CENPEEP

# Performance Optimiser

(Optimisation by using state-of-the-art technologies & practices)

एनटीपीसी NTPC

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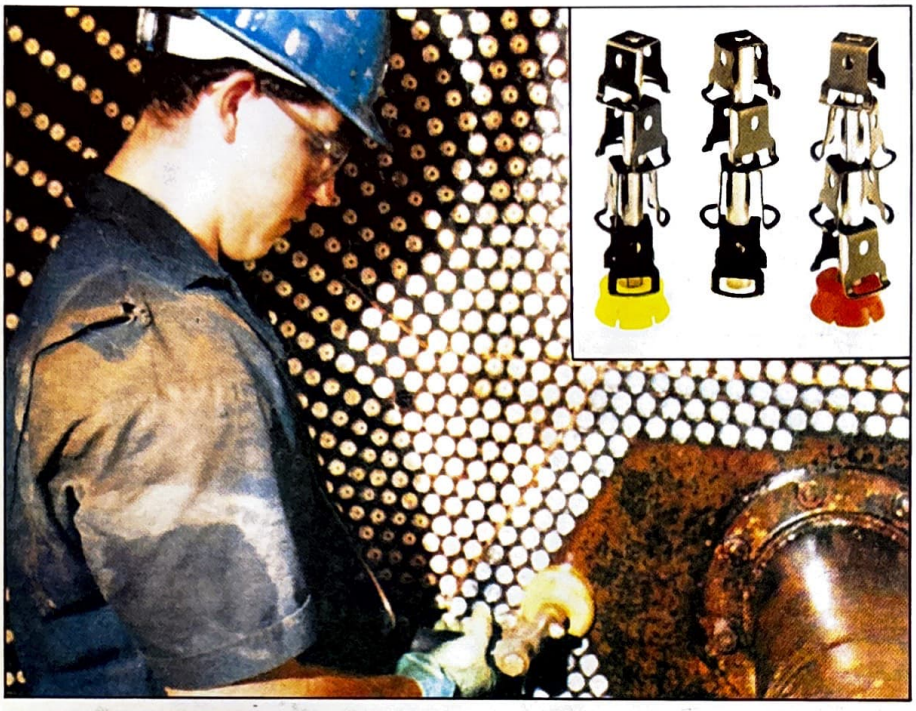


## *NTPC - CENPEEP INTRODUCES WATER POWERED CONDENSER TUBE CLEANERS FOR INCREASED CONDENSER EFFICIENCY, LONGER TUBE LIFE AND ADDITIONAL POWER GENERATION*

**"Water powered tube cleaners are internationally accepted as very effective tools for condenser tube cleaning leading to significant improvements in Heat Rate. In India also, NTPC-Unchahar has recently achieved 1.25% Heat Rate saving"**

## DEMONSTRATED BENEFITS

- ***Estimated saving of coal worth Rs 10 to Rs 15 million per year for a 210 MW rail fed unit considering 10 to 15 mmHg improvement in vacuum and 20 to 25 kcal/kwh (approximately 1 %) improvement in Heat Rate.***
- ***Provides fast, effective and safe Condenser tube cleaning.***
- ***Condenser cleaning within 3-4 days for a 210 MW unit.***

## OBJECTIVE

Performance optimisation for lowest unit cost of generation is the key objective of all progressive utilities of the world. Awareness for early implementation of "Efficiency and Heat rate Improvement Programme" is increasing due to competitive pressures as well as growing concern for sustainable development and eco-friendly power generation. Although condenser with no moving parts receives very little maintenance attention, it has to play a ***major role*** in heat rate improvement programmes. The key challenges for sustainable performance optimisation of condenser are:

- Improving heat transfer by minimising the impact of scaling fouling etc. through ***periodic and effective cleaning.***
- Improving heat transfer by minimising air ingress.
- Timely detection of sub-optimal performance by online instrumentation and periodic testing.

This "performance optimiser" deals with the first part i.e. Condenser cleaning.

## RESPONSE

### *CONVENTIONAL TECHNIQUES*

- **HP Jet** – Most of the Power Utilities in India currently use High Pressure jet cleaning (400-600 Kg/cm²). In this system High Pressure Jet Lance is traversed manually through the tube

length. The average time taken for cleaning a 210MW condenser is about 15 days. This technique requires utmost care for safety since very high pressure is involved. Effective cleaning by this arrangement is rather difficult to ensure because the length of the Condenser tubes is around 12 to 15 meters. The major limitations of this technique are concern for safety due to high pressure , long time taken for cleaning and ineffective cleaning leaving back uneven deposits which generally lead to early scale formation in future.

- **Chemical cleaning :** This technique is used in situations when the thickness of scale is very high and/ or the deposit is very hard. However, power utilities do not prefer frequent chemical cleaning of condensers due to rather elaborate and cumbersome preparatory requirements, possibility of loss of tube metal unless extreme care is taken and relatively high cost of chemical cleaning. Since the cost of replacement of tube bundle for a 210 MW unit is around Rs.32 million (approx.), frequent chemical cleaning is generally not a preferred option.

### *NEW TECHNIQUE*

In the Process of technology transfer from US to India, USAID provided one set of "Conco Condenser Cleaning Equipment" which is being used by a large number of US utilities. The Technique involved is to use ***proprietary spring loaded metal scrappers*** which are propelled at high speed (3 to 6 m/ sec) by medium pressure water guns (15 to 25 Kg/cm$^2$).

*Knowledge is not enough, it is the **implementation** which leads to real benefits.*

## Advantages of New Technique:

- The cleaning by this technique leaves behind ***polished shining surface*** all through the tube length.
- The cleaned surface drastically reduces the accumulation ***of future deposits.***
- Cleaning process is ***very fast*** and the total time taken for cleaning Condenser of one 210 MW Unit is about 3-4 days.
- The system is ***very safe*** as the operating pressure is much lower (15-25 Kg/cm$^2$).
- Cleaners are also able to ***effectively remove obstructions*** and debris such as rubber plugs, rubber balls, brushes etc.

*Performance Optimisation is a race without goal post. It is a continuous process.*

The cleaners are manufactured precisely to fit the inside diameter of the condenser tubes which results in the removal of internal deposits including Calcium Carbonate, Organic deposits, Oxides etc. Different types of cleaners are available for soft scale and hard scale and these are selected based on the type of deposits. For scale of average quality and thickness, each cleaner could be used approximately 8 to 12 times. Generally off-line mechanical tube cleaning is performed during a Unit outage. However, it has been successfully used in USA for Condenser cleaning at reduced load (while the Unit is in operation) after isolating one half of the Condenser during the weekends or periods of low grid demand.

## CENPEEP PERSPECTIVE

CENPEEP is closely working with USAID, USDOE , EPRI, TVA and other US agencies for achieving the objective of Green House Gas reduction through performance optimisation of thermal power plants in India. This new technique of Condenser tube cleaning has been successfully used by the majority of leading Utilities in USA and in many other parts of the world for Condenser optimisation and heat rate improvement. Based on the success of this technique in USA and the recommendations of USAID / TVA, CENPEEP demonstrated the new technique at NTPC, Dadri. Subsequent to the demonstration, it has been utilised at various other stations like NTPC Ramagundam, Unchahar etc. and significant improvement in Heat Rate have been achieved.

## *RECENT CASE STUDY*

### Unchahar Unit # I (210MW) Condenser Performance Data Before/After Condenser Cleaning by 'New Technique'

| Sr. No. | Parameter | Unit | Design Data | Operating Data | | Corrected Data | |
|---|---|---|---|---|---|---|---|
| | | | | Before O/H | After O/H | Before O /H | After O/H |
| 1. | Load | MW | 210 | 195 | 213 | 210 | 210 |
| 2. | Condenser Vacuum | mm Hg | 684 | 659.68 | 674.88 | 668.95 | 682.64 |
| 3. | C.W. inlet temperature | $^{o}C$ | 33 | 36.72 | 33.5 | 33 | 33 |
| 4. | C.W. outlet temperature | $^{o}C$ | 41.69 | 47.75 | 42.5 | — | — |
| 5. | C.W. temperature rise | $^{o}C$ | 8.69 | 11.03 | 9.0 | — | — |

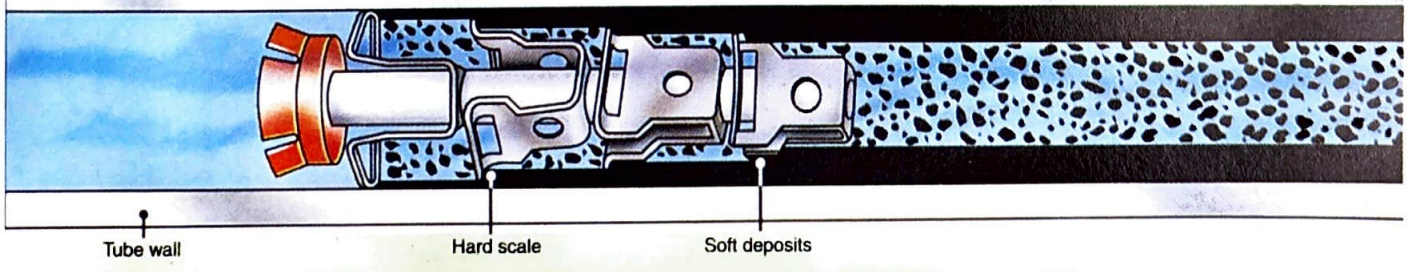
## Benefits Observed

1. ***Vacuum*** improved from 668.95 to 682.64mmHg i.e. a gain of 13.69 mmHg which in terms of heat rate is 30.8 kcal/kWh (approx.) and in terms of money is about Rs. 15 million per year.
2. The effectiveness of cleaning is also reflected in the C.W ***temp. rise*** across Condenser i.e. present value is $9^{o}C$ as against $11.03^{o}C$ before cleaning.
3. The ***differential pressure*** across each half of condenser has improved i.e. present value is 7/7.5 mwc as against 9/9.5 mwc before cleaning.
4. The above improvement in Vacuum is ***despite higher air-ingress*** in present condition as against before O/H. (Presently 2 ejectors are in operation instead of one earlier)

## Highlights of Savings for 210 MW

- Improvement in Vacuum — 14 mm Hg
- Improvement in Heat Rate — 31 Kcal / kwh
- Fuel Saving — 9400 Tons / year
- $CO_2$ reduction — 11,750 Tons / year
- Money Saved — Rs. 15 million / year
- Expenditure in Cond. cleaning — Rs. 0.5 million (Approx.)
- Net Saving — Rs. 14.5 million / year

Above success has been achieved through close cooperation & team work between NTPC Unchahar , US agencies and CENPEEP under GEP Project.




***Eco-friendly power and greenhouse gas reduction through performance optimisation***

## Seven Steps for Performance Optimisation

### (Many leading utilities in the world have benefited by this. Why not your station ?)

- Establish Efficiency Management System (EMS) under a **dyanamic HOD** for "Optimising" availability, PLF, heat rate and other performance parameters like auxiliary power consumption, make up water consumption, specific oil/coal consumption etc.
- Start daily unitwise review of key peformance parameters.
- Compare with best figures achieved till date for the same unit and other units of the station.
- Analyse reasons for lower than "previous best" performance and take corrective actions.
- Compute best achievable figures for each unit.
- Compare the performance of your station with respect to CEA norms and best achieved figures of Power Plants in India and abroad.
- Prepare "Action Plan" covering corrective actions, categorise short-term, medium-term and long-term actions. Closely monitor for implementation and ensure senior level support for resolving implementation problems.

**Note :** After best possible results are achieved based on initial inhouse efforts, support from outside agencies having adequate experience in similar work could also be considered keeping in view the pay back period for the expenditure involved.

## Our Expectations from Readers

We strongly believe that Thermal Power Plants in India could derive significant benefits by **Implementation** of a number of new techniques and practices. Even 2% heat rate improvement could result in coal saving of about 80,000 tonnes (Rs. 120 millions) per annum for a 1000 MW rail-fed station. Hence, we request our readers to take the following initiatives for deriving full benefits :

**Implementation of Seven Steps :** Ensure implementation of "Seven Steps for Performance Optimisation" given above for one year and give us the feedback regarding the cost benefit analysis.

**Formation of POGs :** Ensure formation of "Performance Optimisation Groups" (POGs) in the following areas :

- Reduction of Specific Oil Consumption
- Heat rate Improvement
- Condenser Optimisation
- Availability / PLF Improvement
- Mills & Combustion Optimisation
- ESP Optimisation

(CENPEEP may be contacted for guidelines for formation of these groups and ensuring their effective functioning).

**Feedback :** Ensure sharing with CENPEEP the full details regarding any other methods of Condenser Cleaning (both online and off-line) which has been found effective. After techno-economic evaluation we would like to try out the new techniques in one of our stations and share the results with all stations through another Performance Optimiser.

**Annual Meetings of POGs :** Considering the importance of condenser for heat rate improvement, CENPEEP proposes to take the initiative for organising annual meeting of "POG for Condenser" from various NTPC and SEB stations for sharing of information and experiences. Please ask your POGs to closely interact with CENPEEP.

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