

National Aluminium Company Limited

Smelter Plant, Angul, Orissa

Company Profile

National Aluminium Company Limited (NALCO) is the only Public Sector Undertaking in India producing alumina, primary aluminium and semi-finished products. NALCO is a Star Trading House and has received highest Capexil awards many times for excellent export performance. NALCO is the largest integrated Aluminium Complex with operations spanning from mining, refining, power generation, smelting and production of value added products such as strips, billets, sheets etc. Since inception of the company NALCO has produced high purity aluminium, alumina and established itself in both domestic and international market. The products are registered in London Metal Exchange (LME). NALCO has not only addressed the need for self-sufficiency of the country but also has given the country the technological edge in producing this metal to the best of world standards. NALCO is one the profit making PSUs and Mini Ratnas which has always strived to produce high quality metal and alumina with state-of-the-art technology. NALCO is an early adopter of best of technology and has always believed in continuous upgradation and renovation which have resulted in minimizing cost of production and better quality products.

Unit Profile

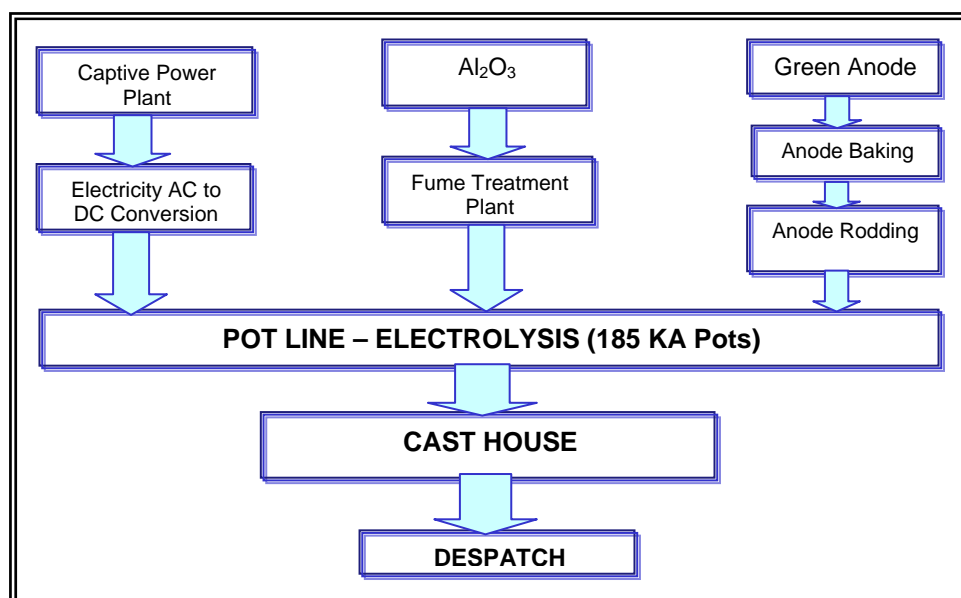
Smelter unit is located in Angul district of Orissa. The Smelter unit has increased its production capacity from 2,30,000 MT to 3,45,000 MT with the commissioning of 3rd Pot Line consisting of 240 electrolytic pots. There are total 720 pots of 185 KA rating. Smelter unit has adopted technology from Aluminium Pechiney, France. The unit is again undergoing capacity expansion from 3,45,000 MT to 4,60,000 MT. The new pots are expected to be commissioned by Sept'2008.

NALCO's smelter unit has received ISO 9001, 2000 certificate from RWTUV, Germany. It has made constant efforts to implement Quality Management System by employee involvement through Quality Circles and Quality Improvement Projects. Smelter unit's quality circles have participated in various national and international level competitions and received many awards. Smelter unit is also certified for ISO 14001 from RWTUV and it is also going for OHSAS 18001 certification. Preliminary assessment audit is over and final certification audit shall be carried out in the month Sept'2005.

NALCO smelter unit is also the recipient of many more awards such as:

- 1) National award on Excellence in Energy Management, from CII, 2004.
- 2) Best Energy Conservation Project Implemented for the year 2004, from CII.
- 3) FIMI environment award 2000 -01
- 4) Indira Gandhi Paryavaran Award, 2000
- 5) State Pollution control award – 2002.
- 6) FICCI Award for pollution control and environment, 1996 – 97.

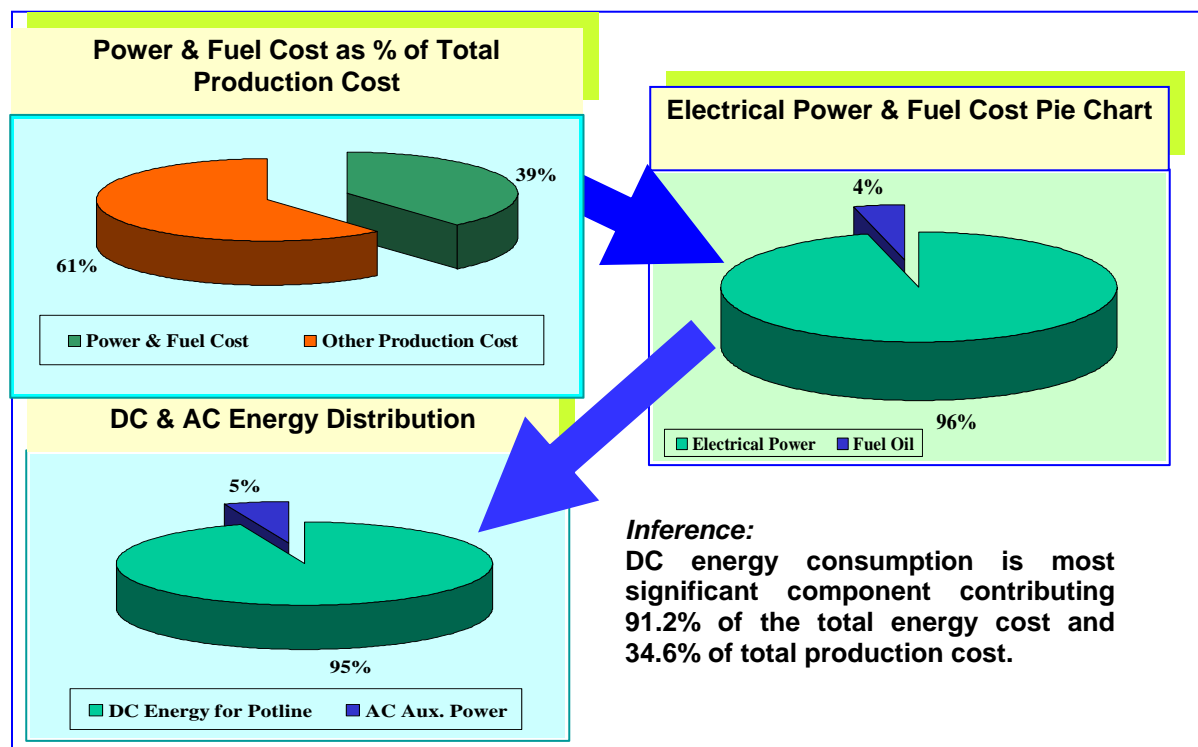
Process Flow Chart



Energy Consumption

Aluminium production is the most energy intensive process. For the smelter unit, energy cost is 39.71 % of total production cost and out of total energy consumption electrical energy is 96 % and the rest is thermal energy i.e. fuel oil consumption contributes to only 4 % of total energy consumption. Fuel oil consumption is mainly due to baking of anodes and for operation of Melting cum Holding furnaces of Cast House. Out of 96% electrical energy use the DC energy used in Pot Lines for Electrolysis process is 91%.

Graphical Representation of Energy cost and energy break up



Specific DC energy consumption = $2.98 \times (\text{Volts/Pot}) / (\text{Current Efficiency})$

Hence DC Energy consumption can be decreased by

- Reducing Volts/Pot
- Increasing Current Efficiency

In the past NALCO has taken several steps to reduce volts / pot and increase current efficiency. Some of the measures already implemented as follows:

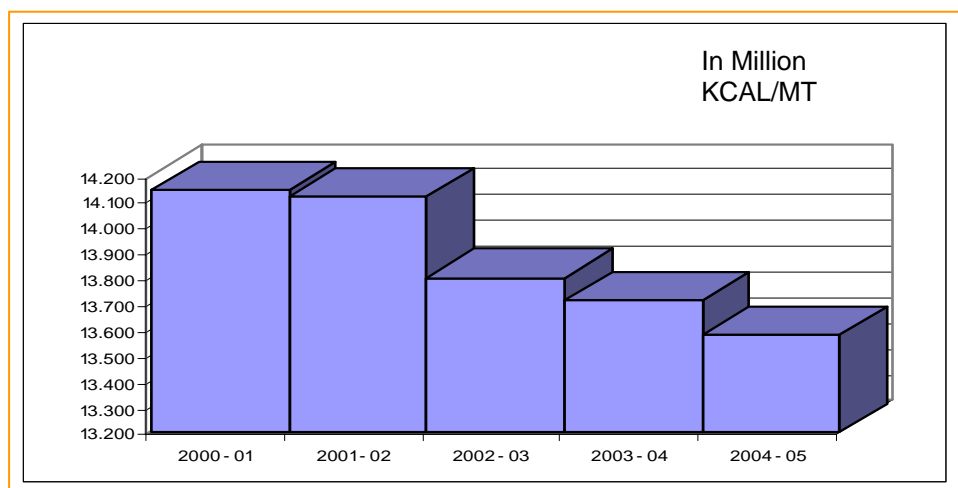
- Advanced pot regulation system adopted to reduce Volts/Pot from 4.32 to 4.27
- Better resistance control achieved through Advanced Pot Regulation system.
- Stem beam drop reduced from 50 mv to 35 mv through modifications carried out in stem brushing.
- Pot lining changed to semi-graphitic cathode blocks from anthracite blocks to reduce cathode drop by 20 mv.
- Improvement in current efficiency by improving AlF_3 conformance in bath & anode reactivity by better baking.

Smelter unit has always strived to reduce specific electrical and thermal energy consumption by improving several operating practices, adopting best of technologies and doing in-house R&D projects. NALCO has also gone for mathematical modeling and heat balance of pots for improving energy consumption figure.

DESCRIPTION	UNIT	2002-03	2003-04	2004 – 05
Total Production of Cast Metal	MT	244708	298207	338483
Total electrical energy consumption	Lakhs KWH	36456.60	44423.90	50034.56
Specific electrical energy consumption	KWH/MT	14898	14897	14782
Total Thermal (Fuel) Consumption / Annum	Million KCal/year	242498.50	269082.71	298625.14
Specific energy consumption – for HFO & LDO	Million KCal/tonne	0.9910	0.9023	0.8822
Energy Cost as % of Manufacturing cost	Percentage	38.1 %	37.76 %	39.71%

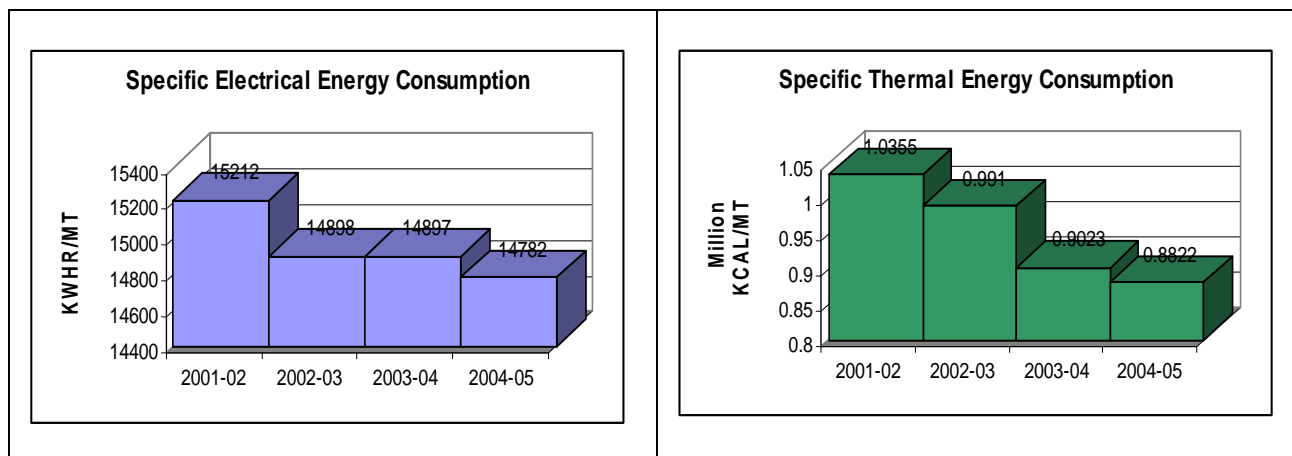
Year	Electricity		Thermal (Fuel :HFO + LDO)	
	Consumption (Kwt/MT)	% Reduction over 2002-03	Consumption (MKCal/MT)	% Reduction over 2002-03
2002 – 2003	14898	-	0.9910	-
2003 – 2004	14897	0.0067%	0.9023	8.95%
2004 - 2005	14782	0.779%	0.8822	10.979%
Year	Electricity		Thermal (Fuel :HFO + LDO)	
	Consumption (Kwt/MT)	% Reduction over 2003-04	Consumption (MKCal/MT)	% Reduction over 2003-04
2003 - 2004	14897	-	0.9023	-
2004 - 2005	14782	0.772%	0.8822	2.228%

Graphical Representation of Specific energy Consumption

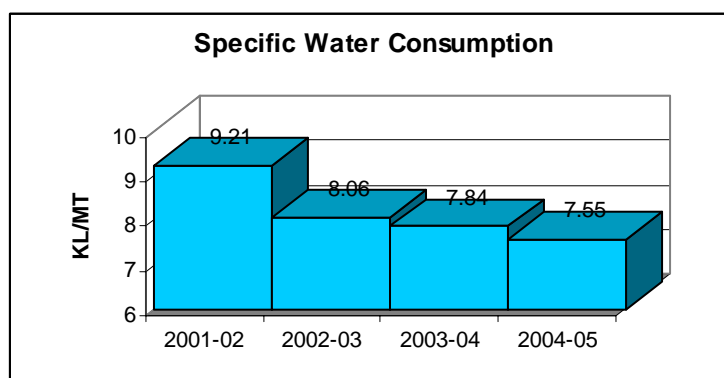


YEAR	2000-01	2001-02	2002-03	2003-04	2004-05
Specific Energy Million KCal/MT	14.142	14.115	13.80	13.711	13.576

Trend of Electrical and Thermal energy consumption:



Graphical representation of Water consumption



Energy Conservation Commitment, Policy and Organizational Set up

Smelter unit has constituted an Energy Conservation Cell (ECC) under the Chairmanship of General Manager (O&M). A senior DGM (Electrical) has been nominated as Energy Manager and he is also the convener of Energy Cell. Members of ECC have also been nominated from various cross functional departments e.g. Production, Maintenance, R&D etc. The ECC members meet regularly to discuss various strategies and action plans to implement energy conservation measures in line with NALCO's energy conservation policy and objectives. Apart from that small group activity (SGA) involving employees from various functions and levels and Quality Circle teams are encouraged to work on energy saving projects. The small groups identify scope for improvement and implement energy conservation projects. NALCO has a reward scheme named "Sarjana" for felicitating employees.

Seminars, presentations are carried out from time to time to create awareness among the employees and action is formulated to achieve target of energy conservation. In the 3rd Aluminium Task Force held at HINDALCO, Hirakud, NALCO's QC teams presented energy savings projects implemented by them successfully. A special training programme on 'Efficient use of Energy' was conducted to train 34 engineers by inviting external faculties from M/s Devki Consultancy Pvt. Ltd. Internal auditors nominated have passed written examination of 2nd National Level Energy Auditor Exam 2005 conducted by BEE. Once they become certified auditors, internal audit activities will start. We have recently conducted one energy survey by CII, Godrej GBC. An annual energy saving potential of Rs.125 Lakhs has been identified. A detailed energy audit is planned to be conducted this financial year.

As per the direction of BEE, we have conducted Energy Conservation Awareness Programme for school students. In the first phase we have conducted the programme in three schools and plan to do the same in many schools.

Main functions of ECC are as follows:

- ❖ Preparation of annual activity plan in line with energy policy & strategy, target setting and responsibility assignment.
- ❖ Ensure proper measurement of different types of energy.
- ❖ Calibration of measuring equipments.
- ❖ Reporting on various kinds of energy consumption.
- ❖ Conducting training programmes, seminars, presentations on energy conservation.
- ❖ Encouraging improvement projects through SGA (Small Group Activities).
- ❖ Development of auditors for system audit.

Monitoring and Measuring Functions

Monitoring of Energy consumption patterns is done on Daily, Monthly and Yearly basis. The formats are prepared by Technical Services (MIS) Dept. and Electrical Power Distribution Department. NALCO signs Memorandum of Understanding (MOU) with Ministry of Mines to achieve target Energy consumption figure such as specific DC energy consumption and fuel oil consumption. This is monitored at the highest level and NALCO has always received Excellent grade in achieving MOU targets.

Major Energy Conservation projects implemented during 2004 – 05:

1. Reduction in Resistivity of Baked Anodes:

Previous Practice: The carbon anodes to be used in pots were baked at 1070 Deg C for reducing resistivity of the anodes. Resistivity achieved was 62.33 Micro Ohm mtr.

Present Practice:

1. Anodes are baked at 1090 Deg C to achieve better resistivity. Average resistivity has decreased from 62.33 Micro Ohm to 60.18 Micro Ohm mtr.
2. Heating rate is controlled to minimize micro cracks. This also helps in reducing resistivity.

Investment: Nil

Energy Saved: 73.65 Lakh KWH.

Money saved: Rs. 98.69 Lakhs

2. Improvement in current eff. by improving AIF3 conformance in Bath for Pot Lines 1 & 2

Ideal Operation: The ideal composition of AIF3 in bath is 11.5% + / - 1%.

Previous Practice: Previously AIF3 feeding in bath was being done based on historical consumption pattern. The conformance achieved was around 35%.

Present Practice:

Feeding of AIF3 in bath has been made more scientific based on bath analysis, history and consumption rate. This has resulted in improved conformance of around 50% i.e. an improvement of 15%.

Investment: Nil

Energy Saved: 355.720 Lakh KWH.

Money saved: Rs. 476.66 Lakhs

3. Reduction of Power of Hydraulic power pack of Hooking Unhooking station by increasing bore size.

- Hydraulic power pack operating pressure was reduced from 200 Bar to 140 Bar by increasing bore size from 160 mm to 200 mm.

- Total Investment : Nil
- Total energy saved per year: 8500 KWHR
- Money saved: Rs.11390/-

4. Optimisation of atomizing air of Melting Furnace # 2 by resizing of motor and changing pulley of air compressor.

- Motor rating reduced from 15 KW to 11 KW, motor RPM reduced from 2850 RPM to 1460 RPM.
- Pulley diameter also changed to match the compressed air requirement.
- Investment : Negligible (Old spare motor used)
- Savings : 28800 KWHR per annum
- Money saved: Rs.38,592/- per annum.

5. Modification of burner ramp heating regulation thermocouple arrangement system of Bake Oven -1:

- Previously thermocouple were failing frequently causing improper firing and wastages of fuel oil.
- Thermo-couple locations changed and thermo couple cables were rerouted.
- To avoid direct contact of thermocouple neck with furnace top an additional neck was added.
- Break down hour reduced from - 1200 to 32 Hrs. per year
- Maintenance cost saved Rs._75,27,064/- per year.
- Oil consumption saved substantially as there was proper firing.