**NATIONAL ALUMINIUM COMPANY LIMITED**
**MINES AND REFINERY COMPLEX**
**DAMANJODI, KORAPUT**
**ORISSA**

***UNIT PROFILE:-***

## Alumina Refinery:-

The 15,75,000 tpa Alumina Refinery, having three parallel streams of equal capacity, is located in the picturesque valley of Damanjodi in Koraput district. In operation since September 1986, the Refinery is designed to:

- Provide Alumina to the Company's Smelter at Angul.
- Export Alumina to overseas markets through Visakhapatnam Port.

Presently, the capacity is being expanded to 21,00,000 tpa.

The salient features:

- Atmospheric pressure digestion process
- Pre-desilication and inter-stage cooling for higher productivity
- Energy efficient fluidised bed calciners
- Co-generation of 3x18.5 MW power by use of backpressure turbine in steam generation plant.
- Advanced red mud disposal system.

## "ENERGY CONSERVATION POLICY"

Energy is the key factor to economic development. In recognition to same Nalco emphasizes on energy conservation and cost effective utilization of energy in all its areas of operation.

To meet the above goal we strive for: -

- Adopting Energy efficient technology and to increase investment in all cost effective energy saving measures.
- To create awareness within the company of the need for and benefits of energy conservation.
- To promote and provide the efficient use of energy while protecting human safety and environment.
- Efficiency improvement in energy conservation process and utilities.
- Identifying the Energy conservation opportunities and implementing actions to minimize avoidable Losses.
- Continual effort for improvement in specific Energy consumption in all operations.
- Conducting Energy Audit and management review to continue actions for improvement on sustained basis.

## Commitment:

We dedicate ourselves to ensure efficient use of energy in all our organizational activities in the field of Aluminium Extraction.

*Production and Energy consumption salient features:-*

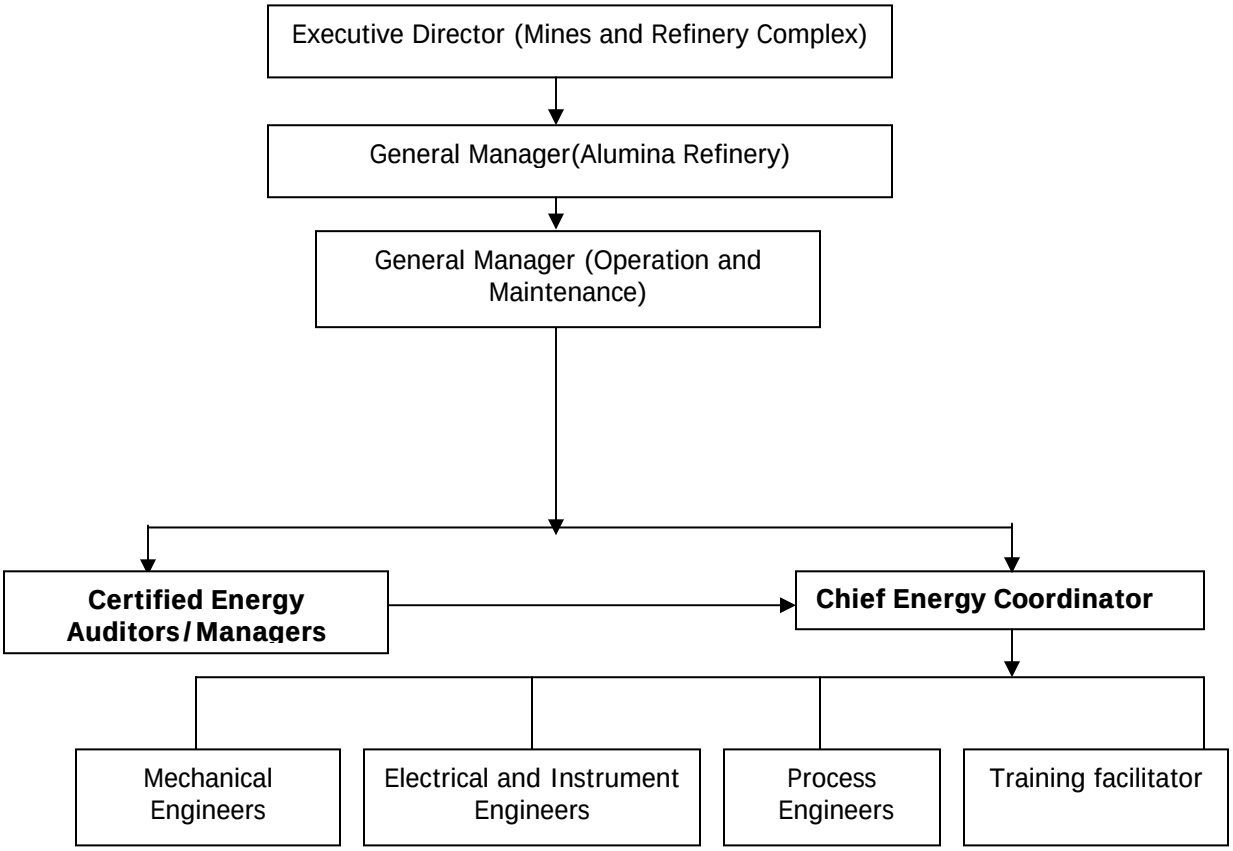
| Sl N | SPECIFIC POWER CONSUMPTION DETAILS | UNIT | 2004-05 | 2005-06 | 2006-07 |
|---|---|---|---|---|---|
| 1 | Annual Hydrate production | MT | 15,75,500 | 15,90,000 | 14,75,200 |
| 2 | Annual Calcined Alumina Production | MT | 15,66,720 | | |
| 3 | Power generation | MU | 350 | 358 | 325 |
| 4 | Total Thermal Energy Consumption | Million Kcal | 4976195 | 5072850 | 4659728 |
| 5. | Total Electrical Energy Consumption | Lakhs KWH | 5402.39 | 5377.00 | 5158.26 |
| 6. | Energy Cost as % of Manufacturing cost | % | 21.15 | 20.68 | 19.48 |

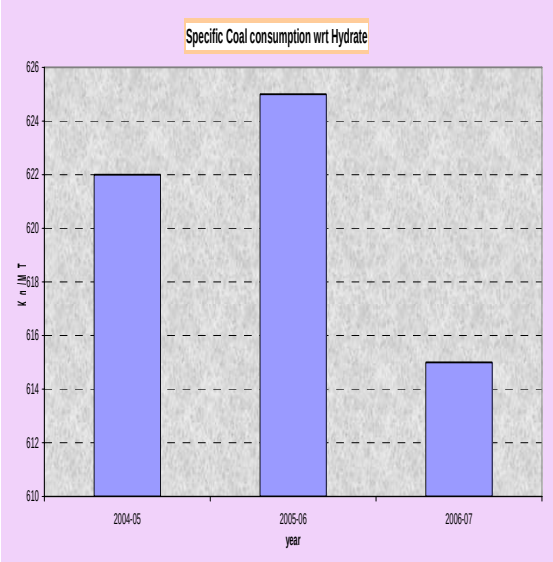
Energy Conservation Commitment Policy and Set up:-

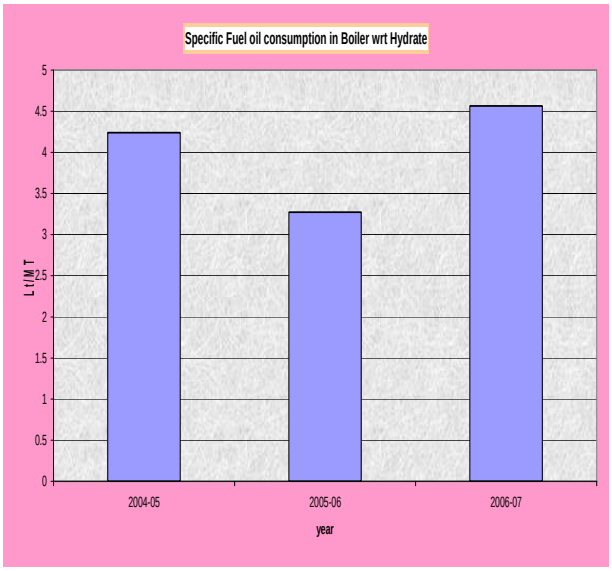
**Salient Features of Energy Conservation Cell:-**

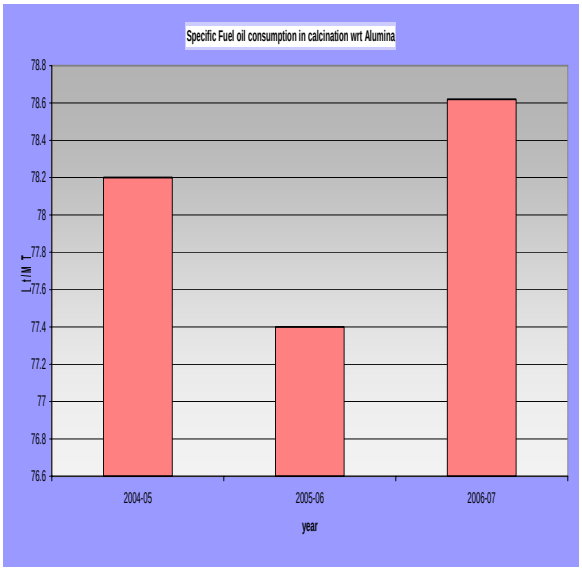
The Refinery Unit has Energy Conservation cell at Damanjodi, Orissa, headed by the D General Manager (Alumina Refinery) assisted by group of certified Energy Auditors/Managers and supported by engineers from each department forming a cross functional team. The team finds various energy saving potential in various processes and different working areas, brings the proposal to Energy cell for elaborate discussions and brain storming sessions for finalization and implementation. The unit is committed to fine tuning of operation, maintenance and other associated activities continuously to achieve the goal, technology up gradation with energy efficient process and equipment, and motivating and encouraging the employees to adhere different energy conservation practices in their working area as well as in daily life.

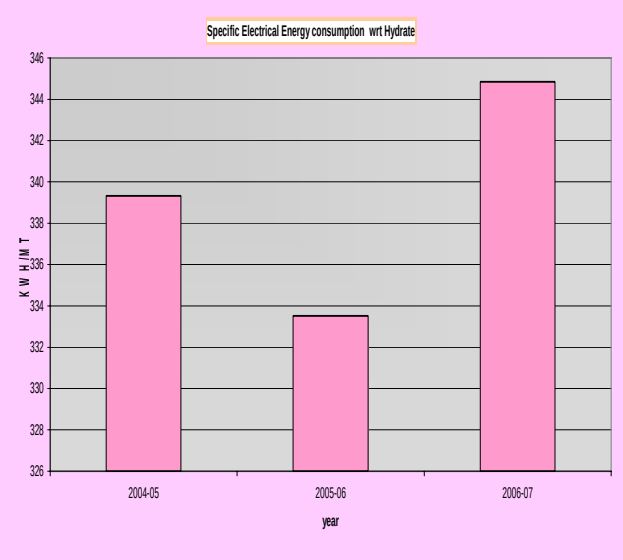
**Energy Conservation Cell Structure**

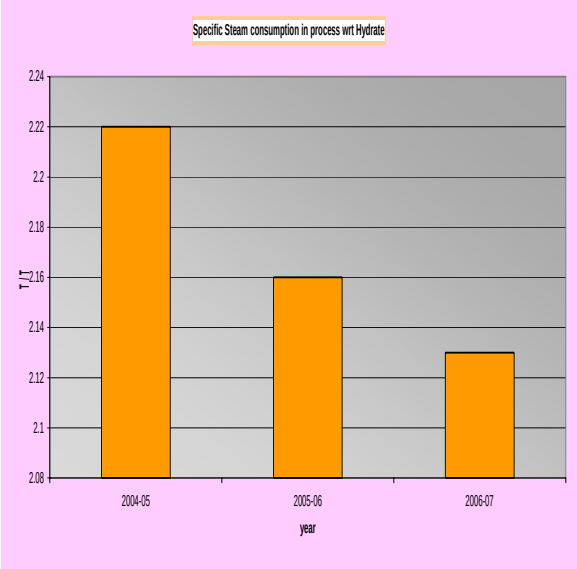


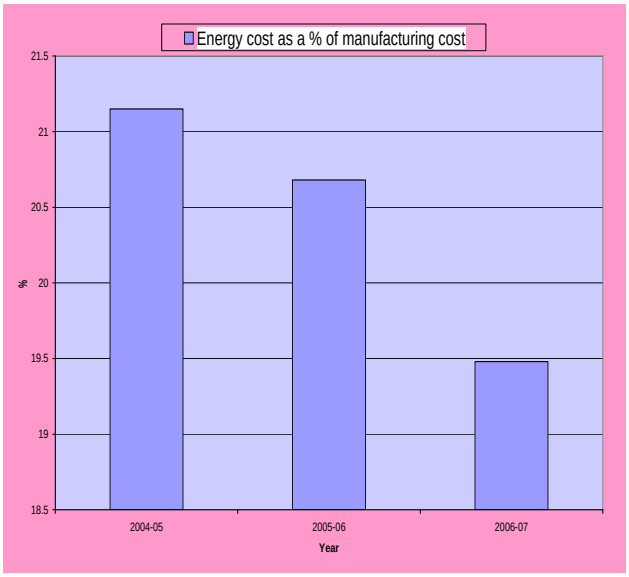

Specific Coal consumption wrt Hydrate
626
624
622
620
618
616
614
612
610
K n /M T
2004-05
2005-06
2006-07
year


Specific Fuel oil consumption in Boiler wrt Hydrate
5
4.5
4
3.5
3
2.5
2
1.5
1
0.5
0
L t/M T
2004-05
2005-06
2006-07
year


Specific Fuel oil consumption in calcination wrt Alumina
78.8
78.6
78.4
78.2
78
77.8
77.6
77.4
77.2
77
76.8
76.6
L t/M T
2004-05
2005-06
2006-07
year


Specific Electrical Energy consumption wrt Hydrate
346
344
342
340
338
336
334
332
330
328
326
K W H/M T
2004-05
2005-06
2006-07
year


Specific Steam consumption in process wrt Hydrate
2.24
2.22
2.2
2.18
2.16
2.14
2.12
2.1
2.08
T /T
2004-05
2005-06
2006-07
year


Energy cost as a % of manufacturing cost
21.5
21
20.5
20
19.5
19
18.5
%
2004-05
2005-06
2006-07
Year

**Energy Conservation Achievement in Alumina Refinery: -**

The Refinery unit of NALCO has implemented many energy saving proposals of small, medium scale. Details of energy Conservation Achievements in Alumina refinery for the year 2005-06 and 2006-07 along with financial benefits are as follows:-

**2005-06**

1) **Specific Coal Consumption**

Specific coal consumption for the year 2005-06 could be maintained in the level of 0.625T/T (0.622 T/T in 2004-05) in comparison to MOU target of 0.7 T/T.

(a) Reduction in specific steam consumption from a level of 2.87 T/T (total) to 2.79 T/T (total) even with increase in consumption in Zeolite & SGH plant with increase in production volume. Steam consumption reduced with reduction in evaporation load from a level of 4.13 T/T to 3.83 T/T. This is mainly due to

(i) Increase in liquor productivity from a level of 73.29 kg/m3 to 74.83 kg/m3.

(ii) Reduction in unauthorized water addition in process circuit.

(iii) Regular monitoring of steam and water loss in total process circuit and attending on priority basis.

(iv) Continuing to maintain the Quality parameters of steam i.e. pressure and temperature supplied to process, there by achieving optimal steam consumption.

(b) Optimal control of excess air to achieve efficient and complete combustion inside the furnace resulting improvement in Boiler performance.

(c) Improvement in Milling system output by proactive maintenance and time based replacement of critical spare parts like gearbox.

(d) Replacement of inefficient impellers of PA fans in each overhauling, thereby achieving adequate velocity profile of pulverized coal from Mill to furnace.

(e) Major repair/replacement of flue gas duct & repair of AH seals in Boilers, thereby arresting air infiltration into flue gas circuit thus achieving effective combustion.

(f) Rigorous monitoring of coal leakages and repairs.

The benefit in financial terms in comparison to MOU norms of specific coal consumption works out to

(0.075 T/T )X(1590000MT)X(Rs.1187.78) = 14,16,42,765 or **Rs14.43 cores.**

[Specific coal consumption w.r.t Hydrate: - 0.625 T/T (for the year 05-06)

: - 0.700 T/T (MOU target for 05-06)]

Improvement in specific coal consumption: - 0.075 T/T

Total Hydrate production in 2005-06: - 1590000 MT

Coal cost: - Rs.1187.78 per tonne of coal (2005-06)

2. Specific Fuel oil consumption in Calcination

The specific fuel oil consumption in Calciners was reduced during the year with following measures.

(a) Modification in old Calciners through Quality improvement projects. A hydrate by pass system was installed & commissioned in unit-A. The required materials are being procured for implementation in unit-B.

(b) Better capacity utilization of Calciners with higher production of hydrate beyond target.

(c) Maintaining the PTS of unit-A & B for operation of fine hydrate by-pass most of the time.

Specific oil consumption in Calciners reduced to a level of 77.40 lit/T from 78.20 lit/T achieved in 2004-05. In financial terms, the benefit works out to

(0.80/1000) X(1578000)X(Rs.15510.63)=Rs 1,95,80,619=Rs1.96 Cores

[Specific fuel oil consumption wrt Alumina:- 77.40LT/T ( for the year 05-06)

:- 78.20LT/T ( for The Year 04-05)

Improvement in specific Oil consumption:-0.80Lt/T

Total Alumina production in 2005-06:-1578000MT

Fuel cost (05-06): -Rs 15510.63 per KL of oil.

3. **Specific Fuel oil consumption in SPP**

Specific oil consumption in SPP could be reduced to a level of 3.272 lit/T from a level of 4.243 lit/T achieved in 2004-05. This could be achieved due to the following measures:-

- Changing the grinding Media quality from conventional manganese steel to better quality Hi-chrome steel in most of the Mills, Close monitoring of Mill fineness and periodical cleaning of coal Mill classifier ensures proper fineness of pulverized coal, thereby achieving efficient combustion and better furnace stability, thus restricting the requirement of taking oil support for furnace stability.
- Optimal control of secondary air to achieve efficient and complete combustion inside furnace, thereby eliminating the requirement of taking oil guns in case of furnace disturbance.
- Adhering to the improved maintenance philosophy of time based/ condition based replacement of critical spare parts like Mill gear box, thereby increasing Mill availability and ensuring the running of two Mills in each boiler, thus no requirement of oil support.
- Improved stabilization period after Boiler overhaul/ cold light up.

In financial terms the benefit works out to

(0.971/1000) X(1590000)X(Rs. 15510.63)=Rs 2,39,46,707=Rs.2.40 Cores

[Specific fuel oil consumption wrt Hydrate:- 3.272LT/T ( for the year 05-06)

:- 4.243LT/T ( for The Year 04-05)

Improvement in specific Oil consumption:-0.971Lt/T

Total Hydrate production in 2005-06 in 2005-06: - 1590000 MT

Fuel cost: -Rs 15510.63 per KL of oil.]

4. Specific Electrical Energy consumption

Specific electrical consumption for the alumina refinery dropped from a level of 339.32 kwh/T to 333.52 kwh/T with increase in consumption in Zeolite & SG main plant with increase in volume of production. This could be achieved due to

- Replacement of additional four cooling tower fans of SPP by FRP fans, thus achieving an average power saving of 25%.
- CT3 fan-1,2,3:-
- Power consumption in conventional Aluminum bladed fan:- 41.49KW
- Power consumption in FRP bladed fan:- 32.76KW
- Net saving of power:-8.73 KW per fan.
- CT3A fan-1:-
- Power consumption in conventional Aluminum bladed fan:- 21.45KW
- Power consumption in FRP bladed fan:- 15.29KW
- Net saving of power:-6.16 KW
- Running of two Cooling tower fans during cold weather lasting about five months in CT-3 of SPP in stead of three fans leading to a net saving of: -
  (45KW)X(24hrs)X(30days)X(5months)X(Rs.1.35)=Rs2.19lakh
- Running of one Seal air fan instead of two fans in Boilers after attending the seal leakage and introduction of orifices in the seal airline, thus optimizing the seal airflow.
- Closing the manual recirculation valve of running MW pumps and BFPs, thereby reducing the burden on the pump and reducing power consumption.
- Conversion of mechanical variable speed drive to frequency controlled drive in alumina plant (4 nos.)
- Reduction in idle running of seed filters and coal mills by introducing interlocks in logic circuit.

In financial terms, the benefit out of total electrical energy consumption works out to
(339.32-333.52KWH/T)X(1590000X(Rs.1.35)=Rs 1,24,49,700= **Rs 1.24cores**
[Specific Electrical Energy consumption (total):- 333.52KWH/T (for the year 05-06)
339.32KWH/T(for the year 04-05)
Improvement in specific Elect. energy consumption:-5.80KWH/T
Total hydrate production in the Year 2005-06 :-1590000MT
Power cost:-Rs1.35 per unit of electricity.]

Overall specific prime energy consumption continued to remain as 13.91GJ/MT against the norm of 15.6GJ/MT because of above important energy conservation measures taken in addition to increased general awareness and close monitoring**.**

**2006-07**

**1. Installation of Hydrate by-pass system in Calciner- A**

Hydrate by-pass system helps Calcining a part of hydrate fed from the heat available with hot product, thereby reducing temperature of product Alumina and saving fuel oil to the tune of 0.5 to 1.0 litre per MT of production.

Even if we consider fuel oil saving of 0.5 litre/T of production, this will result in a monetary saving of (0.5X18.5X15,65,000 X17/54) or **Rs 45.57 lacs a year**.

(18.5 is the cost of fuel oil per litre, 15,65,000 is annual production of Calcined Alumina & 17/54 is ratio of Calciner-A production to the total production)

**2. Use of Spent liquor for Product Filter O/F line flushing instead of wash filtrate**

Necessary modification has been carried out to use Spent Liquor for flushing of product filter overflow lines instead of wash filtrate. As soda concentration of spent liquor (153-154gpl) is substantially higher than that of wash filtrate (40-45 gpl), it drastically reduces circuit dilution and evaporation load (MT of water evaporated per MT of production). The effect of the above change has duly reflected on evaporation load. In spite of substantially higher rainfall during the current year (2.22 metre against 1.46 metre during 2005-06), there has been reduction in evaporation load by 0.03 T/T of production. Considering a steam economy of 2.9 T/T, this is equivalent to steam saving of 0.0103 T/T of production. In monetary term, this works out to (0.0103X0.23X1000X15,75,000) or **Rs. 37 lacs a year.**

(Where 0.23 is coal consumption per MT of steam, Rs. 1000 is the cost per MT of coal and 15,75,000 MT is annual prodution)

5. **Operation of Condensate Polishing Unit resulted in the following advantages:** -
   - Filter water consumption has reduced; burden on DM plant and water Intake was there fore less.
   - Higher DM water temperature from CPU enhanced the Boiler cycle efficiency and there is reduction in coal consumption.

   In the year 2006-07, 49691 MT of DM water was generated from CPU. This has resulted in a saving of Rs(49691X20.66)=**Rs 10.26 lakhs(Approx)**

**4. Optimisation of pressure drop across three element control valve in Boiler 4:**

a. Previous pressure drop across three element control valve was 10Kg/$cm^2$ resulting in increased pressure loss & energy loss.
b. Pressure drop reduced to 6.5Kg/$cm^2$. Power saving 50KW.
c. Implemented in March 07. Expected Annual saving Rs. 5.80 lakhs.

**5. Other Energy conservation measures undertaken: -**

a. Conversion of conventional fluid coupling to modern variable speed drive in two drives (pump-144 and pump-145) in 06 area.

b. Conversion of three numbers DC drives to AC drive in 06 area.

c. Introducing suitable interlocks for stopping idle running of Kelly filter hydraulic pumps.

d. Provision of timer for switching off of lights in reclaimer area during day time.

6. **Detailed Energy audit in Alumina Refinery**: -

Detailed energy audit of alumina refinery has been completed in three phases. Detailed report from CII is awaited. The preliminary report has identified 32 energy conservation measures. Upon receipt of report, plan for implementation will be made.

**Environment and safety:-**

The unit is located in an environmentally sensitive area and has taken majors not only to preserve the environment around its surrounding but also to improve upon them. As a socially committed organization NALCO takes care to improve the lot of the peripheral villages and the project affected persons to a forward looking rehabilitation and resettlement policy.

The Plant is certified to ISO 14001:2004 and OHSAS:-18001:1999 standards. the plant needs all the applicable environment and safety guidelines and laws.

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