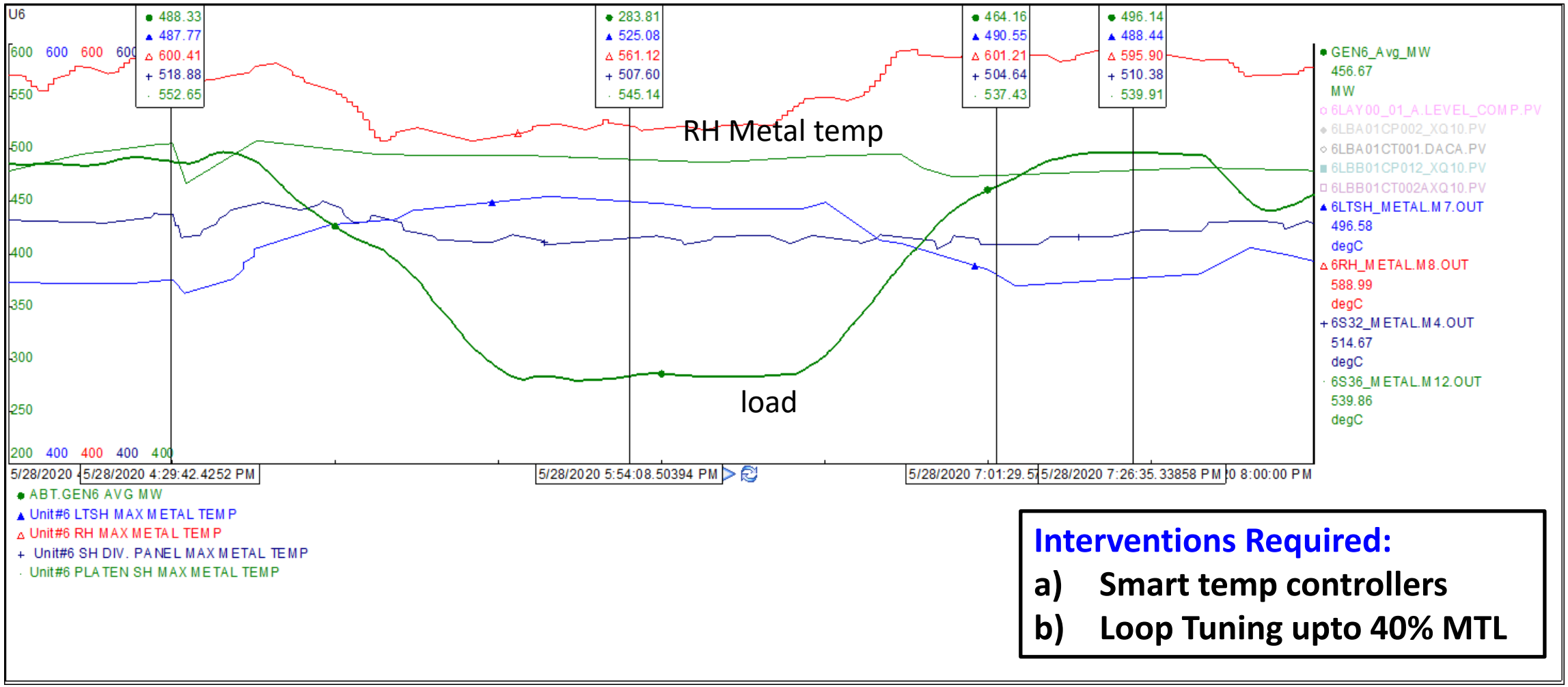



**Interventions Required:**

a) Smart temp controllers

b) Loop Tuning upto 40% MTL

# RH metal temp crossing the excursion limit




**Interventions Required:**

a) Smart temp controllers

b) Loop Tuning upto 40% MTL

# Issues encountered during Pilot Test run at MTL of 40%

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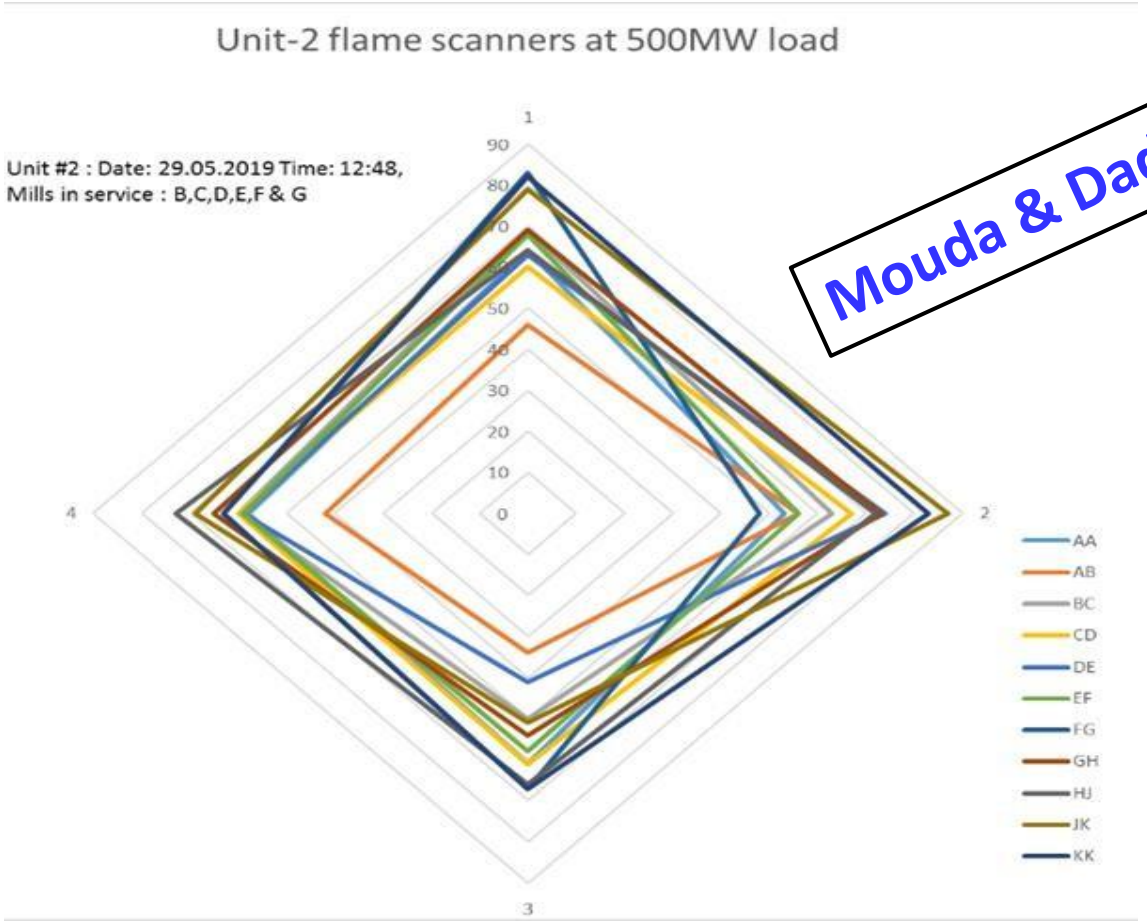
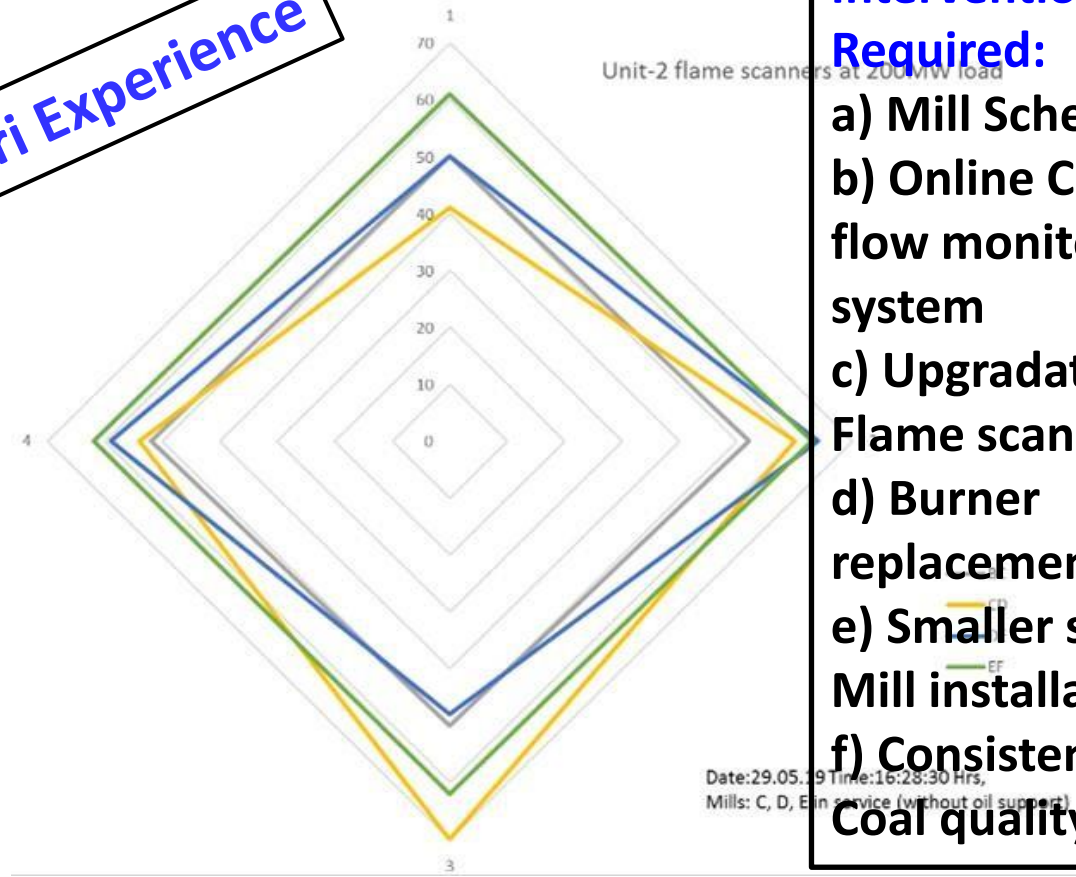
## *Flame scanners at 100% vs 40% load: Safe operation of Boiler?*



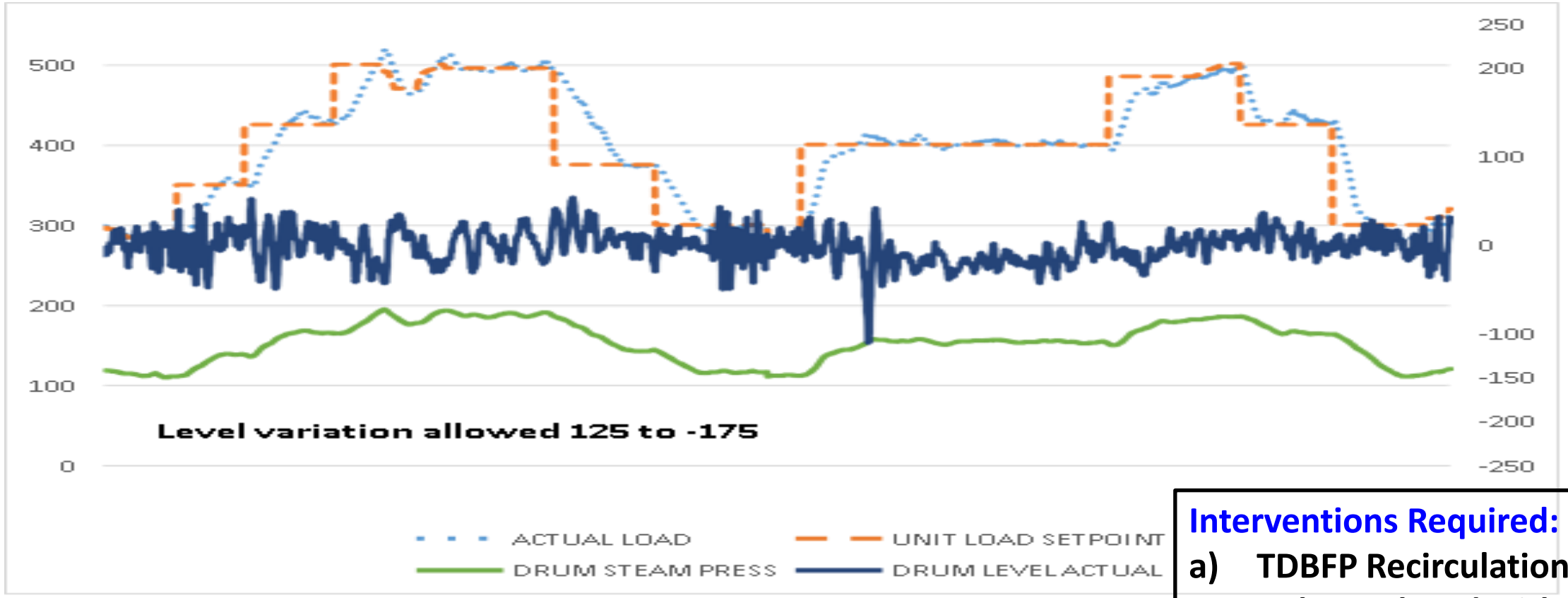

**Mouda & Dadri Experience**




**Interventions Required:**

a) Mill Scheduler
b) Online Coal flow monitoring system
c) Upgradation of Flame scanner
d) Burner replacements
e) Smaller size Mill installation
f) Consistency in Coal quality

# Drum level fluctuation

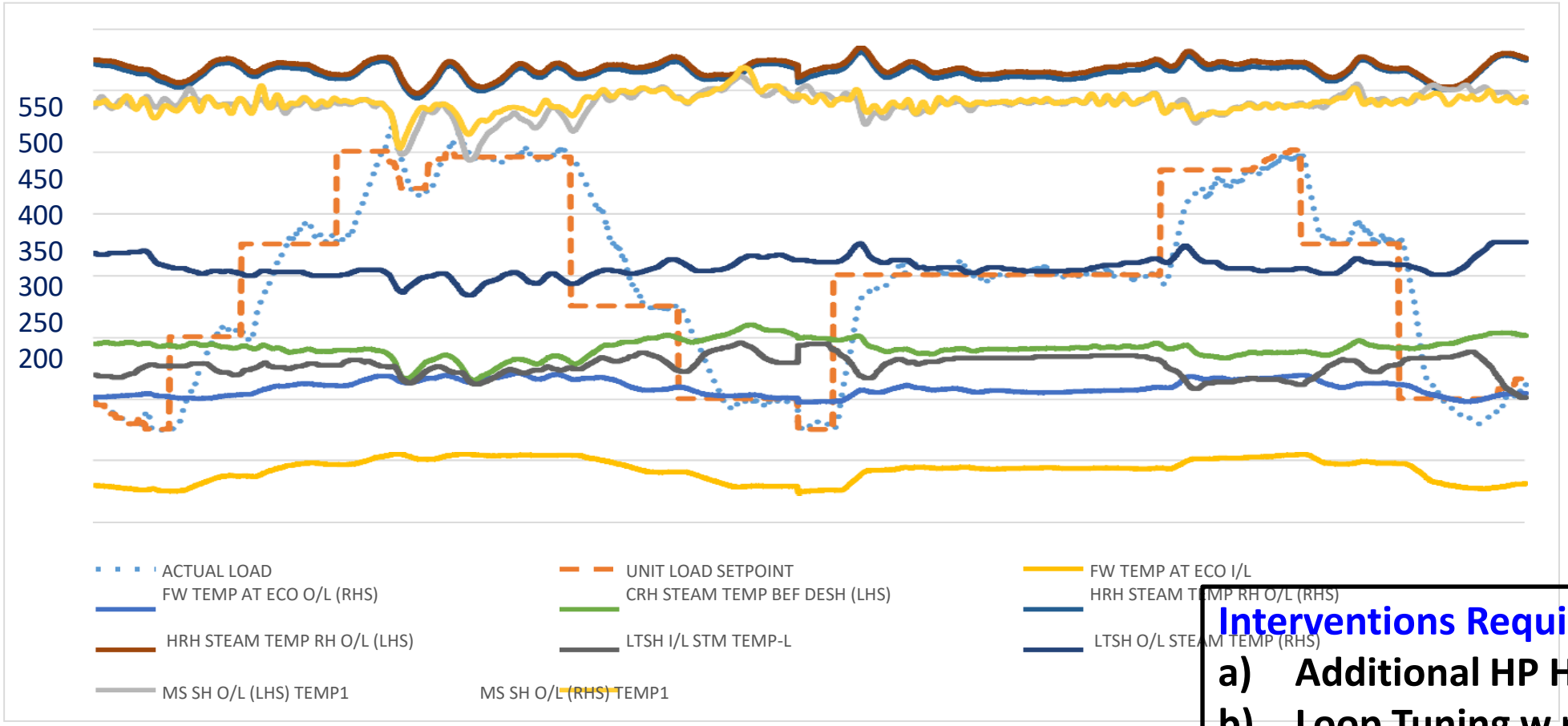



**Interventions Required:**

a) TDBFP Recirculation Valves to be replaced with modulating type.

b) Loop Tuning upto 40% MTL

# Steaming in Economiser and flow accelerated corrosion



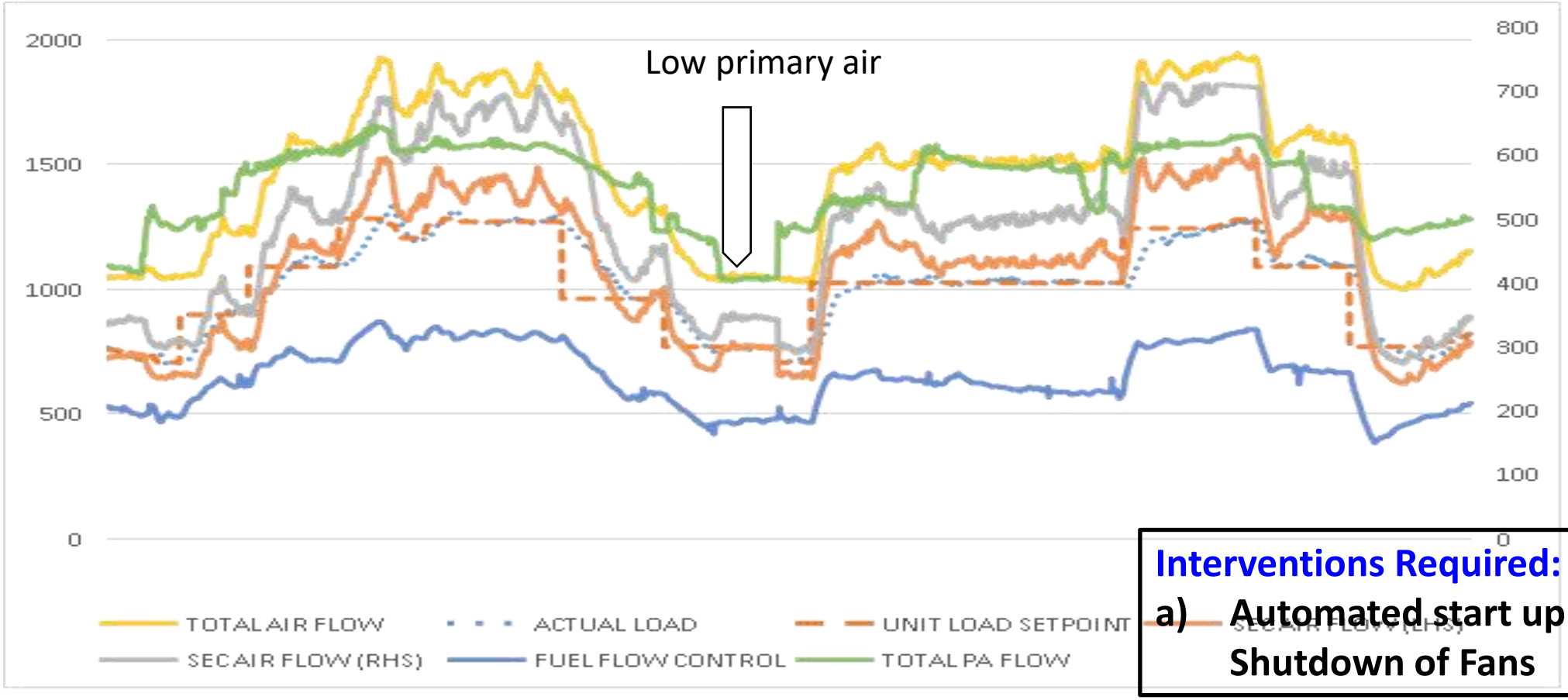

**FW Temp at eco i/l: Dipping down to 220°C at 55% from 254°C at 100% Load**

**Interventions Required:**

a) **Additional HP Heater**

b) **Loop Tuning w.r.t MS press & following Modified sliding press.**

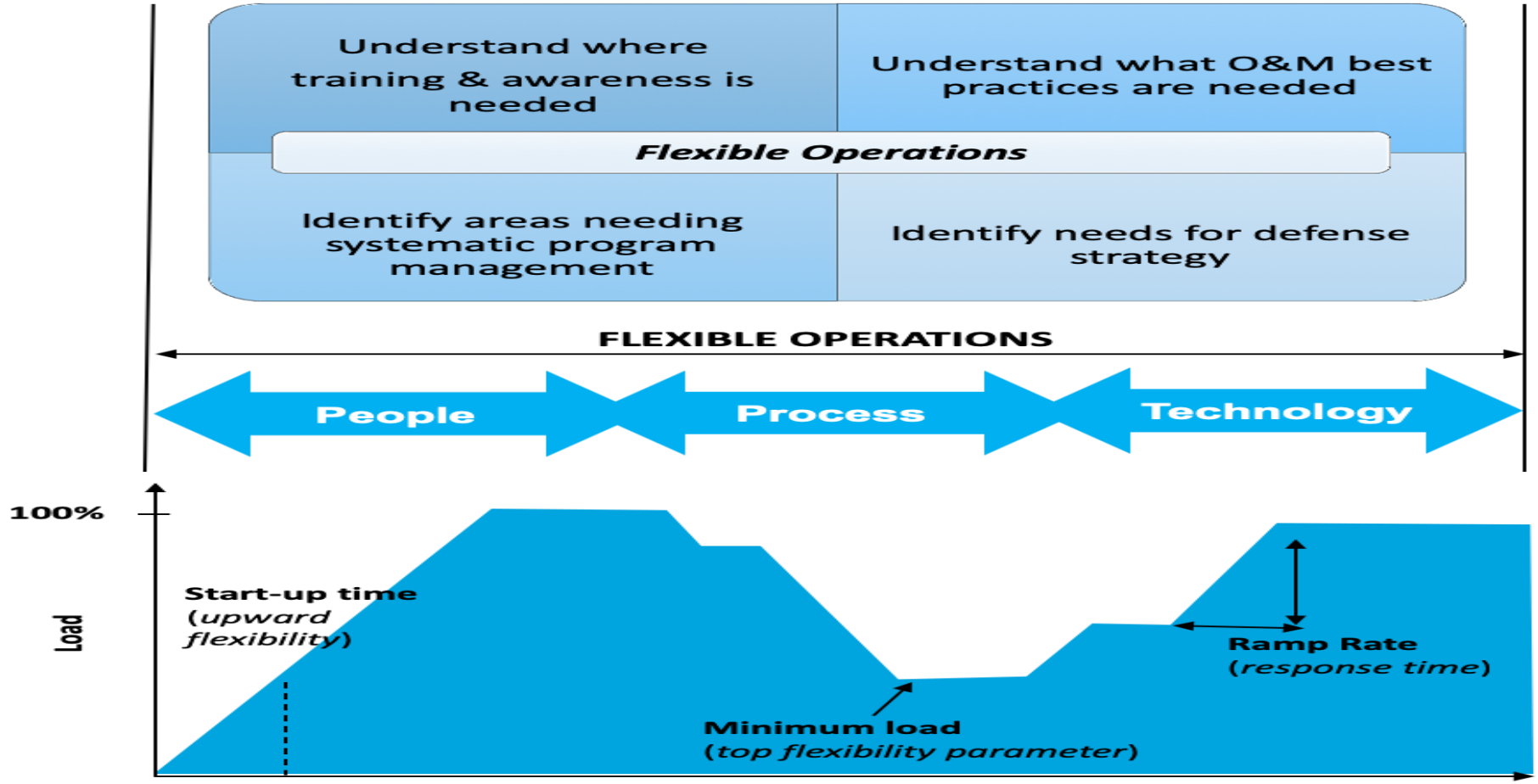
# Low primary air flow can lead to stalling




**Interventions Required:**

a) **Automated start up & Shutdown of Fans**

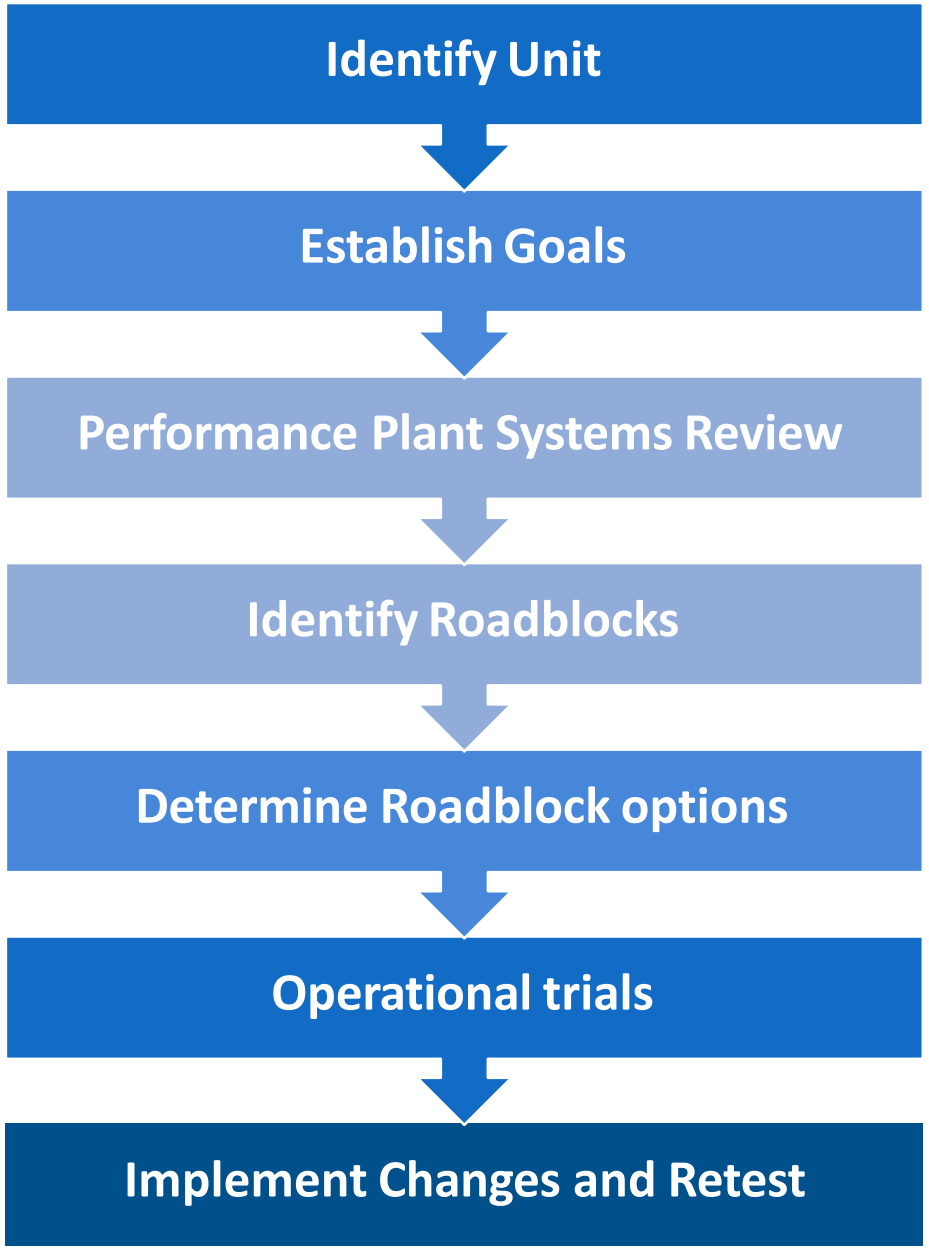
# Flexibilization Implementation



# Reducing Minimum Load

**Common Turn-down Challenges:**

- Controlling steam temperatures.
- Flame Stability
- Feedwater control
- Environmental Controls
- Excessive cooling of steam turbine due to control valve throttling
- FD and ID fan vibrations
- Damage to back end of LP turbine



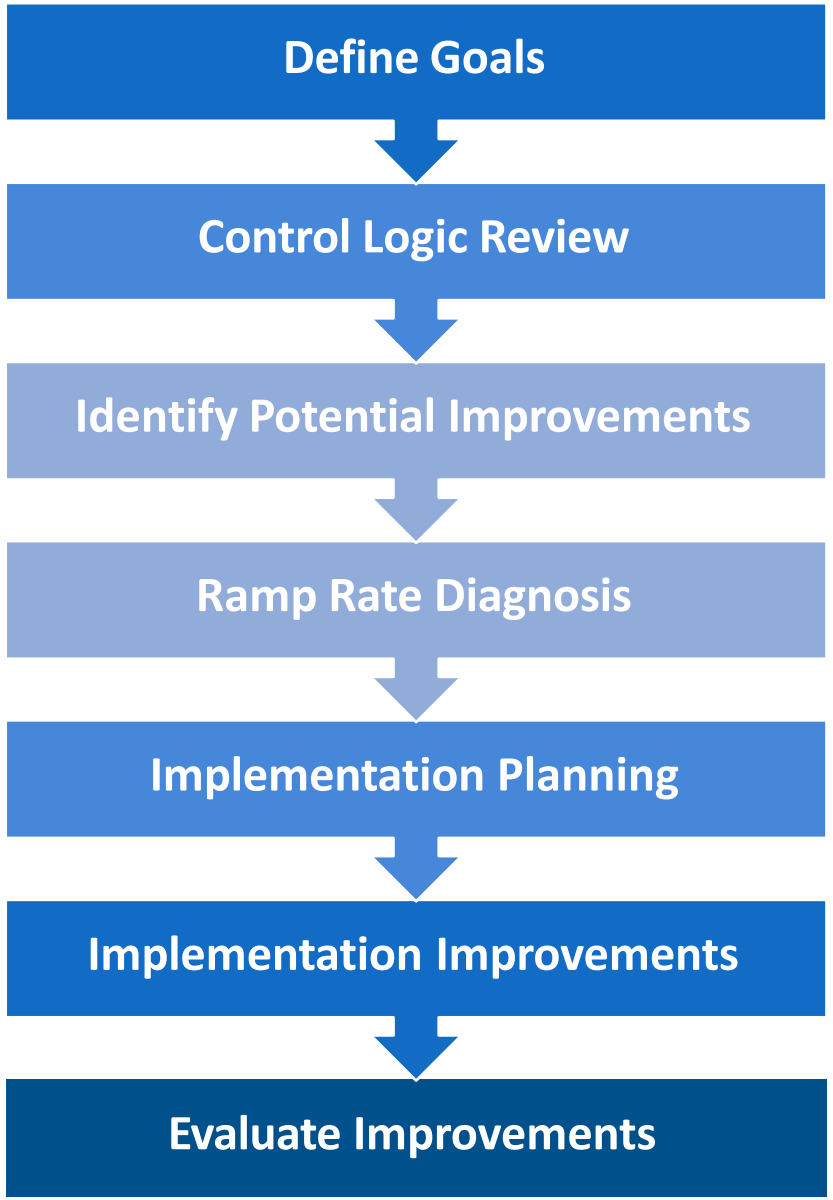
# Fast Load Ramping

**Limitations**

- Temperature control
- Pressure Control
- Level Control

**Common Solution**

- *Control loop tuning*
- *Improved coordination of boiler and turbine masters*



# *Flexibilisation projects- Smart Solution implemented*

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**Dadri Unit#6 -40% Minimum loading operation-**

- Predictive Main steam Temperature Control
- Reheat Steam Temp control
- Installation of Modulating Recirculation valves in BFPs
- Automation in Milling system
- Flue Gas temp control
- Single drive operation- Automated start/ stop of ID/FD/PA fans
- Condition monitoring system- Boiler Fatigue Monitoring System and Equivalent Operating Hours

# Conclusions

- **Coal based units are to be flexed** – Min tech load, High Ramp rate, Frequent start up
- **Cost associated with flexibilization-** Part load degradation, start up cost, life consumption cost due to flexing and same is to be adequately compensated through regulatory mechanism.
- **Plan and prepare** - Competency development, Advance process control, new Technology intervention to minimize life consumption.
- **Phasing down rather Phasing out**- At least for another two to three decades coal units will stay here for sure.

# Thank You



20