BEST PRACTICES IN ENERGY EFFICIENCY
CAPTIVE POWER PLANT, NALCO

Arpan Ghosh, DGM (Elect)
CAPTIVE POWER PLANT,
NATIONAL ALUMINIUM COMPANY LIMITED
ANGUL, ODISHA
NALCO AT A GLANCE

- Navratna CPSE under Ministry of Mines, Govt. of India
- Established on 7th January, 1981
- Integrated and diversified operations in mining, metal and power
- Plants situated mainly in Odisha & the registered office is at Bhubaneswar
- Sales turnover is Rs 7771 crore & PAT is Rs 1322 crore in FY-2014-15
MAJOR PLANTS/ESTABLISHMENTS

- Corporate office at **Bhubaneswar**
- Mines & Refinery at **Damanjodi**
- Smelter & Power complex at **Angul**
- Port facilities at **Vizag**
- Wind Power Plant at **Gandikota** (50.4 MW, 2.1 MW x 24)
- Wind Power Plant at **Jaisalmer** (47.6 MW, 0.85 MW X 56)
CAPTIVE POWER PLANT AT ANGUL

COAL BASED

CAPTIVE THERMAL POWER PLANT

AT ANGUL, ODISHA

CAPACITY - 1200 MW (10x120 MW)
ROLE OF CPP

POWER TO SMELTER FROM CPP SWYD

INTER-CONNECTION WITH GRID

Refinery (Damanjodi)
OUR CPP

- Unit sizing small (120 MW): For reliable power supply & less impact on Aluminium production during unit Trip-out.

- Restricted capacity utilization: Target is to meet only Smelter & Damanjodi Load demand

- No power export target.

- Partial load operation of running units to match our own demand.

- Requirement of Generation variation to manage planned & unplanned load demand of Smelter.
BEST PRACTICES ADOPTED FOR ENERGY EFFICIENCY
BEST PRACTICES IN ENERGY EFFICIENCY: CASE-1

REDUCTION OF BOILER FEED REGULATING STATION (FRS) DP:

- Optimized the DP across FRS (4-5 Kg/cm²) in all units.
- Achieved energy saving of around 1.7 MU per year.
BEST PRACTICES IN ENERGY EFFICIENCY : CASE-2

TURBINE CONDENSOR VACUUM IMPROVEMENT:

Condenser vacuum remained low due to high turbidity in cooling water.

- Primary cause was found to be contamination of cooling water by passing of recycled Ash water, although interconnection gates of fore bays were in closed condition.
- The passing gate valves between the CW & Ash water fore bays were sealed by specialized materials with the help of under water divers.
- Some extra Blow downs were also given to bring down turbidity to acceptable level.
- After sorting out the cooling water quality problem, condenser vacuum improved.
REPLACEMENT OF CT FAN GRP BLADES WITH FRP BLADE:

- Initially all CT fan Blades were of GRP material.
- They were replaced with FRP blades in unit 1 to 8. Blade angles were adjusted to keep same air flow as per design.
- Each cooling tower fan load reduced by around 25% (15 Kw) on an average. Total energy saving of around 4.0 MU achieved per year.
**BEST PRACTICES IN ENERGY EFFICIENCY : CASE-4**

**DRY OIL GUN TESTING TO SAVE FUEL OIL CONSUMPTION**

**Old Practice:**
Earlier, healthiness of oil guns were checked once in a week by taking all of them into service one by one.

**New Practice: (Dry oil gun testing)**
In house modification of logic was done for checking the healthiness of oil guns without actually consuming fuel oil.

**Savings:**
By this modification around **300 KL of fuel oil** is saved pr annum.
PRE START-UP CHECKING FOR REDUCTION OF START-UP TIME:

- Recently we have started a practice of pre startup checking of units which are available in stand by mode.

- Various critical dampers, valves, drives etc. are being checked for readiness and identified problems are being sorted out.

- This is helping in bringing up the unit in to service within minimum possible time.

- In an average this action has reduced approximately 5 to 7 KL of fuel oil consumption per start up.
IMPLEMENTATION OF HIGH PERFORMANCE MILLING SYSTEM (HPMS)

The Conventional Bowl Mills were modified to High performance milling system.

**Advantages:**
1. Better fineness of coal particles
2. Lesser un burnt carbon in bottom ash & fly ash
3. Lesser PA fan loading
4. Lesser preventive maintenance frequency (Fortnightly to Monthly)
OTHER ENERGY SAVING ACTIVITIES

- Drift eliminators & top basin nozzles of cooling towers have been cleaned of ash deposits by high pressure water jet. Performance evaluation of one of the cooling towers has been carried out with help of external agency (NPC) & found to be OK.

- Many malfunctioning thermodynamic steam traps have been replaced with new ones saving considerable amount of steam.

- To avoid wastage of DM water from DM water storage tank due to delay in manual valve operation, all such manual valves are being replaced with actuator operated valves.

- Periodically energy audits are being carried out. Actions are being taken on the recommendations e.g. replacement BFP cartridges in phased manner.

- On line condenser tube cleaning system (COLTCS) has been retrofitted in 6 no of older units.

- To save energy in condensate extraction pumping system, VFD installation process has been initiated.
IMPLEMENTATION OF ISO 50001 : 2011
The scope of the energy management system includes the

“Operation of 10 X 120 MW coal fired thermal power plant at NALCO captive power plant, Angul”.

Note: The coal transportation from MCL to the captive power plant is not within the boundary of ISO 50001 as NALCO does not have operational control over this activity.
Following process were identified for energy management system CPP.

- **Generation**: Power house (Boiler and turbine generators)
- Water Treatment Plant
- **Coal Handling Plant**
- Compressed Air Network
- **Ac and Ventilation system**
- Ash Handling System
- Power distribution & evacuation System
- Systems Department
- **Illumination**
- Maintenance process - Elect/Mech/ EnI
- CWS (cooling water system)
CPP adopted a **fixed baseline** for its energy management system corresponding to the year **2011-2012**.

Thus the baseline for **ISO 50001** energy management system corresponds to the energy performance of the Captive power plant for the year **2011-2012**.

### Few Baseline Parameters:

<table>
<thead>
<tr>
<th>Sl. No</th>
<th>Parameter</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>01</td>
<td>Gross Generation</td>
<td>MU</td>
</tr>
<tr>
<td>02</td>
<td>Net Generation</td>
<td>MU</td>
</tr>
<tr>
<td>03</td>
<td>P.L.F.</td>
<td>%</td>
</tr>
<tr>
<td>04</td>
<td>Specific Coal consumption</td>
<td>KG/KWH</td>
</tr>
<tr>
<td>05</td>
<td>Fuel Oil consumption</td>
<td>ML/KWH</td>
</tr>
<tr>
<td>06</td>
<td>Auxiliary Power</td>
<td>%</td>
</tr>
<tr>
<td>07</td>
<td>DM Water</td>
<td>%</td>
</tr>
<tr>
<td>08</td>
<td>CT Make up</td>
<td>%</td>
</tr>
</tbody>
</table>
Energy Performance Indicators (EnPI)

- These are metrics designed to indicate energy trends in a meaningful manner. *(Energy consumption/time  Or Energy consumption /Unit of production)*

- The appropriate EnPI has been identified and recorded for the processes under control for monitoring & measurement of energy performance in CPP.

**LIST OF EnPI OF CPP**

<table>
<thead>
<tr>
<th>EnPI</th>
<th>Unit of Measurement</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aux Power Consumption (APC) per unit of power generated.</td>
<td>KWh/KWh</td>
</tr>
<tr>
<td>Fuel Oil consumption per unit of power generated.</td>
<td>ml/KWh</td>
</tr>
<tr>
<td>Coal Consumption per unit of power generated.</td>
<td>Kg/KWh</td>
</tr>
<tr>
<td>DM  water make up per unit of power generated.</td>
<td>Litre/KWh</td>
</tr>
</tbody>
</table>
EnMs certification Process

Exhaustive energy review was carried out in all the processes by taking energy loss aspects into consideration.

Significant Energy aspects were identified.

Many Work instruction under ISO-9001 were modified to incorporate significant energy aspects identified in energy review.

Management Action Plans (MAP) were taken.

Energy Policy was issued by the top management on 25/08/2012

Assessment audit was done in Dec-2012 & Jan-2013 by M/S DNV

Certified on ISO-50001:2011 was issued by M/S DNV Netherlands on 11 February-2013
Problems encountered during Implementation

In absence of any reference in energy management system implementation in power plant, the following problems were faced:

- Deciding the energy review methodology (Process wise/Equipment wise).

- Initial documentation.

- Non availability of past process wise energy consumption data.
Benefits achieved after Implementation of ISO-50001

- Energy Awareness increased from top to bottom
- Energy saving became a thrust area along with production target
- Station Heat Rate is being monitored at the highest level
- Performance monitoring is being carried out at unit level
- Auditors are now more focused on energy saving aspects
- Legal requirement are being monitored and are being reviewed at regular basis
- PAT target for 1st PAT cycle (20012-2015) is now achieved
Benefits achieved after Implementation of ISO-50001

- Energy meters for all critical drives are being procured through an MAP.
- DM water flow measurement provision is being done individual units.
- Belt weigher mechanism of coal conveyers of coal handling system have been made functional after implementation of EnMS.
- Auto coal sampler is being procured for installation in individual coal conveyors feeding coal to different units.
Thank You!

NALCO

Ordinary People Extraordinary Attitude