<table>
<thead>
<tr>
<th>Unit</th>
<th>Capacity</th>
<th>Year of Comm</th>
<th>AP</th>
<th>TN</th>
<th>Kar</th>
<th>Ker</th>
<th>Pud</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unit-1</td>
<td>500 MW</td>
<td>Sep 2002</td>
<td>100%</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Unit-2</td>
<td>500 MW</td>
<td>Mar 2003</td>
<td>100%</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Unit-3</td>
<td>500 MW</td>
<td>Sep 2011</td>
<td>45.8%</td>
<td>22.8%</td>
<td>20.4%</td>
<td>9.2%</td>
<td>1.8%</td>
</tr>
<tr>
<td>Unit-4</td>
<td>500 MW</td>
<td>Sep 2012</td>
<td>45.8%</td>
<td>22.8%</td>
<td>20.4%</td>
<td>9.2%</td>
<td>1.8%</td>
</tr>
</tbody>
</table>
This region is suffering from power starvation...

“Customer demanded, we want power and we want it now.”
Generation Loss due to Coal Shortage

Gen Loss due to Coal Shortage (MU)

- 2011-12: 498.55 MU
- Apr-12: 47.86 MU
- May-12: 3.43 MU
- Jun-12: 87.85 MU
- Jul-12: 0 MU
- Aug-12: 67.43 MU
- Sep-12: 97.49 MU
- Oct-12: 116.35 MU
- Nov-12: 53.45 MU
- Dec-12: 51.03 MU
- Jan-13: 62.41 MU
- Feb-13: 51.166 MU
- Mar-13: 638.47 MU
- 2012-13*: 638.47 MU

*Including May-13
Use of High Moisture Imported Coal at NTPC, Simhadri, A Case Study

By
Chinnmoya Choudhury, ASCE,
R.K. Rout, HOD (OPERATION),
S. Narendra, GM (O&M)
Coal Supplying Mines (NTPC, Simhadri)

- Indonesian (Hi GCV)
  - 5800-6500 Kcal/Kg
  - Moisture up to 20%

- MCL (Talcher Mines)
  - 2800-3400 Kcal/Kg
  - Moisture up to 10%

- MCL (Ib Mines)
  - 1800-3000 Kcal/Kg
  - Moisture up to 10%

- Indonesian (Hi MO)
  - 4500-5500 Kcal/Kg
  - Moisture up to 35%

- SCCL (Singareni)
  - 3000-4000 Kcal/Kg
  - Moisture up to 10%
## Imported Coal Property Analysis

<table>
<thead>
<tr>
<th>MINE</th>
<th>INDONESIA-1</th>
<th>INDONESIA-2</th>
</tr>
</thead>
<tbody>
<tr>
<td>SAMPLE</td>
<td>IMPORTED HIGH GCV</td>
<td>IMPORTED HIGH MOISTURE</td>
</tr>
<tr>
<td>BASIS</td>
<td>AS RECEIVED (ARB)</td>
<td>AS RECEIVED (ARB)</td>
</tr>
<tr>
<td>TOTAL MOISTURE (%)</td>
<td>UP TO 20</td>
<td><strong>UP TO 35</strong></td>
</tr>
<tr>
<td>ASH (%)</td>
<td>UP TO 20 (MAX)</td>
<td>UP TO 12 (MAX)</td>
</tr>
<tr>
<td>GCV (Kcal/kg)</td>
<td>5800-6500</td>
<td>4500-5500</td>
</tr>
<tr>
<td>SULPHUR (%)</td>
<td>UP TO 0.90 (MAX)</td>
<td>UP TO 0.70 (MAX)</td>
</tr>
<tr>
<td>SIZE (mm) *</td>
<td>UP TO 50</td>
<td>UP TO 50</td>
</tr>
<tr>
<td>FIXED CARBON (%)</td>
<td>35-50</td>
<td>25-45</td>
</tr>
<tr>
<td>VOLATILE MATTER (%)</td>
<td>25-45</td>
<td>25-45</td>
</tr>
<tr>
<td>HGI</td>
<td>45-60</td>
<td>45-60</td>
</tr>
<tr>
<td>IDT Under Reducing Atmosphere (°C)</td>
<td>1100-1250</td>
<td>1100-1250</td>
</tr>
</tbody>
</table>

* SIZE OF THE COAL LESS THAN 2.36 mm SHALL NOT BE MORE THAN 25% OF THE QUANTITY AS RECEIVED AT THE POWER PLANT
Coal Consumption Pattern

Coal GCV (Kcal/Kg)

Sp Coal (Kg/KWh)
Precautions Taken...

Imported Coal mix to a Max of 10% and Bunkering in Mills A to F

Mill O/L temp at 70 °C

Mill I/L temp at 300 °C

Excess Air to maintain Eco O/L Oxygen at 3.0-3.5%

Close Observation of 10.5 Mtr. Peep Holes

Timely Bottom Deashing

Blending of Imported Coal only with MCL Coal (no SCCL Coal)
Methodology

- Case Study data from Unit-1 & Unit-2 Only.
- Data was Logged at Load>450 MW.
- Main Study Period was Oct-Dec 2012 (Hi MO Blend).
- Coal Blending was done by Belt Blending.
- Blended Coal was bunkered preferably in the Mills A-F.
- The Maximum Imported Coal in the mix was limited to 10% initially.

- Analysis for the study was made for the financial year of 2012-13*.
- In 2012-13, all types of Coal (MCL-Talcher, MCL-Ib, SCCL, Indonesia-Hi GCV, Indonesia-Hi Moisture) were fired in the Boilers of NTPC Simhadri.

*Data for analysis was taken up to Jan 2013.
Slagging and Fouling

Regular observation of the furnace by operation staff and Pressure Parts section confirmed,

• slight soft slagging of the walls that would easily get removed by regular Wall Blowing.
• Wall Blowing was being done periodically only (88 Blowers operated per day).
• After 15 minutes of wall blowing activity, the performance of the heating elements was becoming normal.

Slagging was soft and was not hampering the thermal efficiency of heating elements.
Clinkering

- In the months of Oct to Dec 2012, there was not even a single reported case of Bottom Ash Hopper Build-up and Clinker Grinder over-load i.e. clinkering, in all the running Units, at NTPC, Simhadri.

Clinkering was not observed while firing Indonesian Imported Coal even at blending ratios of 30%.
Mill Reject Problems

- The average Mill Reject Problems encountered while using Hi GCV Indonesian Coal with MCL Coal was 0.6 per day per unit.
- The average Mill Reject Problems for the period of Oct to Dec 2012 came down to as low as 0.2 per day per unit when Hi Moisture Imported Coal was blended with Indian MCL Coal.

Mill Reject Problems were less and Boiler ‘0”mtr area housekeeping was quite Improved.
The Simhadri Experience

FGET

- FGET got lowered to 129 °C in Unit-1 and to 145 °C in Unit-2.
- Lowering of FGET is due to low Flue-Gas Temperatures at Furnace.

Flue Gas Exit Temperatures got lowered. The FGET was more than the allowed Cold End Corrosion Temp (125 °C)
The Simhadri Experience

Oxygen at Eco Outlet

- While using the Hi moisture coal for blending, the oxygen (Total Air Flow) was maintained at 3.0-3.5% to avoid the reaction inside the furnace in reduced atmosphere.

The Eco O/L Oxygen % was maintained at > 3.0 % during Oct-Dec 2012
The Hot PA temperature in both Unit-1 and Unit-2 was more or less stable.

The marginal increasing in Unit-2 may be due to certain degree of fouling caused due to prolonged operation and nearing O/H.

The Hi Moisture Coal has made PA Header Temperatures Stable.
The Simhadri Experience

Mill O/L Temperatures
- The Mill Outlet Temperatures were low even with Cold Air Gates closed.
- During backing down/Part Load regimes, Mill O/L temps came down to about 60-62 °C.
- 7th Mill Operation was maintained even when 6th Mill would be sufficient.

The main concern in running units with the high moisture Indonesian Coal is its adverse effect on the Mill O/L temperatures.
Steam Parameters

- The average SH temp change was marginal in both the Units.
- The HRH temperature in Unit-1 dropped considerably due to high heat recovery in WW. The HRH temp drop in unit-2 was marginal and insignificant.

SH temperatures were stable. HRH temperatures were slightly lowered due to lower FG temperatures.
The Simhadri Experience

SH Sprays
- In Unit-1, the SH spray is on the rise (Due to high heat gain in water wall and SH circuits in a cleaned Overhauled Furnace).
- In Unit-2, The SH Spray is Stable (slight reduction observed).

SH Sprays are Slightly Reduced as the FG temperatures are lower at Furnace.
The RH Sprays

- The RH Spray in Unit-1 was inconsistent and was dependant on the RH Acromat and Metal Temperatures.
- In Unit-2, the RH Spray was steadily increasing.

RH Sprays are on the rising trend which may be due to certain degree of Secondary Combustion.
The Simhadri Experience

ESP Evacuation
• Opacity in both the units is in the downward trend.
• The ESP performance has improved considerably and more ash was getting evacuated.

ESP Performance was Good with the use of Hi MO Indonesian Coal.
The Simhadri Experience

Coal Consumption

Considerable reduction in coal flow for generating 500 MW has multiple good effects.

• This causes less grinding requirement at the Mills,
• Less work-load at CHP and lesser work load at ESP and
• Less work-Load at the bottom ash.

Reduction in Sp. Coal has generated less ash and made ESP more efficient. The Opacity was less and the stack emissions were lessened.
<table>
<thead>
<tr>
<th><strong>Advantages</strong></th>
<th><strong>Disadvantages</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Cost Advantage over SCCL &amp; Hi GCV Coals</td>
<td>Low Mill O/L Temp (up to 62 °C)</td>
</tr>
<tr>
<td>Reduction in FGET by 5-6 °C</td>
<td>Slight Loose Slagging</td>
</tr>
<tr>
<td>Reduction in Sp. Coal</td>
<td>Conveyor Chute, Bunker Chokages</td>
</tr>
<tr>
<td>Less Ash Generated</td>
<td></td>
</tr>
<tr>
<td>(7% less for 10% Blend)</td>
<td></td>
</tr>
<tr>
<td>Stable PA Hdr Temp</td>
<td></td>
</tr>
<tr>
<td>Less Mill Reject Problems</td>
<td></td>
</tr>
<tr>
<td>No Clinkering</td>
<td></td>
</tr>
<tr>
<td>Reduced Stack Opacity</td>
<td></td>
</tr>
<tr>
<td>Better ESP Evacuation</td>
<td></td>
</tr>
</tbody>
</table>
The other Boiler Performance parameters like Slagging, Foulling, have very marginal effects.

The Coal is priced low (Rs. 3600) and has a steady Heating Value (4500 Kcal/Kg). This gives a lot of stability in fuel security and Control over Cost of Generation.

Mill Reject area problems are nullified with this type of coal.

Mill Outlet Temperature is a concern, but it is being controlled by suitable monitoring of the milling system by the Operating Staff.

“The High Moisture Indonesian Coal has Edge over the SCCL Coal and the High GCV Indonesian Coal.”
The Combustion Characteristics of this Grade of Coal may be studied in detail for any long term effects on the Boiler Performance and Life.
The High Moisture Indonesian Coal is found to be suitable for use in BHEL make 500 MW CE design Corner Fired boilers, while mixed with the available Indian Sub-Bituminous Low Grade Coal, up to 30% ratio.

This meticulous study has given a lot of confidence to the entire thermal power producers in the country to use the High Grade High Moisture Imported Coal in the existing Boilers.
Coal is Still King
Thank you ...