Excerpt: Webinar on “Best Practices for Efficiency Enhancement in Coal-Based Power Plants”

This excerpt captures the core of our July 5, 2025, webinar on "Best Practices for Efficiency Enhancement in Coal-Based Power Plants." As a CEA-recognized leader, we deliver actionable insights to cut costs and emissions. View the full recording on our YouTube channel or register for our next session to elevate your plant's performance!

The Efficiency Imperative: Why Every Kcal Counts in Coal Power

Envision a 660 MW coal plant haemorrhaging Rs. 50 crores annually due to a mere 1% efficiency dip—equivalent to 22 kcal/kWh heat rate deviation from suboptimal boiler operations alone. In my four decades, I've seen how design flaws, poor coal quality, aging assets, and lax O&M practices erode efficiency, spiking heat rates and emissions while devouring natural resources. Heat rate, the kcal needed per kWh, inversely ties to efficiency (Efficiency = 860*100 / Heat Rate), making it a superior metric for optimization. Factors like ambient conditions, partial loading, and chemistry upsets amplify losses, but best practices can reclaim 1-3% efficiency gains, ensuring competitiveness amid flexibilization and stringent norms.

Boiler Mastery: Combustion, Heat Transfer, and APH Optimization

Boilers account for 85% of heat input; inefficiencies here cascade plant-wide. Using the heat loss method (Efficiency = 100% - Losses like dry flue gas, unburnt carbon, and radiation), we targeted controllable losses (12.5-15% total).

Combustion Optimization: The 3Ts (Temperature, Turbulence, Time) rule combustion. For Indian coals (high ash, variable VM), blend based on burning profiles (ITvm, PT, BT via DSC) to avoid flame instability. Best practices: Maintain mill outlet temps (80-85°C for normal, 65°C for high-VM coals); ensure >70% through 200-mesh fineness; balance coal pipes via dirty/clean air tests (±5% flow variation, 17-18 m/s velocity). Optimize excess air (O2 at 3-4% via grid mapping, CO monitoring); adjust SADC dampers (10-15% for low-VM, 30-35% for high-VM). Expert tip: Daily furnace temp profiling with pyrometers detects imbalances—I've slashed unburnt carbon by 2% this way.

Efficient Heat Transfer: Slagging/fouling from ash (IDT < furnace temp) hikes flue gas temps and sprays. Mitigate via soot blowing (optimize frequency via temp trends), water lances for stubborn deposits, and anti-slagging additives. Monitor furnace exit gas temp (FEGT) to prevent high SH/RH deviations.

APH Enhancement: Seal leaks (target <10%) inflate fan loads; clean baskets regularly. Track gas-side efficiency, X-ratio; conduct performance tests monthly. Gains: 1% boiler efficiency boost per 5°C exit gas temp drop.

These tactics, battle-tested on high-ash blends, yield 0.5-1% efficiency lifts.

Turbine Cycle & Auxiliaries: From Vacuum to Makeup Minimization

Turbine efficiency (HP/IP/LP cylinders) drops with erosion, deposits, or seal leaks—1% loss = 4 kcal/kWh. Best practices: Maintain rated MS/HRH temps/pressures (0.5 kcal/kWh per °C MS drop); adopt sliding pressure for part loads; overhaul seals/blades based on pressure surveys (monthly HP/IP efficiency calcs).

Condenser Vacuum: Critical—16 kcal/kWh per kPa drop. Analyze deviations (CW inlet temp, flow, air ingress) via TTD/DCA. Practices: Helium leak tests, online tube cleaning (OLTC), acid/jet cleaning (optimize frequency via cost-benefit); ensure chlorine dosing for biofouling. Pro tip: Isolate standby CT cells; monitor air depression at vacuum pumps.

FW Heaters & Cooling Towers: TTD/DCA/TR trends flag issues; modulate levels, vent adequately. For CTs: Test twice yearly (range, approach, effectiveness); optimize fan blades, clean fills, prevent algae (residual chlorine).

DM Makeup & Aux Power: 12.5 kcal/kWh per 1% makeup rise. Reduce via leak hunts, Deaerator drop tests, trap checks. Aux power (8-10%): Minimize MDBFP hours, fix APH leaks, optimize CT/CW ops, install VFDs post-audit.

Use tables for impacts:

Parameter Deviation	Impact (kcal/kWh)
1% Excess O2	7
1°C MS Temp Drop	0.5
1% DM Makeup	12.5
1 kPa Vacuum Loss	16

Holistic Monitoring & Implementation: Tests, Audits, and Benchmarking

Sustain gains via daily parameter tracking (sprays, O_2, vacuum) and scheduled tests: Monthly (TG heat rate, condenser, heaters, APH, boiler eff.); Quarterly (equipment perf., dirty air flows); Semi-annual (turbine surveys, CT tests). Energy audits (internal/external) cover APC, draft systems, CHP—mandatory for compliance.

Benchmark against similar units (adjust for coal/ambient diffs); adopt peers' practices like advanced coal analysis (proximate/ultimate). From my NTPC stints, integrating EMS for real-time APC monitoring cuts 0.5-1% aux power.

Exclusive Expert Tips: 35 Years of Efficiency Wisdom

1. **Coal Blending:** Start low ratios; use HGI/AFT for compatibility—avert slagging.
2. **O_2 Optimization:** Combine O_2/CO for "right excess air at right place"; grid tests pinpoint imbalances.
3. **Vacuum Vigilance:** Trend TTD weekly; flood tests in shutdowns reveal leaks.
4. **Heater Health:** Fix passing sprays via thermocouples; aim DCA near design.
5. **Aux Savings:** Walkdowns shift-wise for leaks; optimize service air pressure (site-specific).

These have boosted efficiencies by 2-4% in aging plants.

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Blending German engineering with Indian expertise, STEAG India's CEA-accredited webinars empower participants on PAN India level, yielding positive results.

Similar webinars with interactive Q&A sessions will be arranged in the future. Please participate—we'll also repeat some topics with the latest updates. We look forward to your overwhelming participation!

STEAG India: Enhancing Efficiency, Energizing Tomorrow.