Council of Enviro Excellence

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Venue: Hyatt Centric, Janakpuri, New Delhi

# FLEXIBLE OPERATIONS IN THERMAL POWER PLANT

## Current Coal Flexing Scenario in India, Future Requirements, Challenges & Solutions

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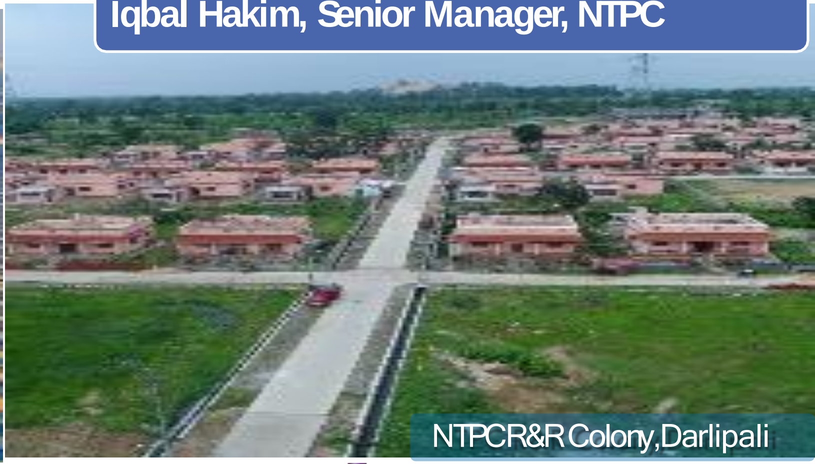
NTPC Ltd


एनटीपीसी
NTPC

# Current Coal Flexing Scenario in India, Future Requirements, Challenges & Solutions

Iqbal Hakim, Senior Manager, NTPC

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# Outline

Current Status of Flexible Operation & Role of NTPC

Flexible Operation with Indian Coal, Challenges & Supercritical Unit Exemption

Flexing Needs of Future

Issues & Remedial Actions

| Boiler | Turbine | Controls | Electrical | Chemistry |
| --- | --- | --- | --- | --- |

Initiatives at Dadri and Simhadri

Regulatory Enablers

NTPC strategy for Flexible Operation

# Current Status of Flexible Operation and NTPC's role in Meeting Country's Flexing Needs

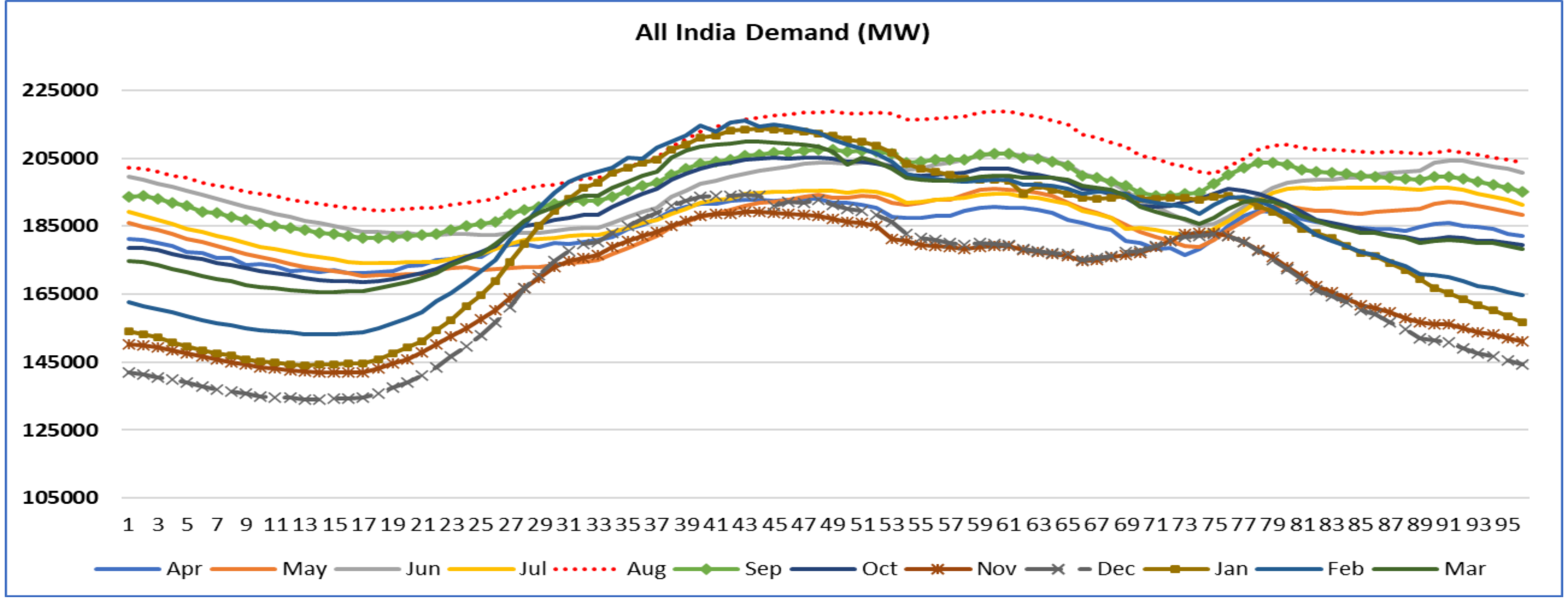
# Need for Flexibilisation: Variable Nature of Demand and Generation

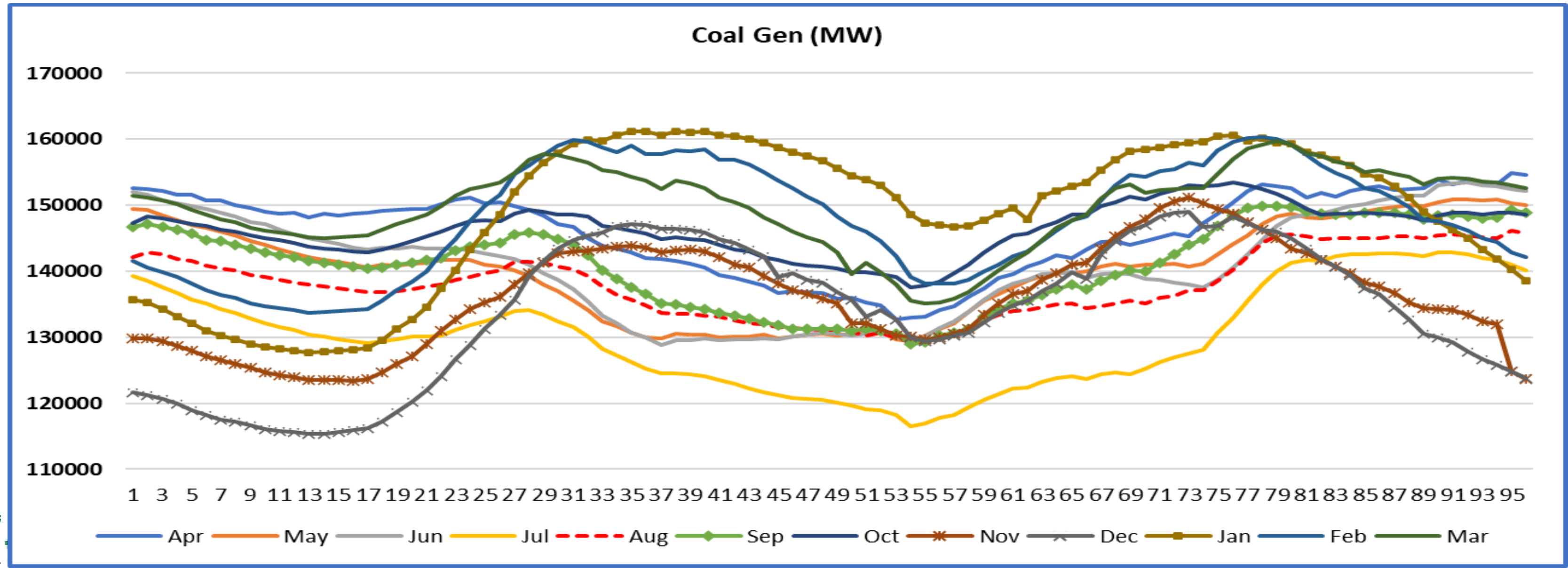
- Demand
  - Diurnal Variations
  - Seasonal Variations

| | |
|---|---|
| **Diurnal**<br>4 Cardinal Points viz | Night Lean |
| | Morning Peak |
| | Day Lean or Afternoon trough |
| | Evening Peak |
| **Seasonal** | Summers (April-May):- High Demand due to Weather & Agriculture |
| | Nov-Jan: Lean Demand |

% contribution of coal in all India demand is higher in the months of **January, February and December** and it is lower in the months of July, August and September due to increased generation from Hydro and Wind

Thus, coal flexing needs a more granular approach for optimal utilisation. In longer term, there will need to define the months where coal flexing will be maximum and accordingly assign most flexible units for operation in such months. Flex Ranking of Units needs to be created & best units incentivised.

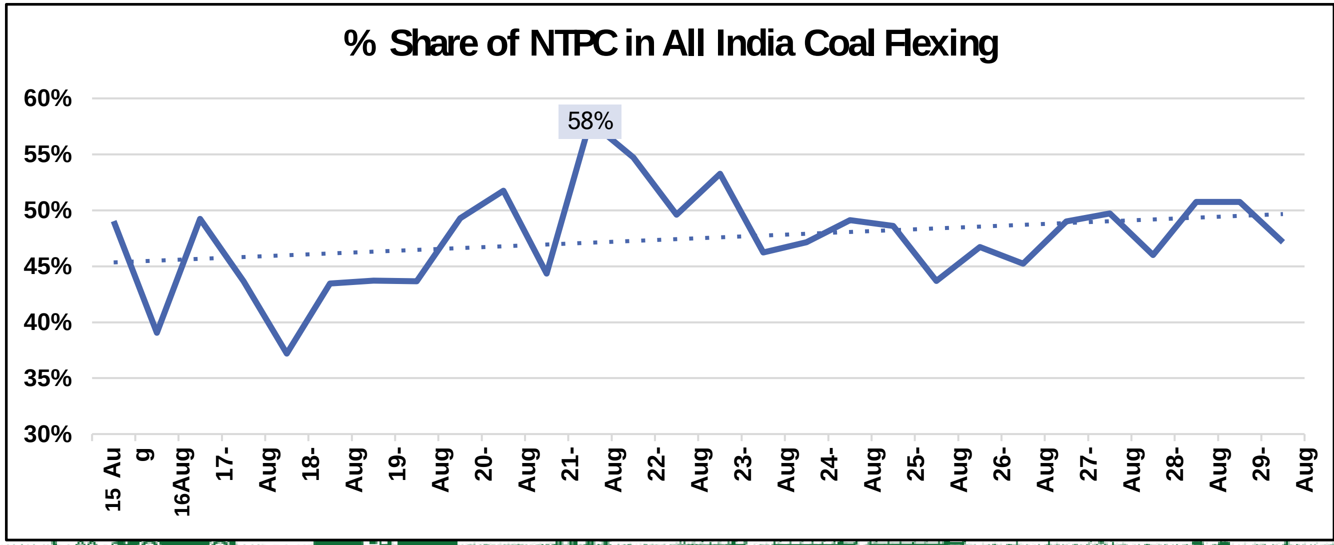


# *For a common Grid, all entities should play by the same rules*

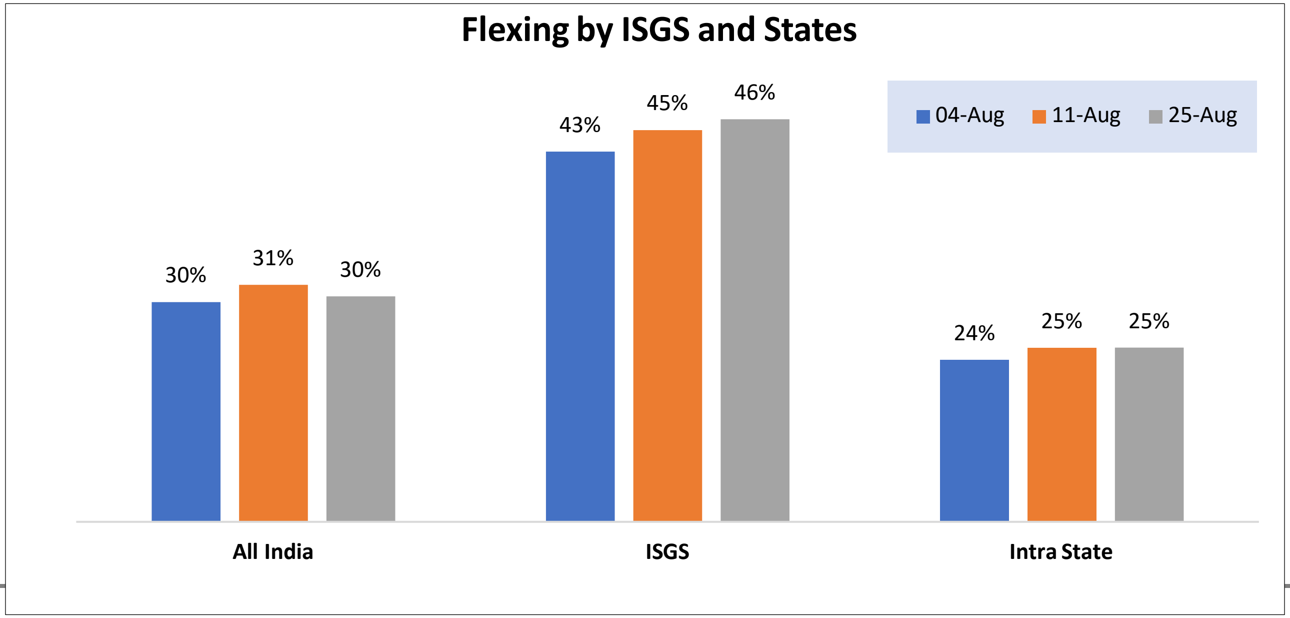
| | |
|---|---|
| **National Grid** | One nation, one grid. Technically, all grid connected entities should abide by the same rules. |
| **Nominal Frequency** | Every entity connected to the grid is responsible for maintaining grid frequency near nominal values. |
| **28%** | NTPC share in Country's Coal based Installed Capacity |
| **50%** | NTPC share in Country's Coal Flexing |

**All Grid connected entities should equally take part in Flexible Operation. 55% MTL rules should be enforced uniformly across all Gencos and Units should be scheduled upto 55%. Moreover, mechanism like SRAS, TRAS, SCED, SCUC etc should also apply uniformly for all Gencos.**



# State Gencos and IPP's should participate in Flexing

| | |
|---|---|
| **CEA Gazette** | CEA Gazette notification dated 30 Jan 2023 envisages all Gencos (including state gencos) to achieve 55% MTL by Jan 2024. |
| **Operation at 55%** | All NTPC stations are operating at 55% MTL. All stations are participating in Markets, Ancillary services, SCED & SCUC. |
| **Non-Participation** | State Gencos & State IPP's are still to follow the above CEA regulations |



# Flexible Operation with Indian Coal, Challenges Faced & Exemption for Super Critical Units

# Flexible Operation with Indian Coal

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Flexible Operation is manageable with good coal quality (Quality near to design coal).

Indian Power Stations receive coal much worse than the specified worst coal limits. Moreover, a single station may receive coal from multiple sources (More than 6 sources is not uncommon). Even there are huge quality variations in the coal received from a single source. Each source may further have multiple sidings.

Boiler flame stability is not consistent during part load operation due to coal quality (low VM & high ash content and sometimes wet coal). With Indian coal conditions, operating units below 55% load with unstable Boiler flame is challenging even with most advanced flame scanners.

During low load operation with poor coal quality (Low VM, High Ash), the combustion stability of the boiler is severely affected and requires additional support of secondary oil.

Many of the technology provider's and OEMs are exiting the thermal power business, posing serious challenge for availability of technology & solution.

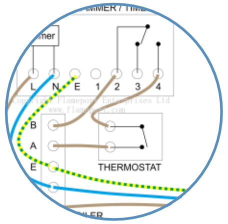
Indian Coal is unique and hence the regulatory requirements must factor in real time coal quality for accessing the flexibility requirements. Flexing with poor coal quality shall adversely impact the reliability of the machines and may lead to power shortages. Provision for variable MTL based on Coal Quality needs to be incorporated in regulations.

# *Pilot Phase testing: Huge operational issues during operation below 55%*

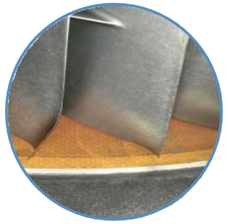
## Pilot Studies

- **Mouda** U# 1 500 MW
- **Simhadri** U# 1 500 MW
- **Dadri** U# 6 500 MW

Flame instability due to high coal quality variations in domestic coal (High Ash, Low VM in Indian Coal).

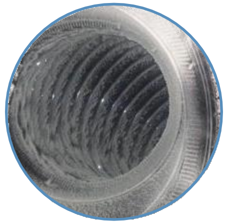



Parametric Excursions.



LP turbine fluttering & may lead to LP blade failure.

Emission issues (Excess wrt norms).



Duct Ash Accumulation.

High Oil Consumption.

May lead to increased BTL.

Electrical Issues

**A detailed assessment is needed to establish the Flexing Capability under Indian Coal Conditions**

# Exemption of Supercritical Units from Operation Below 55% MTL

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**Benson point** -switch from wet to dry mode.

Under actual running, generally every boiler comes in wet mode well before the design Benson point due to following:-

1. Each section of boiler i.e. waterwall, economisers, superheaters etc are designed for certain heat absorption at a particular heat input in terms of fuel. If due to any reason i.e. soot deposition, mill combination, coal quality, this heat absorption pattern in boiler changes it affects the actual Benson point.
2. Higher ramping rate leads to wet mode earlier than design.

- The Super-critical units are designed as highly efficient units suited best for base load operation. These units operate at close to 40% efficiency unlike subcritical units whose efficiency is around 35-37%.
- Efficiency of supercritical units degrades very rapidly at part loads.
- Unit comes in wet mode when load goes below 55% as water starts coming in separator. In wet mode CMC goes off automatically and unit is forced to run in manual mode.
- Due to frequent changeover from dry mode to wet mode during load following, BRP pump will also be subject to multiple start stops. Risk of Low eco flow unit trip.
- Frequent opening of separator level control valve.
- In super critical units during Mill trips at lower loads, wide variation in MS temperature is observed which is difficult to contain & unit is liable to trip on HPT stress very high or MS temp very high or low.
- High chances of failure due to thick walled components.
- Chances of LP blade failure will increase at part load.

Benson Points ( Wet-Dry mode Changeover) for Different Supercritical (SC) Boilers

| Sl No | Station | Capacity (MW) | Supplier/ Design | Benson Point | |
|---|---|---|---|---|---|
| | | | | Design (% of Load) | Actual (% of Load) |
| 1 | Sipat Stage 1 | 3x660 | Doosan/ Alstom | 30 | 45-50 |
| 2 | Barh Stage 2 | 2x660 | BHEL/Alstom | 44 | 50-55 |
| 3 | Mouda Stage 2 | 2x660 | BHEL/Alstom | 44 | 50-55 |
| 4 | Kudgi | 3x800 | Doosan/Babcock | 30 | 40-45 |
| 5 | Lara | 2x800 | Doosan/Babcock | 30 | 40-45 |
| 6 | Meja | 2x660 | BGRE/HPE | 40 | 45-50 |
| 7 | Solapur | 2x660 | BGRE/HPE | 40 | 45-50 |
| 8 | Gadarwara | 2x800 | BHEL/Alstom | 42 | 45-50 |
| 9 | NPGCL | 3x660 | BHEL/Alstom | 44 | 45-50 |
| 10 | Darlipalli | 2x800 | BHEL/Alstom | 42 | 45-50 |
| 11 | Khargone | 2x660 | L&T/LMB | 30 | 35-40 |
| 12 | Tanda | 2x660 | L&T/LMB | 30 | 35-40 |
| 13 | NKSTPP | 2x660 | BHEL/Alstom | 44 | 45-50 |
| 14 | Telangana | 2x800 | BHEL/Alstom | 44 | 45-50 |

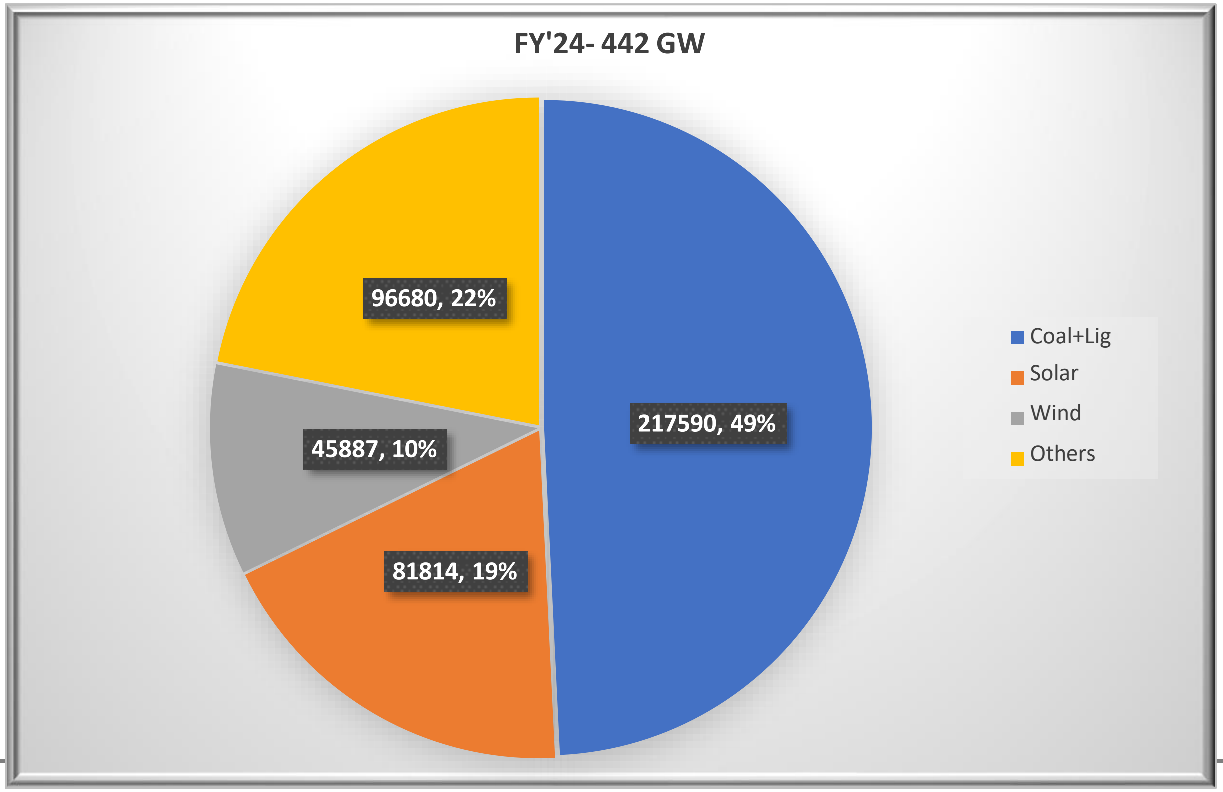
In recent incidences when unit was being stopped for planned outage, during ramp down, unit came in wet mode at 50% load in Gadarwara and at 47% load at Darlipalli even though the ramp rate below 55% was below 1% .With higher ramp rates below 60 % load , wet mode is anticipated earlier.

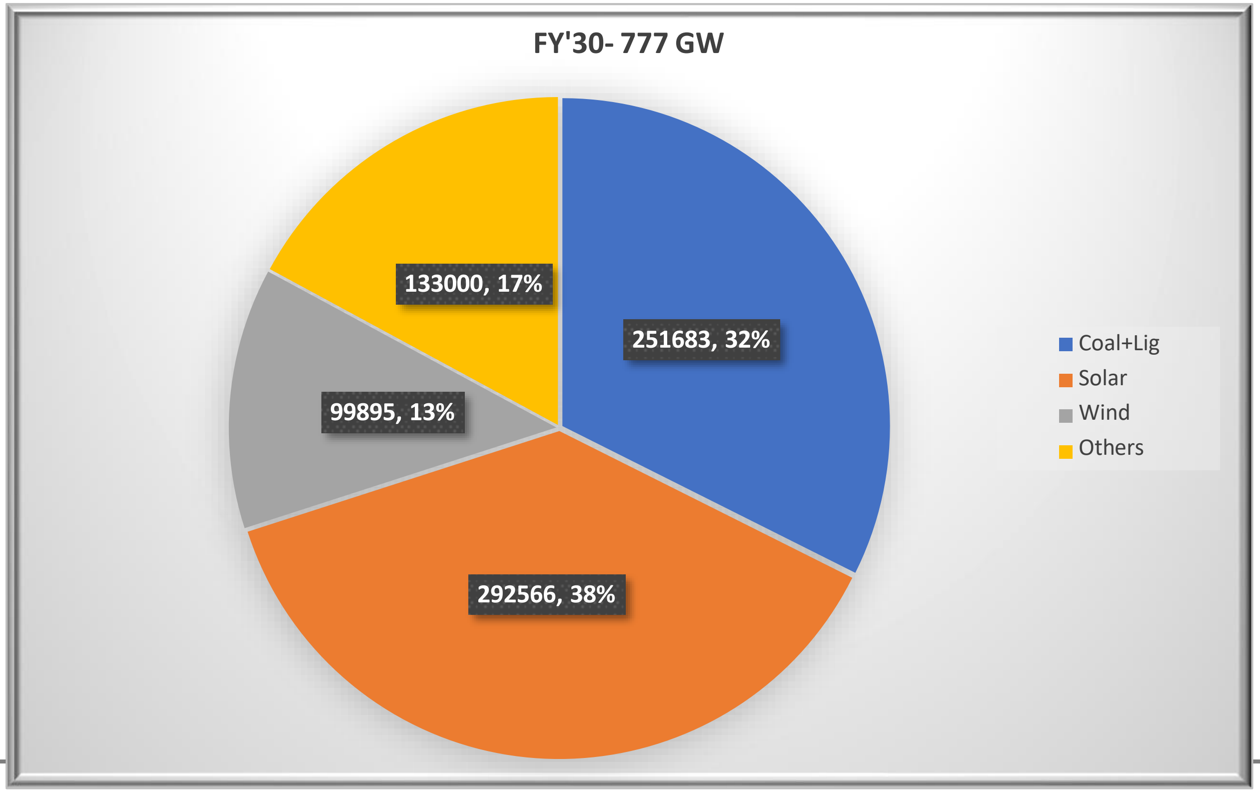
# Flexing Needs of Future

# Capacity Mix by 2030

- As per CEA 2030 plan, the country's capacity mix will change significantly by 2030. Nearly 60 GW capacity needs to be added every year (80% from Solar & Wind) for meeting the energy requirements in 2030.
- By 2030, the share of Solar and Wind will increase from 19% & 10% to 38% & 13%, respectively.

**CAGR**
- Overall Capacity: 10.2%
- Wind+Solar: 21.7%



# As more RE is added, Coal Stations would need to Flex through-out the day to accommodate the VRE.

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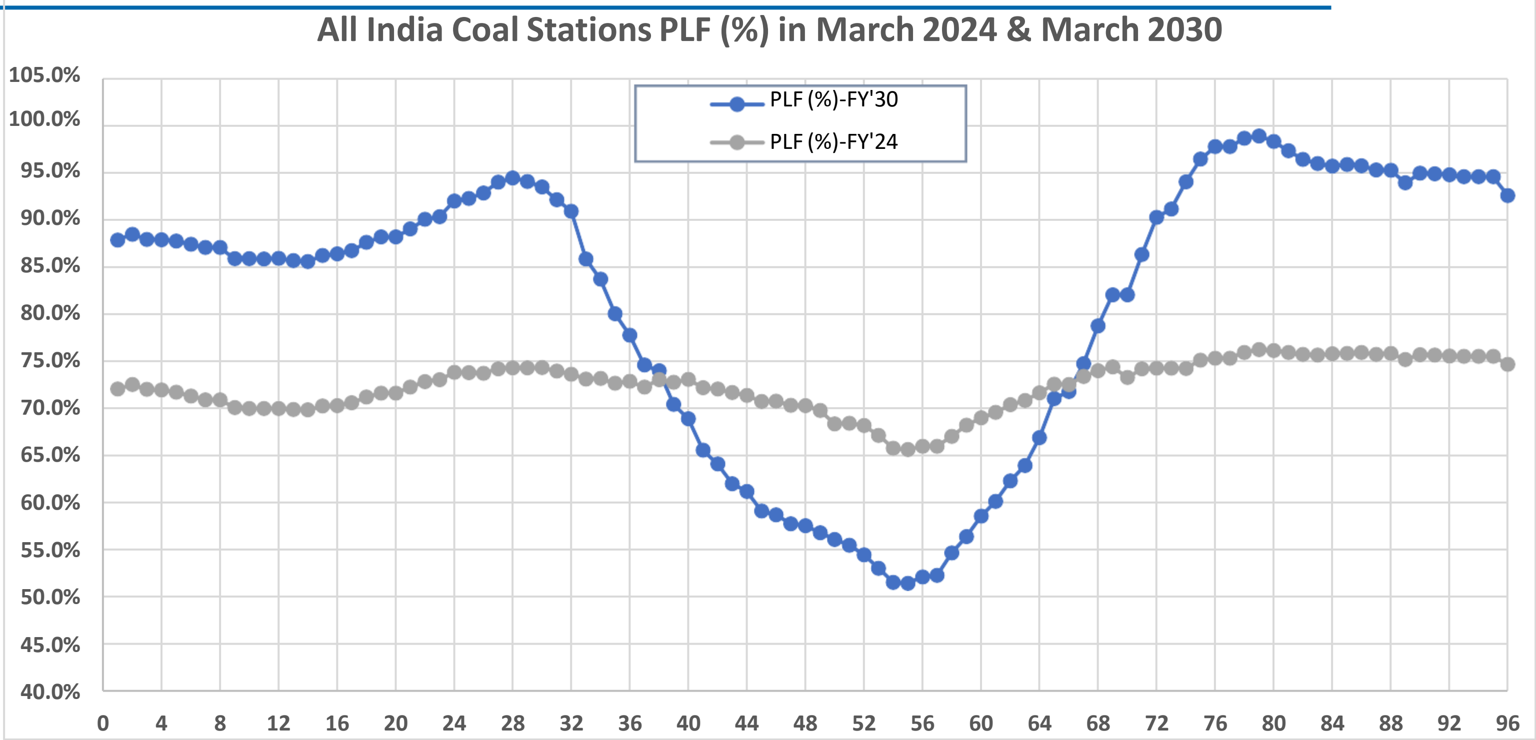
The Coal Stations across the country would need to Flex from 100% LF to about 50% LF. This would test the reliability of Coal stations and present operational, maintenance and commercial challenges.




- By 2030, in certain time blocks the RE generation may be as high as 70%.
- Moreover, for about 1/5th of the time, coal contribution will be lower than 40% necessitating increased turndown levels and possibility of TSO.
- Overall, the Coal PLF shall still be more than 60% mainly due to dependence on coal during non- solar hours.
- Overall Ramping needs will increase to about 1% necessitating automatic load changes.

# Key Issues and Remedial Measures

## Intervention Areas

| # | Issues | |
|---|---|---|
| 1 | **Combustion Issue at less than 55% load** resulting in Unit tripping on Flame Failure. Inadequate Windbox furnace DP during part load can cause furnace disturbance. | Procure flame monitoring systems, Flame Scanners with flicker frequency monitoring, SADC with individual control, Furnace exit temp / CO at ECO outlet / Furnace cameras, improved furnace air damper hardware/controls. |
| 2 | **High Fatigue in Boiler & Turbine**: Variation in MS/HRH temperature shall cause high fatigue in Boiler and Turbine. | **Boiler**: Upgradation of material in tubes experiencing temperature excursions. Installation of Boiler Fatigue Monitoring System (BFMS) & additional thermo couples for temperature mapping. Replacement of TP 347 H tubes with shot-peened tubes to prevent exfoliation. Extensive preventive NDT / Replacement of high stress points. Replacement /Modification of attachments. Review of existing acceptable standards for tube replacement.<br>**Turbine**: Increase maintenance due to casing deformation owing to temperature variation. Procure Turbine EOH Calculator. Increase OH frequency. Replacement of capital spares like HPT/IPT/LPT Turbine casing / rotors/bearings at less interval. |
| 3 | **Frequent opening of TDBFP Recirculation valves** due to low load operation | BFP R/c valve to be converted to modulating type. BFP Cartridge replacement frequency to be enhanced. |
| 4 | Smooth **changeover of BFP** control from MCV to ACV & vice versa. | Modifications in drive turbine piping's / valves (CRH / Aux steam source) to be done. Replacement of drive turbine internals to take care of flexible operation. |
| 5 | **Valve Erosion**: Erosion in Main turbine valves, CEP R/c and TDBFP r/c shall increase during part load operation | Valve maintenance to be enhanced. Replacement of valve trim/internals to take care of erosion |
| 6 | **LPT blade failure**: Increased potential of LPT blade failure due to blade fluttering due to frequent change of operating conditions | Blade vibration monitoring system (VMS) to be installed and maintenance intervention to be further increased. |
| 7 | **Excessive exhaust hood spray** leading to LPT blade erosion | LPT Blade replacement frequency to be enhanced owing to enhanced erosion |
| 8 | Variation of load in generator shall cause **life consumption of generator**. Frequent operation of equipment's during ramp up/down to 40% i.e. breakers, motors | Maintenance and OH practices needs to be reviewed. Component replacement frequency to be increased. |
| 9 | At low load, samples do not come properly at **SWAS** Cooler | Flow control valves to be installed for Feed water, Boiler water, Separator tank, Saturated steam, Main steam & HRH sample flows. |
| 10 | **Ash accumulation** Due to low flue gas velocity at 40% load, duct ash accumulation shall take place. | Provision of hoppers in FG duct at identified zones of ash accumulation |
| 11 | **NOx** values are increasing at low load due to high excess air | Changes are required in regulations for low load operation |
| 12 | **Premature failure** of equipment | Increase in frequency of overhauls, increased preventive maintenance, early equipment replacement/repair etc |
| 13 | **Supercritical units** are not fit for 40% load operation | Unit comes in wet mode and CMC goes Off, Machine cannot be run in auto. |

# Boiler: Issues and Mitigation Measures

| Sl. No | Issues | Mitigation Action/Action Plan |
|---|---|---|
| 1 | Poor flame intensity at 40% load operation, and any outage of mill may cause flame failure. | Enhancing reliability of milling system. |
| 2 | Inadequate WB-Furnace DP during part load can cause furnace disturbance | SOFA /COFA/BOFA dampers to be kept closed to ensure adequate SA for combustion , same to be tuned for 40% load operation (NOx shall increase with this action) |
| 3 | PA Fan may go to stall as it shall be operation at very low load at 40% load | Real time Operating Point on PA fan stalling curve to be provided as PA Fan shall operate near to stall. |
| 4 | Variation in MS/HRH temperature shall cause high fatigue in Boiler and Turbine. | Upgradation of material in tubes experiencing temperature excursions.<br>Boiler Fatigue Monitoring System to be installed to assess boiler damage including installation of additional thermo couples for temperature mapping.<br>Replacement of TP 347 H tubes with shotpeened tubes to prevent exfoliation.<br>Extensive preventive NDT / Replacement of high stress points.<br>Replacement /Modification of attachments.<br>Review of existing acceptable standards for tube replacement. |
| 5 | Primary & secondary air temp will come down at low loads so SCAPH needs to be charged. | SCAPH needs to be revived wherever not available. Increased frequency of APH Soot Blowing |
| 6 | Due to frequent operation of SH/RH Spray erosion of valve shall increase | Valve maintenance to be enhanced. |
| 7 | Minimum total air flow to be restricted to 1050 -1100 tph to avoid improper combustion & ensuring adequate flue gas velocity to avoid ash accumulation in ducts. | Logic to be implemented based on input from Operation |
| 8 | NOx values are increasing at 40% load due to high excess air | Policy advocacy is required for increasing the values at low load |
| 9 | Erosion of APH outlet flue gas damper flaps due to prolonged throttling operation | Replacement of damper flaps during Overhauls |
| 10 | Due to low flue gas velocity in flue gas ducts at 40% load, duct act ash accumulation shall take place. | Provision of hoppers in FG duct at identified zones of ash accumulation |
| 11 | SH spray limitation: Saturation temp limit is acting at low load in SH spray control due to less MS pressure, specially operating with sliding pressure mode. | Pressure curve to be reviewed further. |

# Turbine: Issues and Mitigation Measures

| Sl. No | Issues | Mitigation Action/Action Plan |
|---|---|---|
| 1 | Frequent opening of TDBFP Recirculation valves due to low load operation | BFP R/c valve to be converted to modulating type |
| 2 | Poor Drum level control: During less pressure operation slightest of the disturbance in furnace is causing fluctuations in drum level leading to swing in drum level & consequently spray control. | Loop tuning for 40% prolonged load operation. |
| 3 | Smooth changeover of BFP control from MCV to ACV & vice versa (Modifications to be done in turbine piping's). | Modifications in drive turbine piping's / valves (CRH / Aux steam source) to be done. Replacement of drive turbine internals to take care of flexible operation. |
| 4 | Variation in MS Temperature and material degradation /deformation in casing/rotor due to temperature variation. High vibration of rotor train due to frequent ramp up / ramp down | Increase maintenance intervention in turbine area due to casing deformation owing to temperature variation, Turbine EOH calculation to be made available. Frequency of OH of turbine shall be increased owing to reduced life of turbine due to flexibilisation. Replacement of capital spares like HPT/IPT/LPT Turbine casing / rotors/bearings to take of material degradation due to flexible operation / temperature & pressure swing. |
| 5 | Erosion in Main turbine valves, CEP R/c and TDBFP r/c shall increase during part load operation | Valve maintenance to be enhanced. Replacement of valve trim/internals to take care of erosion |
| 6 | Increased potential of LPT blade failure due to blade fluttering due to frequent change of operating conditions | Blade vibration monitoring system to be installed and maintenance intervention to be further increased. |
| 7 | Excessive exhaust hood spray leading to LPT blade erosion | LPT Blade replacement frequency to be enhanced owing to enhanced erosion |
| 8 | As variation in BFP Flow at 40% plays a key role for stable drum level maintaining in auto. variation in BFP flows at same speed to be minimized. | BFP Cartridge replacement frequency to be enhanced. |
| 9 | Erosion of Heaters drip CVs / piping | Replacement of drip CV's internals / Drip piping due to erosion |

# Chemistry, Electrical and C&I : Issues and Mitigation Measures

| | | |
|---|---|---|
| | Chemistry | |
| 1 | In Subcritical unit CPU flow to be kept stable | Modulating-type pneumatic bypass valve to be installed in CPU service vessel system (if not envisaged in design).<br>Also, logic needs to be modified to get maximum/full condensate flow through one CPU service vessel during part load operation of unit. |
| 2 | At 40% load, samples does not properly come at SWAS Cooler | Flow control valves to be installed for Feed water, Boiler water, Separator tank, Saturated steam, Main steam & HRH sample flows. |
| | Electrical | |
| 1 | frequent operation of equipments during ramp up/down to 40% i.e. breakers, motors | Maintenance and OH practices needs to be reviewed. |
| 2 | variation of load in generator shall cause life consumption of generator | Maintenance and OH practices needs to be reviewed. |
| | C&I | |
| 1 | Controls enhancement for low load operation | Shall be carried out as per requirement |
| 2 | Flame Scanners with flicker frequency monitroing | TO be procured |
| 3 | SADC with individual cotrol | TO be procured |
| 4 | High precision blade pitch actuators | TO be procured |
| 5 | Furnace exit temp / CO at ECO outlet / Furnace cameras for better monitoring | TO be procured |

# NTPC Initiatives for Flexible Operation-Dadri U 6 & Simhadri U 4

## Processes Implemented

- ✓ Intelligent Proactive Process control
  - (MS HRH temp, Flue gas temp. etc.)
- ✓ Single drive operation (Higher Efficiency & Lower Reliability)
- ✓ Automated Milling System
- ✓ Condition monitoring system
- ✓ Combustion Optimisation
- ✓ Boiler Fatigue Monitoring system (BFMS)
- ✓ Unit Response Optimisation (Reduce Over & Undershoots)

## Work with M/s Siemens & Emerson

**Hardware E&C (Control panel, BFPR/c valves replaced)**

**ID, FD ,PA , Mill SGC**

**Sliding pressure implementation**

**TDBFP and MDBFP SGC**

**BFMS** : Commissioning done

**Condensate throttling, Unit control, Drum & S/H control**

# Regulatory Enablers

# Regulatory Provisions

**Tariff Regulations 2024-29:**
**Regulation 19** (2 and 3):-The **Capital Cost** of a new/existing project shall include the following:
Expenditure required to enable flexible operation of the generating station at lower loads.

**Regulation 26 Additional Capitalization** beyond the original scope
Works required ...towards enabling flexible operation of the generating station...

| Tariff Regulations 2024-29: 1st Amendment | | | | | | |
|---|---|---|---|---|---|---|
| | Coal Stations | | | Gas Stations | | |
| Loading % | % Increase in HR | | % Decrease in APC | % Increase in HR | | % Decrease in APC |
| | Sub Critical | Super Critical | | CC | OC | |
| 85-100 | Nil | Nil | Nil | Nil | Nil | Nil |
| 80-<85 | 2.1 | 1.8 | 0.5 | 2.5 | 3 | 0.25 |
| 75-<80 | 3 | 2.5 | 1.1 | 5 | 7 | 0.5 |
| 70<75 | 4 | 3.3 | 1.1 | 5 | 7 | 0.5 |
| 65-<70 | 5.1 | 4.1 | 1.8 | 8 | 11 | 0.8 |
| 60-<65 | 6.1 | 4.9 | 1.8 | 8 | 11 | 0.8 |
| 55-<60 | 7.6 | 6 | 2.5 | 12 | 16 | 1.2 |
| 50-<55 | 9.2 | 7.1 | 2.5 | 12 | 16 | 1.2 |
| 45-<50 | 11.3 | 8.3 | 3.2 | | | |
| 40-<45 | 13.8 | 9.9 | 3.2 | | | |

**SOC below 55% MTL= 0.2 ml/ kWh.**

Tariff Regulations 2019-24

| LF(%) | HeatRate(Kcal/kWh) | | APC (%) |
|---|---|---|---|
| | Super-Critical | Subcritical | |
| 85-100 | Nil | Nil | Nil |
| 75-85 | 1.25 | 2.25 | 0.35 |
| 65-75 | 2 | 4 | 0.65 |
| 55-65 | 3 | 6 | 1 |

| Start up Condition (IEGC 2023) | | |
|---|---|---|
| Condition | S/D (Hrs) | T/B Metal Temp below full load |
| Hot | <10 | 80% |
| Warm | 10-72 | 40% to 80% |
| Cold | >72 | <40% |

The CERC Tariff Regulations 2024-29 is an enabler for Flexible Operation. CERC shall allow the Capital Costs and provide part load compensation for operation at below normative levels. **Increase in O&M cost to be provided.**

**Stations which declare flexibilisation (Monthly Basis) may be provided additional Flex O&M charges.**

# NTPC Strategy for Variable Load Operation

# 3-Pronged Strategic Approach for Variable Load Operation

## Technology

- Control & Monitoring System for early warning & smooth operation
- Schematic & Technological/Metallurgical upgrades
- Partnership (National/Global)

**Technical Up-gradation**

- OEM/Expert Support
- Boiler Combustion System
- Boiler Fatigue Monitoring System
- Vibration Monitoring System
- Control Optimization etc

## Process

- Capital OH reduced from 6 to 4 Yrs.
- Optimisation of Overhauling Interval
- Control Loop Tuning
- Studies- OEM/ Experts

**Regulatory Support**

- Higher Incentives for Voluntary low load contribution.
- Uniform implementation for all grid connected entities irrespective of Ownership
- Coal Quality.

## People

- Training & Development.
- Centralized Tuning group
- Collaboration with International agencies like EPRI, JICA etc
- Simulator training


# Thank You

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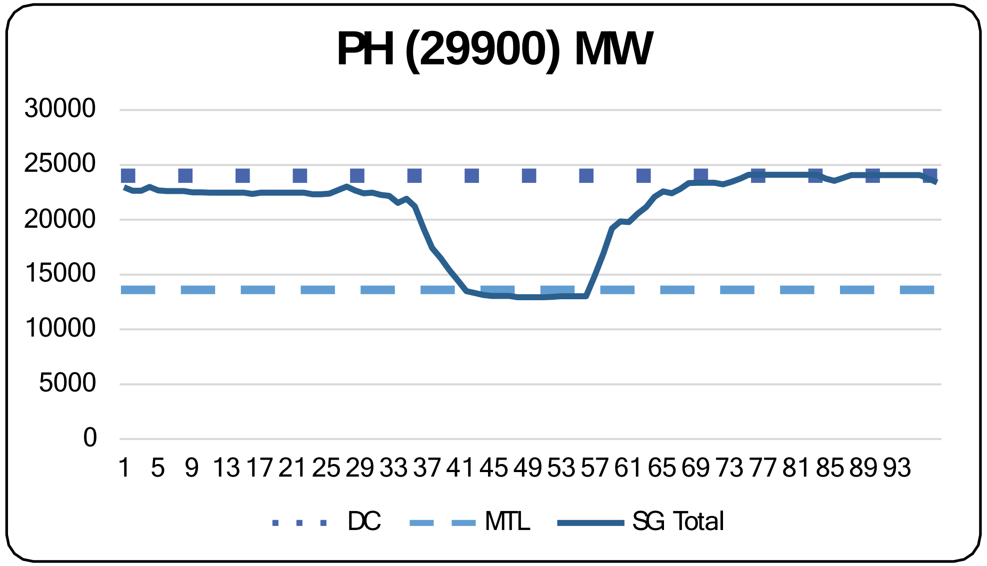
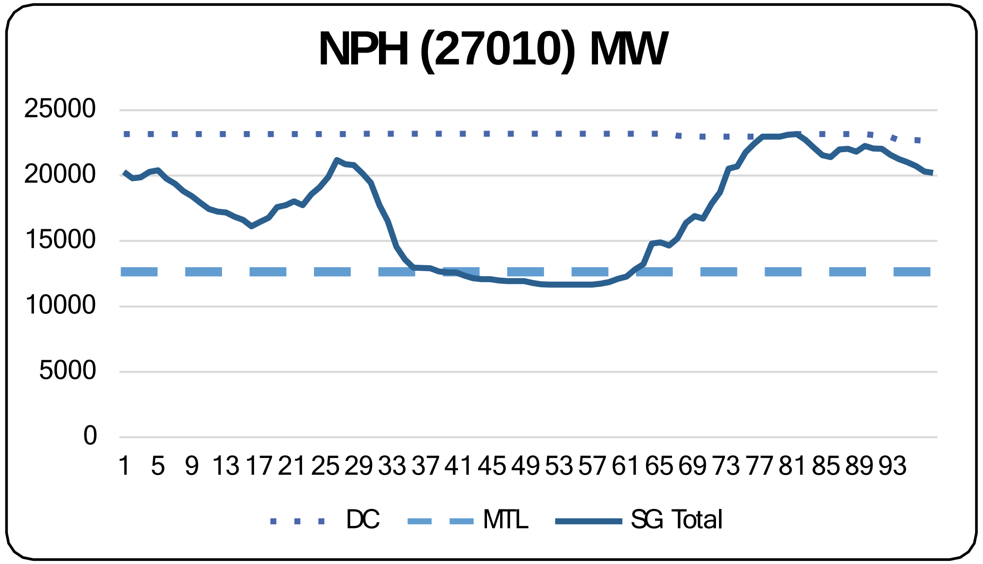
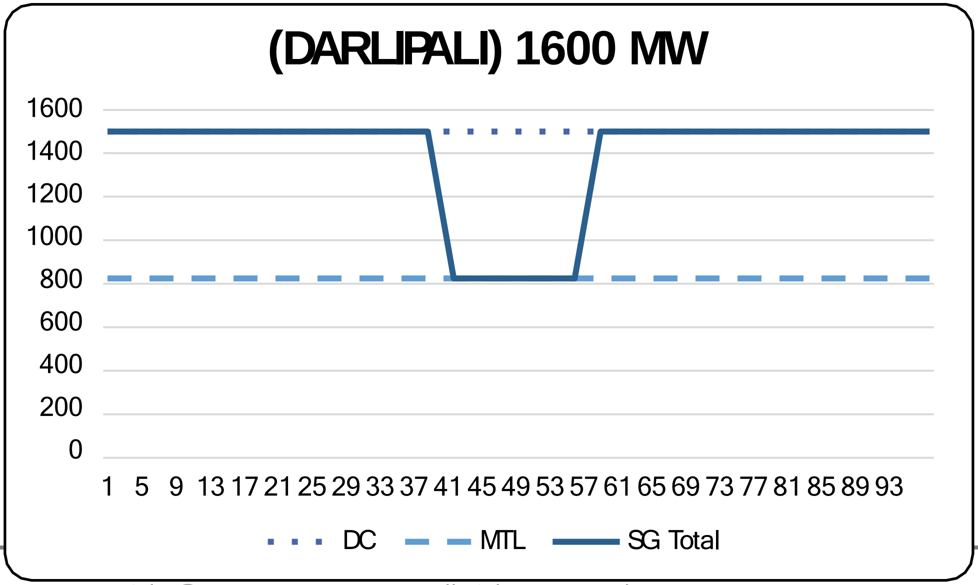
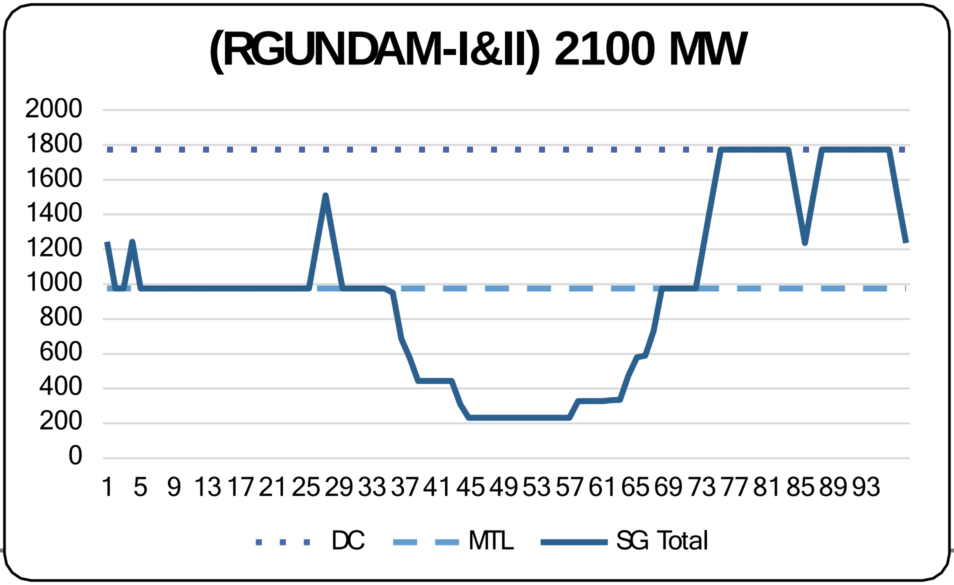
# *Scheduling Summary for 11 Sep 2024*



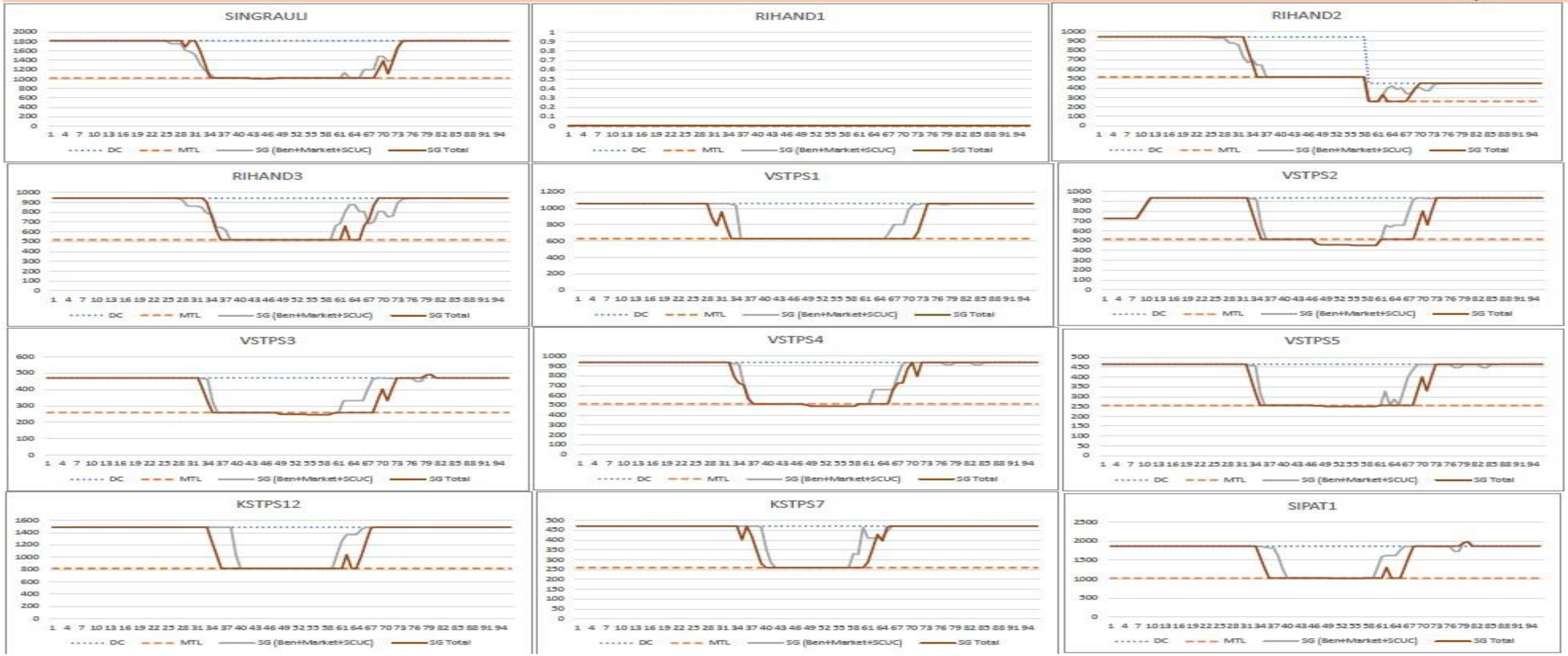



NTPC Station Dashboard 08-Sep-2024


NTPC PH Station Dashboard 08-Sep-2024

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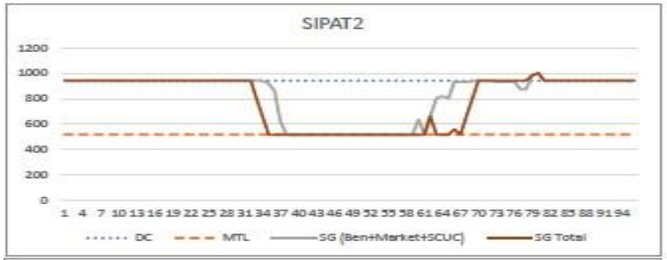
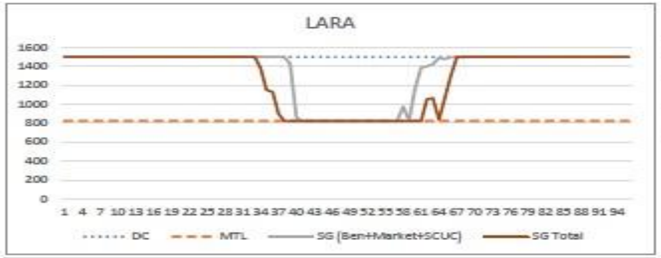
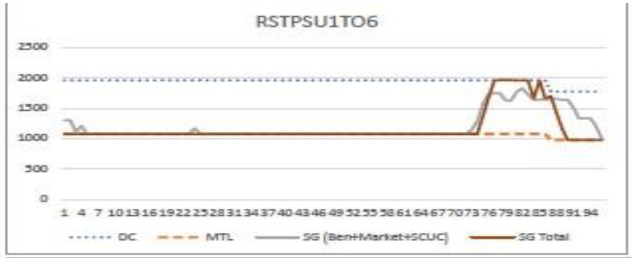
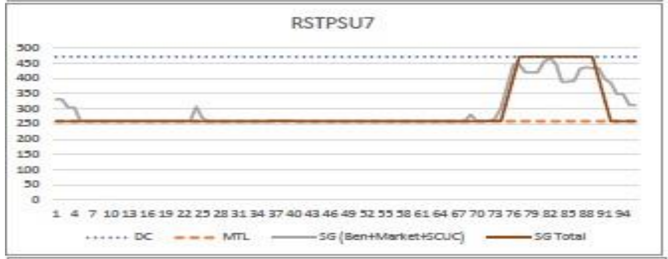
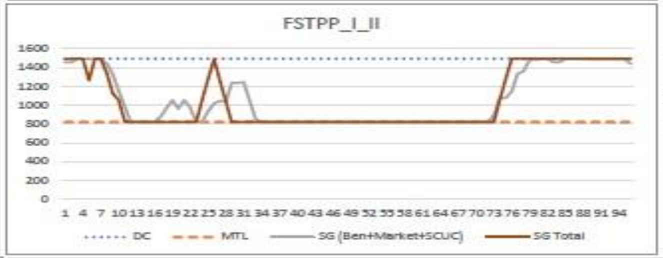
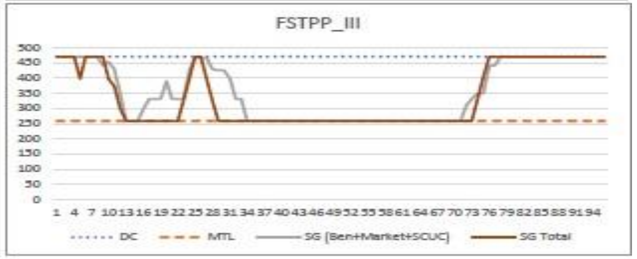

SIPAT2
DC
MTL
SG (Ben+Market+SCUC)
SG Total

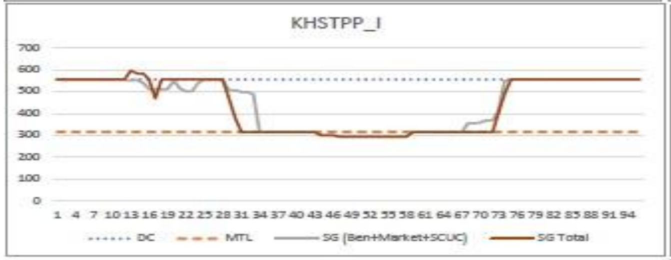

LARA
DC
MTL
SG (Ben+Market+SCUC)
SG Total

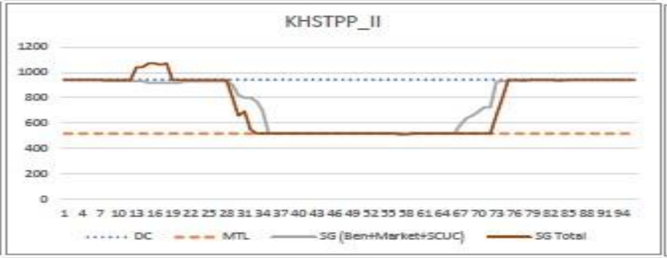

RSTPSU1TO6
DC
MTL
SG (Ben+Market+SCUC)
SG Total

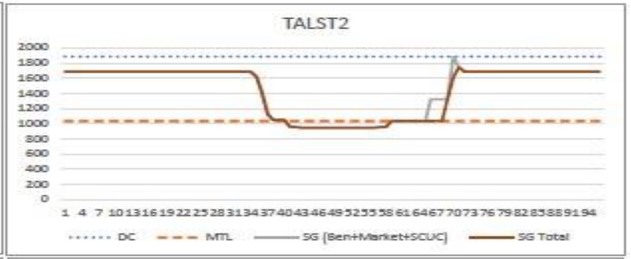

RSTPSU7
DC
MTL
SG (Ben+Market+SCUC)
SG Total

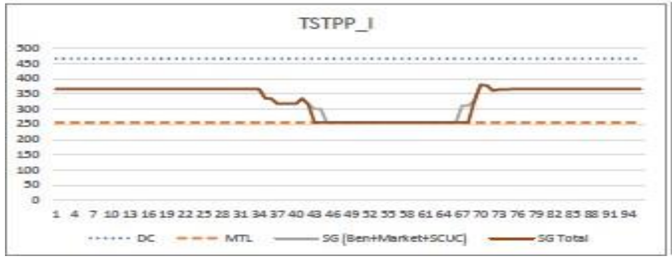

FSTPP_I_II
DC
MTL
SG (Ben+Market+SCUC)
SG Total

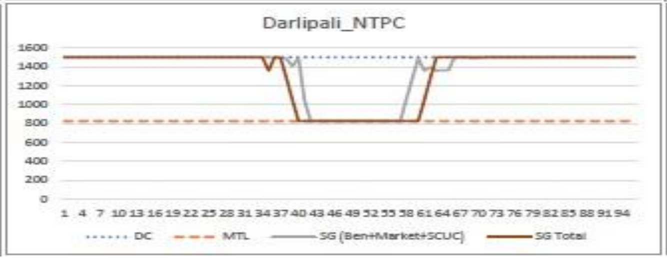

FSTPP_III
DC
MTL
SG (Ben+Market+SCUC)
SG Total

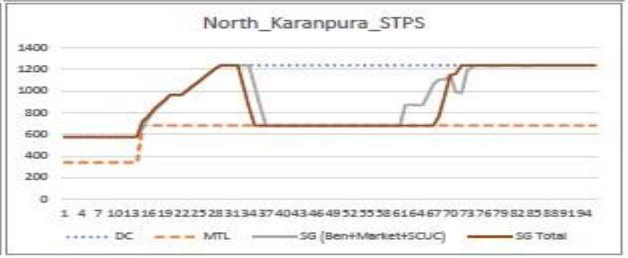

KHSTPP_I
DC
MTL
SG (Ben+Market+SCUC)
SG Total


KHSTPP_II
DC
MTL
SG (Ben+Market+SCUC)
SG Total

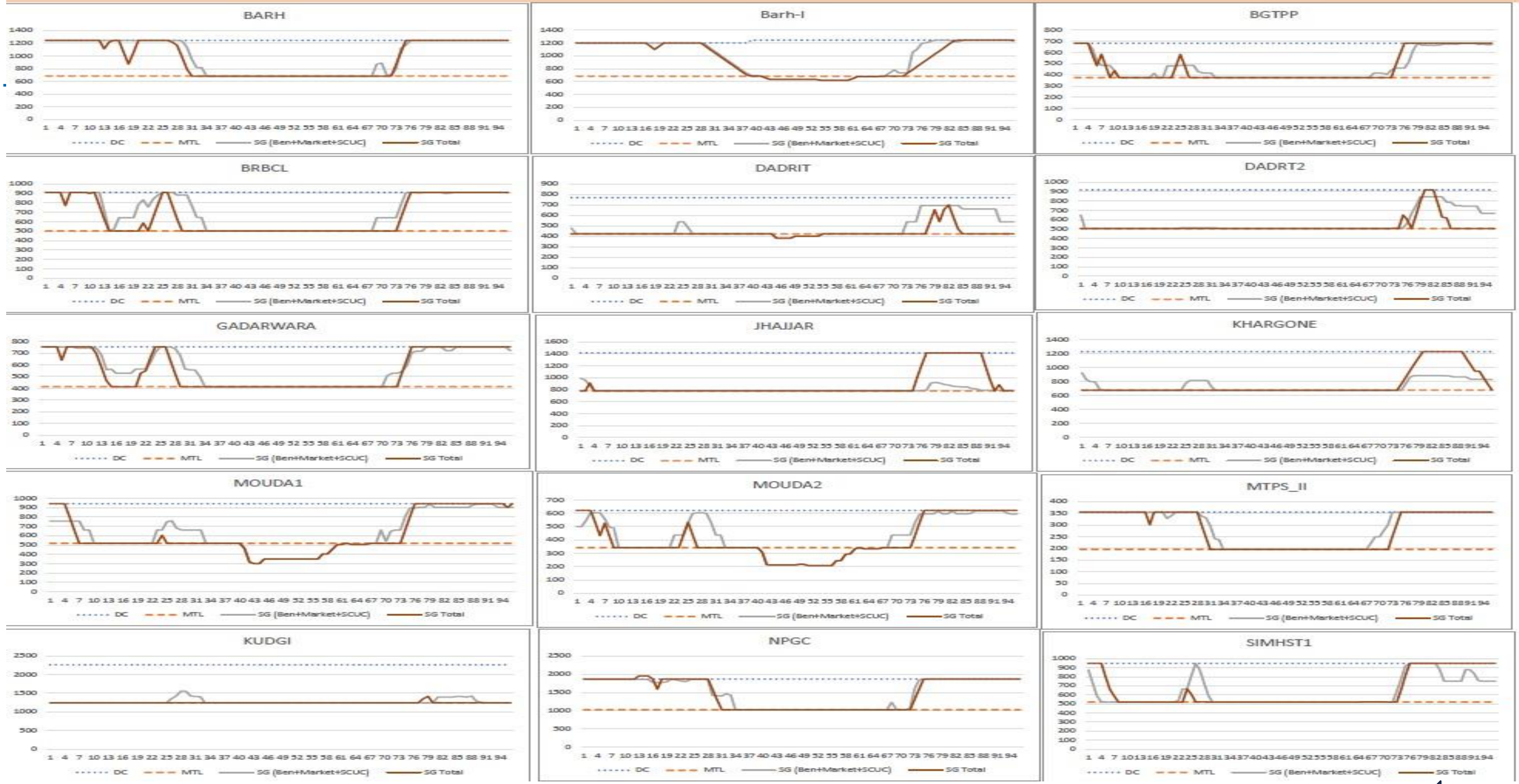

TALST2
DC
MTL
SG (Ben+Market+SCUC)
SG Total


TSTPP_I
DC
MTL
SG (Ben+Market+SCUC)
SG Total


Darlipali_NTPC
DC
MTL
SG (Ben+Market+SCUC)
SG Total


North_Karanpura_STPS
DC
MTL
SG (Ben+Market+SCUC)
SG Total

NPH Stations 08-Sep-2024



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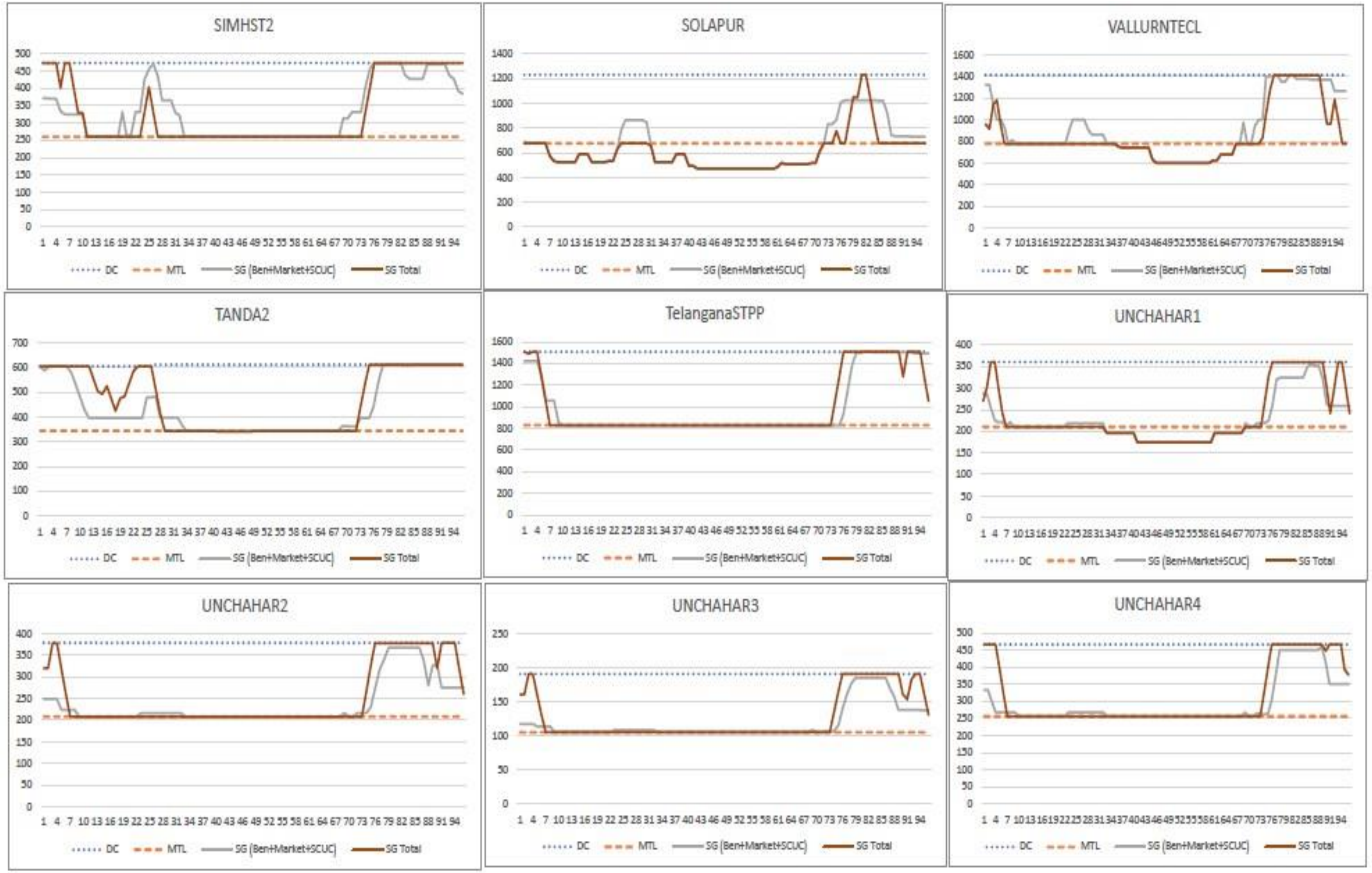

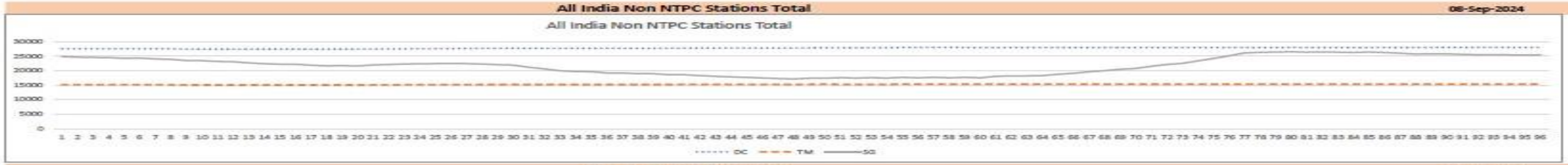


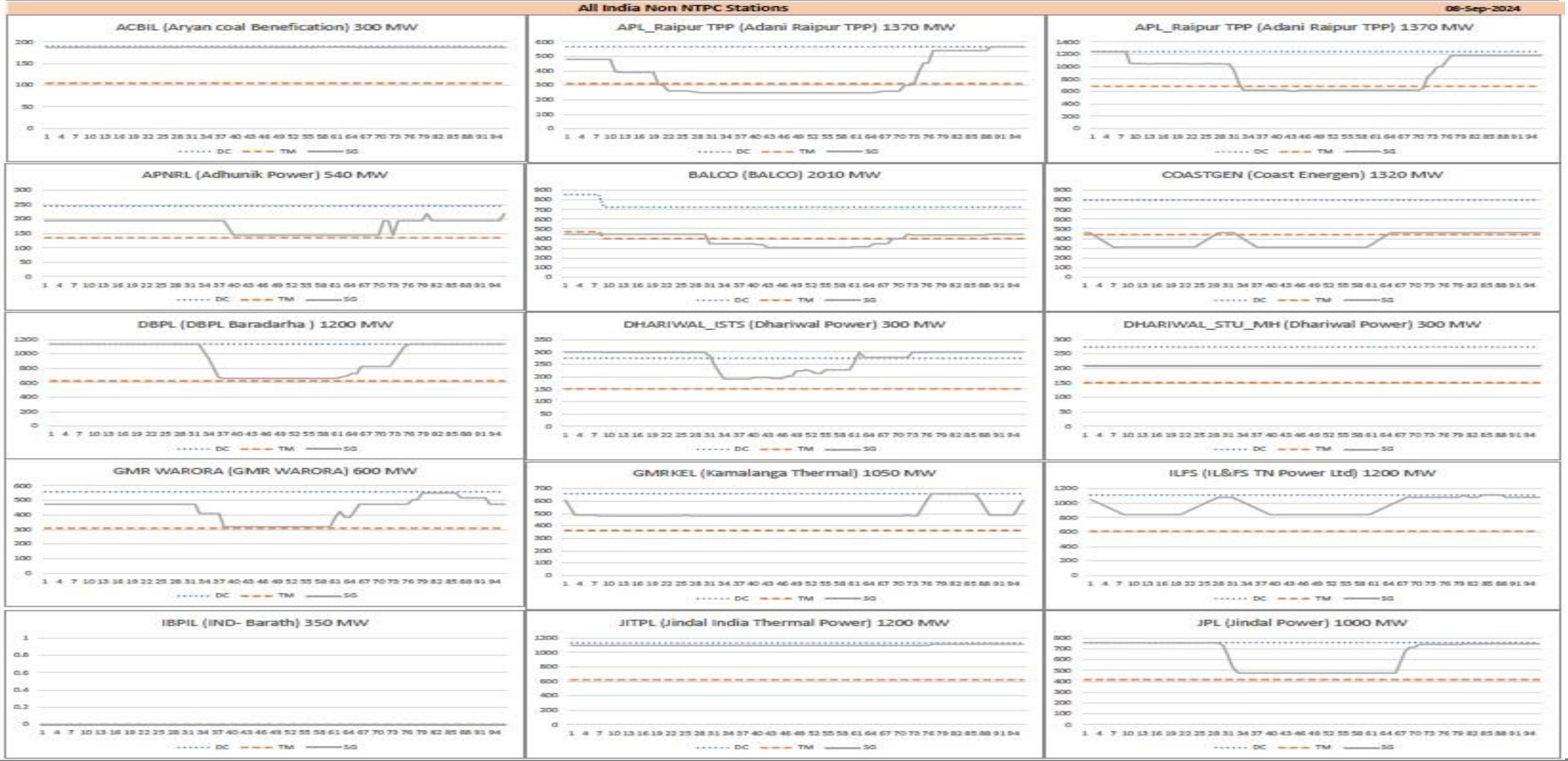


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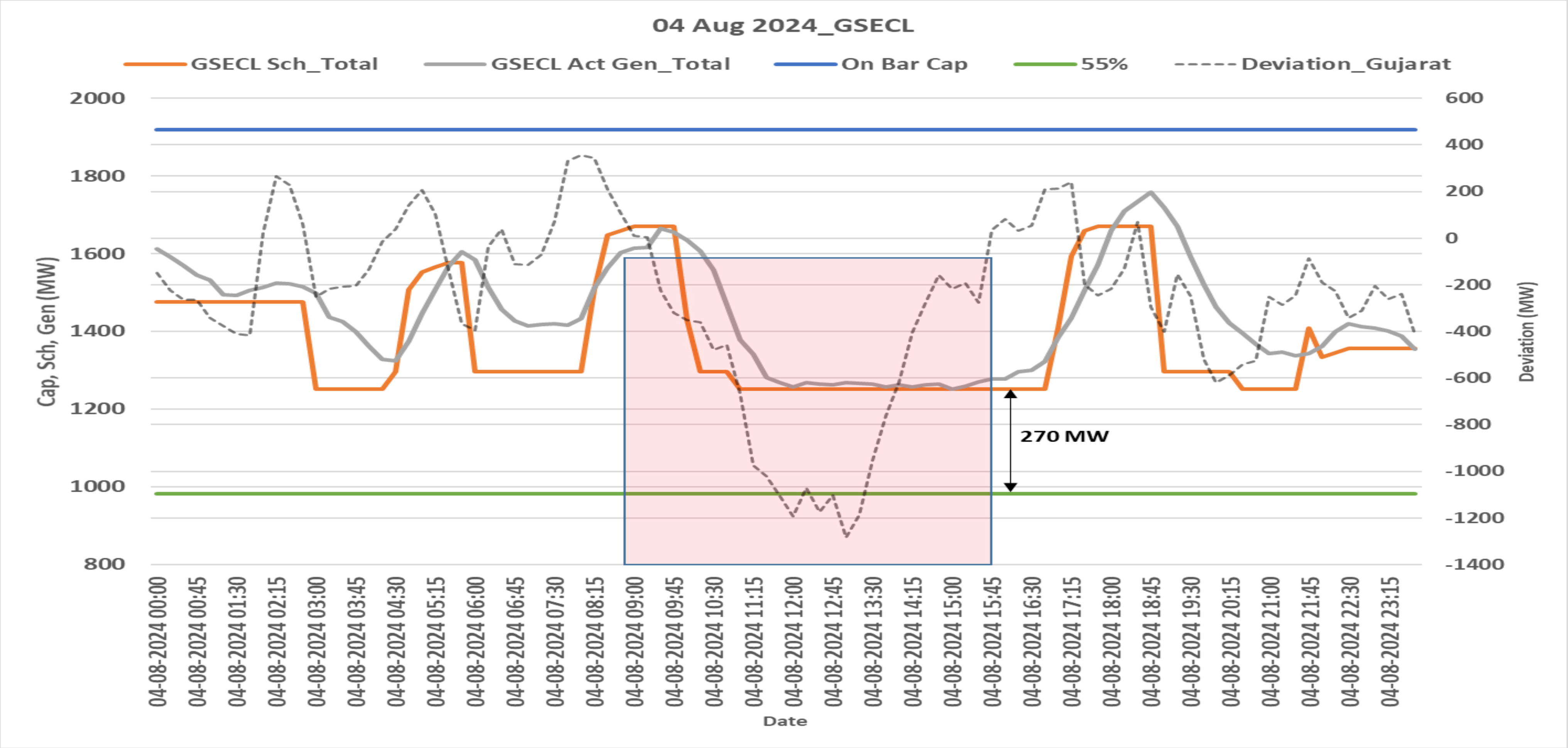
MBMP (Moserbaer Power) 1320 MW
MCCPL (Maruti Clean Coal Power) 300 MW
MPL (Maithon Power Plant) 1050 MW
NLCEXP (Neyveli Lignite I Expansion) 420 MW
NLCIIST1 (Neyveli Lignite I ) 420 MW
NLCIIST2 (Neyveli Lignite II ) 1470 MW
NLCTS2EXP (Neyveli Lignite II Expansion) 500 MW
NNTPP (Neyveli New Thermal) 1000 MW
NSPCL
NTPL (NLC Tamilnadu) 1000 MW
RKM_POWER (RKM_POWER) 1400 MW
SEIL (SEMB Corp) 1320 MW
SEILP2 (SEMB Corp) 1320 MW
SIMHAPURI (SIMHAPURI ENERGY) 600 MW
SKS Raigarh (SKS Power Generation) 600 MW
TPCL_Mundra (Tata Mundra) 4000 MW
TPTCL_DHPPB
TRN_ENERGY (TRN_ENERGY) 600 MW
SASAN (SASAN) 3960 MW
DC
TM
SG

# Gujarat Scheduling

| MW | IC | DC | SG | Min SG |
|---|---|---|---|---|
| GSECL | 1900 | 1786 | 1250 | 70.0% |



# States Flexing as per Grid India Report for 4 Aug 2024

| Cap On Bar (MW) | Gen at Max Freq (MW) | 55% Cap | Min Load |
|---|---|---|---|
| 33335 | 23451 | 18341 | 75% |

**Freq 50.39 Hz at 12:02:30 hrs**

| S.No. | Station | State | Cap On Bar (MW) | Gen at Max Freq (MW) | 55% Cap | Min Load |
|---|---|---|---|---|---|---|
| 1 | RAYALASEEMA TPP | ANDHRAPRADESH | 1440 | 860 | 792 | **64%** |
| 2 | Marwa (2*500) | CHATTISGARH | 1000 | 919 | 550 | **98%** |
| 3 | KORBA EAST | CHATTISGARH | 250 | 230 | 138 | **98%** |
| 4 | WANAKBORI | GUJARAT | 1010 | 669 | 556 | **70%** |
| 5 | Ukai | GUJARAT | 700 | 445 | 385 | **68%** |
| 6 | GANDHINAGAR(GTPS) | GUJARAT | 210 | 145 | 116 | **73%** |
| 7 | BLTPS (2*250) | GUJARAT | 250 | 162 | 138 | **69%** |
| 8 | KLTPS (2"75) | GUJARAT | 75 | 58 | 41 | **82%** |
| 9 | RGTPP( KHEDAR)( 2 " | HARYANA | 1200 | 744 | 660 | **66%** |
| 10 | KODERMA(2*500) | JHARKHAND | 1000 | 642 | 550 | **68%** |
| 11 | BOKARO-A'(1"500) | JHARKHAND | 500 | 341 | 275 | **73%** |
| 12 | TENUGHAT(2"210) | JHARKHAND | 420 | 282 | 231 | **71%** |
| 13 | RAICHURTPS | KARNATAKA | 1090 | 721 | 600 | **70%** |
| 14 | JP BINA (2"250) | MADHYA | 250 | **141** | 138 | **60%** |
| 15 | TATA TROMBAY Th | MAHARASTRA | 250 | 270 | 138 | **115%** |
| 16 | DAHANU (2*250) | MAHARASTRA | 500 | 284 | 275 | **60%** |
| 17 | IB.TPS ( 2 * 210 ) | ODISHA | 420 | 317 | 231 | **80%** |
| 18 | RAJPURA(NPL) TPS( 2 | PUNJAB | 1400 | 1318 | 770 | **100%** |
| 19 | TALWANDI SABO TPS | PUNJAB | 1320 | 1037 | 726 | **84%** |
| 20 | LEHRA MOHABBAT | PUNJAB | 710 | 634 | 391 | **95%** |
| 21 | GGS TPS (ROPAR) | Punjab | 840 | 703 | 462 | **89%** |
| 22 | GOINDWAL(GVK) | Punjab | 270 | 231 | 149 | **91%** |
| 23 | KOTA TPS | RAJASTHAN | 1240 | 936 | 682 | **80%** |
| 24 | CHHABRA | RAJASTHAN | 2320 | 1484 | 1276 | **68%** |
| 25 | Rajwest IPP | RAJASTHAN | 945 | 725 | 520 | **82%** |

| S.No. | Station | State | Cap On Bar (MW) | Gen at Max Freq (MW) | 55% Cap | Min Load |
|---|---|---|---|---|---|---|
| 26 | Kawai | RAJASTHAN | 1320 | 852 | 726 | **69%** |
| 27 | Barsingar | RAJASTHAN | 250 | 169 | 138 | **72%** |
| 28 | Kalisindh | RAJASTHAN | 600 | 361 | 330 | **64%** |
| 29 | Mettur | Tamil Nadu | 1440 | 923 | 792 | **68%** |
| 30 | ST CMS | Tamil Nadu | 250 | 170 | 138 | **72%** |
| 31 | North Chennai | Tamil Nadu | 600 | 347 | 330 | **62%** |
| 32 | KOTHAGUDEM TPS | Tamil Nadu | 1550 | 1113 | 853 | **76%** |
| 33 | Singreni | Uttar Pradesh | 600 | 441 | 330 | **78%** |
| 34 | JAWAHARPUR | Uttar Pradesh | 660 | 383 | 363 | **62%** |
| 35 | Obra | Uttar Pradesh | 800 | 449 | 440 | **60%** |
| 36 | Sagardighi | West Bengal | 1100 | 789 | 605 | **76%** |
| 37 | Mejia | West Bengal | 710 | 540 | 391 | **81%** |
| 38 | Mejia 2 | West Bengal | 1000 | 681 | 550 | **72%** |
| 39 | Kalaghat | West Bengal | 630 | 447 | 347 | **75%** |
| 40 | RTPS | West Bengal | 600 | 425 | 330 | **75%** |
| 41 | Bakreshwar | West Bengal | 840 | 542 | 462 | **69%** |
| 42 | Santalidh | West Bengal | 500 | 323 | 275 | **69%** |
| 43 | Bandel | West Bengal | 275 | 198 | 151 | **77%** |
| | | | 33335 | 23451 | 18341 | **75%** |

# Flame failure data for FY-23-24

| Reason | Type of Boiler | Nos | Reason for Trip |
|---|---|---|---|
| Flame Failures due to equipment outage | All Boiler | 17 | Equipment outage |
| Flame failure at Part Load | Corner fired | 25 | Lean mixture |
| | Wall fired | 1 | Lean mixture |
| Flame failure at Full Load | Corner fired | 3 | Fall of Ash |
| | Wall fired | 5 | Fall of Ash |
| | | 5 | Improper combustion |
| Total | | 56 | |

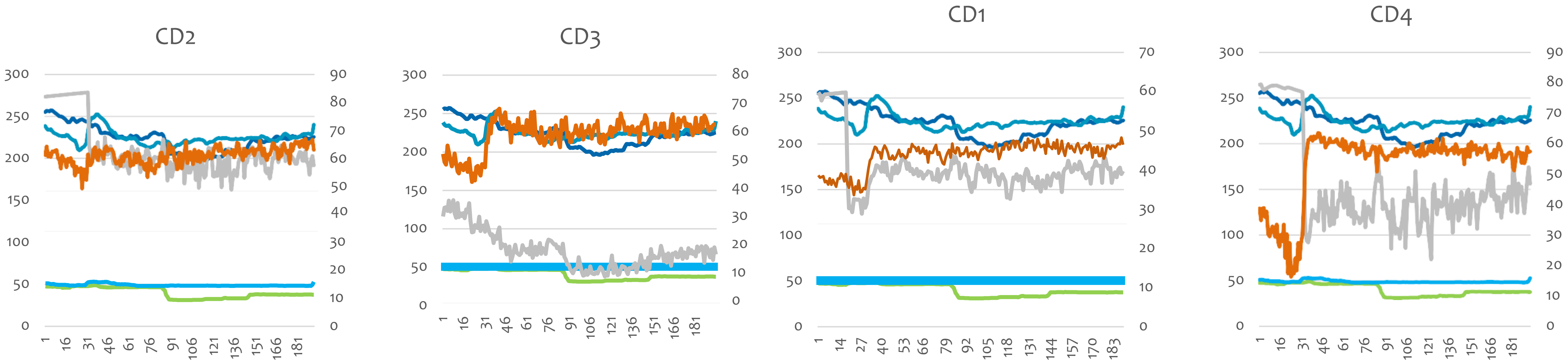
Recently in Tanda U6 flame failure took place at 55 % load with stable unit parameters. After analysis of coal quality, it was observed that ash content was more than 50% & Volatile matter in coal was less than required in 3 Mills.

Design Coal =3300 kcal/kg

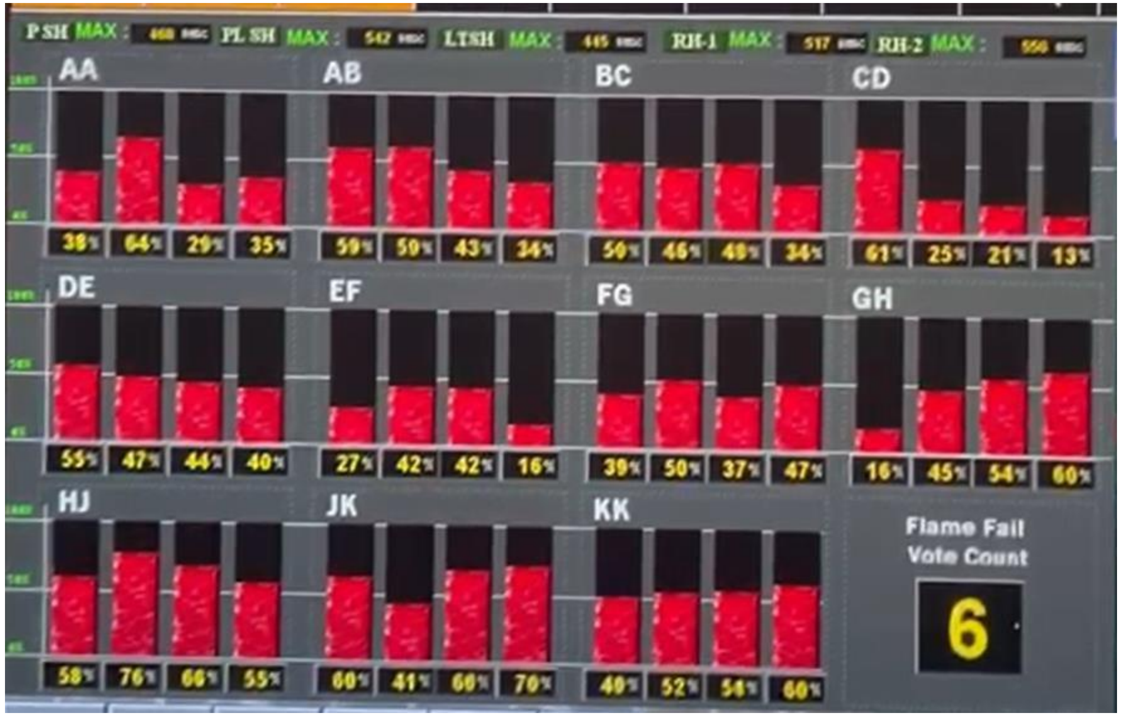
| Mill | Moisture | Ash | VM | GCV |
|---|---|---|---|---|
| Mill B | 4.3 % | 52.5 % | 22.9 % | 3018 Kcal/kg |
| Mill C | 3.4 % | 49.9% | 16.1% | 3336 Kcal/kg |
| Mill D | 3.8% | 52% | 20.4% | 3120 Kcal/kg |
| Mill E | 2.1 % | 54.2 % | 15.3% | 3062 kacl/kg |
| Mill G | 3.9 % | 58% | 18.7% | 2575 kcal/kg |

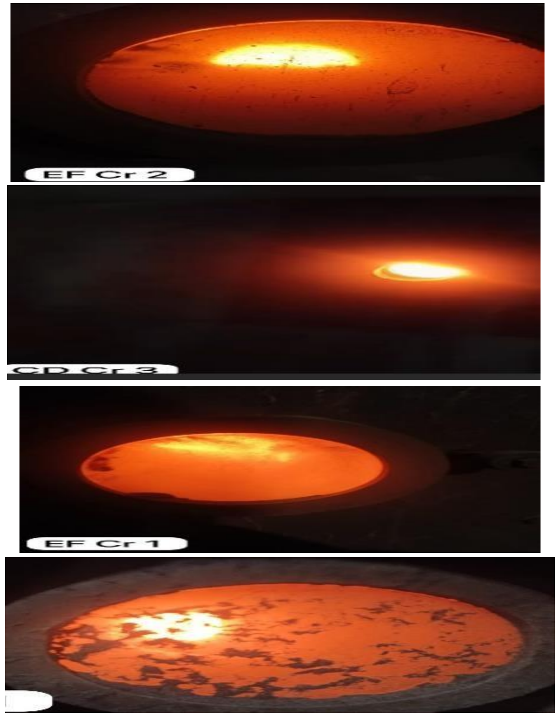
# Ramagundam unit 7 flame study observation during 40% load:

- Flame intensity is drastically reduced.
- Tests were conducted during different time of year & on both instances, flame condition was not observed to be healthy.
- Flame intensity trends are given below

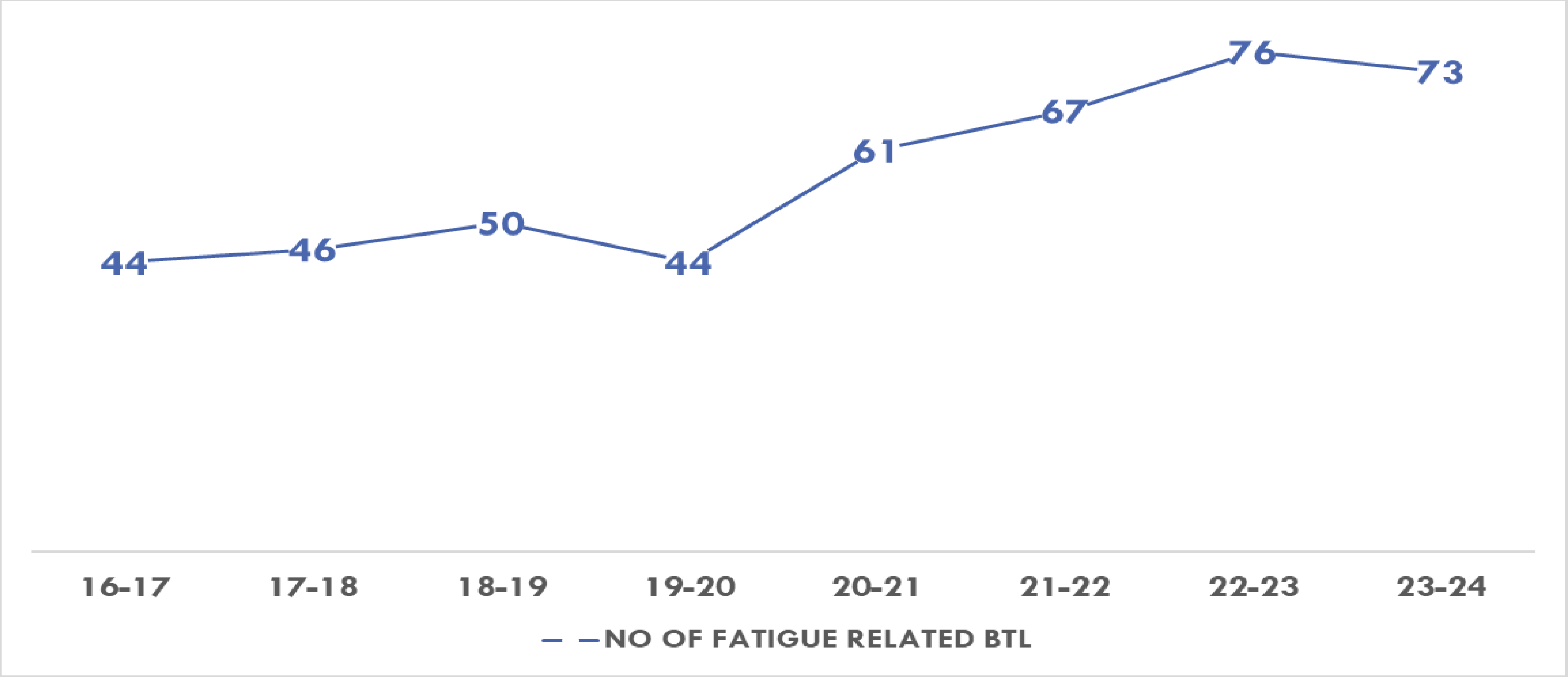


# Mouda flame study observation during 40% load:



# High Fatigue BTL




**As boiler will be subjected to maximum temp variation, exfoliation related issues will rise further**

# Electrical Issues

Stator windings degradation

Degradation of electrical insulation causing electrical shorts, partial discharges, or complete winding failure.

Looseness of core leading to failure of Generators, motors & transformers.

Increased failure of breakers.

Cyclic loading causes repeated heating and cooling of the generator components, leading to thermal fatigue.

Expansion and contraction of the generator casing.

Components wear out faster leading to higher maintenance costs and potential downtimes.

Reduction in actual life of components & regular Inspection and Monitoring, Component Upgrades.

Motor shaft /coupling failures.

# LP Turbine Blade Failure Report

NTPC
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results have shown that L-0R blades in steam turbines are sensitive against back pressure variation at certain operating conditions. The dynamic blade excitation rises due to aerodynamic phenomena in low load or part load operation with an elevated level of back pressure. The aerodynamically induced vibration of the last-stage blade is a function of the volumetric flow and the back pressure. Rotating instabilities cause higher non-synchronous excitation of the last stage blade in a certain load range and will increase with higher backpressure levels.

A continuous operation of the last stage blades (see figure 1) at certain load points can cause elevated blade vibrations which results in an increased blade lifetime consumption. The risk of

# Start-up Oil Consumption for Super Critical Units per Cold start-up (KL/Start)

| NTPC Stations | 18-19 | 19-20 | 20-21 | 21-22 | 22-23 | AVERAGE (KL/Start) |
|---|---|---|---|---|---|---|
| SOLAPUR STPS (2 x 660 MW) | 748 | 319 | 277 | 217 | 259 | **364** |
| KUDGI STPS (3 x 800 MW) | 320 | 357 | 293 | 349 | 285 | **321** |
| LARA STPS (2 x 800 MW) | - | - | 316 | 251 | 262 | **276** |
| TANDA ST-II (2 x 660 MW) | - | 383 | 515 | 252 | 422 | **393** |
| SIPAT ST-I (3 x 660 MW) | 688 | 600 | 814 | 409 | 575 | **617** |
| MAUDA ST-II (2 x 660 MW) | 143 | 181 | 86 | 183 | 210 | **160** |
| GADARWARA (2 x 800 MW) | - | 377 | 489 | 571 | 396 | **458** |
| KHARGONE (2 x 660 MW) | - | - | 364 | 220 | 314 | **299** |
| BARH ST-II (2 x 660 MW) | 640 | 735 | 430 | 175 | 232 | **442** |
| NABINAGAR (3 x 660 MW) | - | 176 | 272 | 254 | 233 | **234** |
| DARLIPALLI (2 x 800 MW) | - | 175 | 395 | 338 | 399 | **327** |
| | | | | | | |
| **Average Oil Consumption per Cold start up (KL/Start)** | | | | | | **354** |

# THANKING YOU!
# ON BEHALF OF

Council of Enviro Excellence