

National Aluminum Company Limited (NALCO)

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The East Coast bauxite discovery led to the setting up of India's largest Alumina-Aluminium complex, National Aluminium Company Ltd (NALCO) in 1981 following technical collaboration agreement with Aluminium Pechiney of France. The project cost of ` 2,408 crore was part financed by 980 million euro dollar loan extended by a consortium of International banks. The Company has long back prepaid the loan, besides contributing more than ` 16,000 crore to Central and State exchequer as tax and duties etc, besides having huge cash reserve for future growth activities.



Hon'ble Minister of Finance Shri Pranab Mukherjee delivering a speech on Foundation Day of NALCO on 9th January 2011

Presently, Govt. of India holds 87.15% share in NALCO. It is an integrated and diversified mining, metal and power group 'A' CPSE with annual sales of ` 6,370 crores in FY10-11. The Company has bulk shipment facilities at Vizag port, besides utilizing the facilities at Kolkata and Paradeep ports.

With the emergence of NALCO on the aluminium scene, there has been a quantum jump in alumina and aluminium production in the country. NALCO is the 1st Public Sector Company in the country to venture into International market in a big way with LME registration since May 1989. Export sales account for almost 30-35% of its turnover with business in more than 30 countries in recent past. Its alumina and metal enjoy premium in world market on account of quality and international standard.

The production units at NALCO are operating consistently near or more than 100% capacity. Due to its consistent track record in managing operations and improving costs and output, the Company has been accorded prestigious 'Navratna' status by Govt. of India in 2008. NALCO is one of the lowest cost producers of alumina and aluminium in the world.

The Company is listed at Bombay stock exchange (BSE) since 1992. Besides, ISO 9002, ISO 14001 & OHSAS 18000 certifications, the Company has also adopted SA 8000 International Standards, for Corporate Social Accountability.

For its genuine concern and care of the locals, the Company has endeared itself to the people of the State. For its care for ecology and environment, the Company has received the coveted 'Indira Priyadarshini Vrikshamitra Award' and 'Indira Gandhi Paryavaran Puraskar'.

In addition to existing operations, NALCO has extensive plans for brown field and green field expansion projects worth ` 40,000 crore in the country and abroad. Further, the Company has taken up steps for commissioning of allotted coal block (Utkal-E in Odisha) at a cost of ` 338 crore. At the same time, to offset the vagaries of international market related to aluminium, NALCO is looking beyond its core strength and venturing into other metals and energy sectors. NALCO has signed agreement with Nuclear Power Corporation of India Limited (NPCIL) to form a joint venture Company for establishment of 2X 700 MW nuclear power plants at Kakrapara in Gujarat, where the construction work has already started. To harness the non-conventional energy source, the Company is setting up a wind power project of 50.4 MW capacity in Andhra Pradesh for which order has been placed in June, 2011. The Company has also been shortlisted by Govt. of Gujarat for alumina refinery.

10.8 NALCO has plans to set up thermal power plants as independent power project (IPP) and even Ultra Mega Power Projects(UMPP) and exploring for solar plants also. Further, the Company is developing bauxite mines (Gudem and KR Konda in Andhra Pradesh and likely to start Pottangi in Odisha); besides setting up forward and backward integration projects.



Hon'ble Minister of State for Mines (I/C) receiving the dividend cheque from acting CMD (NALCO) in the presence of the then Secretary (Mines) Shri Vijay Kumar and Additional Secretary (Mines) Shri S.K. Srivastava

Leveraging the technical collaboration with Aluminium Pechiney (now Rio Tinto Alcan) since 1982, NALCO has continued to add value and is poised to grow further.

Bauxite Mine

The Company mines bauxite requirements which is the primary raw material used to produce alumina. This bauxite mine is situated on a hill in Damanjodi, Koraput, in the State of Odisha. This plateau bauxite deposit is mined by a fully mechanised system at a capacity of 6.3 million tonnes per year.

The Panchpatmalli plateau stands at elevation of 1154 meter to 1366 meter above mean sea level. Bauxite occurs over the full length of the Panchpatmali plateau, which spans over 18 kms.

Alumina Refinery

The alumina refinery is located at Damanjodi, Odisha, approximately 14 kms from the bauxite mine at Panchpatmali. The mined out bauxite from captive mine is transported to refinery by a 14.6 km long single flight multi curve 1,800 tonnes per hour (TPH) capacity cable belt conveyor. The alumina produced is transported to aluminum smelter at Angul and to Vizag port storage and handling facilities by rail for export.

The present capacity of alumina refinery is 2.1 million tonnes per year, consisting of four production lines of 525,000 metric tonnes each. The capacity is being augmented to 2.275 million tonnes per year under 4th stream up-gradation project at an estimated cost of ` 409 crore. Alumina produced is used to meet Company's own requirements for production of primary aluminum at smelter. The surplus alumina that remains after internal consumption is sold to third parties in the export markets.



Calcination plant at Alumina Refinery of NALCO, after 2nd phase expansion.

Aluminum Smelter

The aluminum smelter is located at Angul, Odisha, approximately 699 kms, from refinery and 5km away from captive thermal power plant. The aluminum produced at aluminum smelter is transported to Vizag port storage and handling facilities (564 km away) and the Paradeep port (194 km away) by rail for export.

The aluminum smelter started production progressively from 1987. After completion of 2nd phase expansion in December, 2009, the present capacity of smelter is 4.60 lakh tonnes per year, which is being augmented to 5.67 lakh tonnes per year under current amperage up-gradation project from present 180 KA to 220 KA in phases. Alumina is converted into primary aluminum through a smelting process using electrolytic reduction. From the pot-line, the molten aluminum is routed to either NALCO's casting units, where the aluminum is cast into ingots, sow ingots, tee ingots, billets, wire rods, cast strips and alloy ingots, or to holding furnaces at flat aluminum products unit where the molten aluminum can be rolled into various cold-rolled products or casted into aluminum strips.

Captive Power Plant

The coal based captive power plant is located at Angul approximately 5 kms away from aluminum smelter with access to low cost electric power and minimal transmission losses.

The location of captive thermal power plant at Angul is also strategic to the coal availability and supply. The Company sources major coal requirement for captive thermal power plant from the Talcher coalfields of Mahanadi Coalfield Ltd. located approximately 15 kms from Angul. The 18.5 kms captive railway system links the captive thermal power plant to the Talcher coalfields, enabling it to transport the critical and bulk requirement of coal at relatively low cost.

The captive thermal power plant commenced operations in 1986. Presently the captive thermal power plant has generation capacity of 1200 MW with 10 turbo-generators, each rated at 120 MW. While the captive thermal power plant provides entire electric power requirement of aluminum smelter, it also provides for approximately 35% of the power requirement of alumina refinery plant.

Physical performance, Financial performance and sales performance from 2009-2010 to 2011-2012 are shown at Table 10.1, 10.2 and Table 10.3.

Table 10.1
Physical Performance of NALCO

Product	Unit	2009-10 Actual	2010-11 Actual	Target for 2011-12	2011-12 Actual up to Dec'11	2011-12 Estimated Jan'12 to Mar'12
Bauxite	MT	48,78,888	48,23,909	60,00,000	37,08,359	12,00,000
Alumina Hydrate production	MT	15,91,500	15,56,000	20,00,000	12,18,300	4,81,700
Aluminium Metal Production	MT	4,31,488	4,43,597	4,38,000	3,09,018	1,00,983
Net Power Generation	MU	6,295	6,608	7,160	4,597	1,685

MT- Metric Tonnes

MU- Million Tonnes

Table 10.2
Financial Performance of NALCO

(` in crore)

Sl. No.	Details	2009-10 Actual	2010-11 Actual	Target for FY 2011-12	Actual up to Nov'11	Estimated Dec'11 to Mar'12
1.	Income	5,549	6,418	7,315	4,696	2619
2.	Operating Cost	4,073	4,471	5,590	3,634	1955
3.	Depreciation	319	422	459	301	158
4.	Net Profit before Tax (PBT)	1,155	1,525	1,367	760	506
5.	Net Profit after Tax (PAT)	814	1,069	1,266	761	330
6.	Dividend Paid	161.07	257.72	-	-	

Table 10.3
Sales Performance of NALCO

Product	Unit	2009-10 Actual	2010-11 Actual	Target for 2011-12	2011-12	
					Actual up to Dec'11	Expected (Jan.-Mar.'12)
Aluminium -Export	MT	146,948	98,200	98,000	66,813	31,187
Aluminium - Domestic	MT	289,031	340,752	340,000	242,235	70,350
Total Aluminium Sale	MT	435,979	438,952	438,000	309,048	101,537
Alumina/Hydrate	MT	744,048	681,917	1,054,380	557,102	252,000

Export/Import Performance

10.20 Under the Foreign Trade Policy 2009-10, NALCO has been granted with 'Premier Trading House Status' for achievement in export target. Certificate of recognition as Premier Trading House has been issued on 30th September, 2009 which is valid upto 31th March, 2014. Premier Trading House status is the highest status awarded to any Export House by Govt. of India. NALCO has achieved export earnings of ` 2,065 crore in the year 2010-11 and ` 1,493 crore during the year 2011-12 upto November, 2011.

Memorandum of Understanding (MoU) Rating of NALCO during last three years is given below:-

Year	Composite Score	Grade
2008-09	1.78	Very Good
2009-10	2.06	Very Good
2010-11	2.35(Prov.)	Very Good

On-Going Projects

Utkal-E Coal Block

Ministry of Coal, Govt. of India had allocated Utkal-E coal block in August, 2004 to meet the coal requirement for 9th & 10th as well as proposed 11th & 12th captive power plant units of NALCO, at Angul. As per the feasibility report, the total mineable reserve of Utkal-E coal block is 67.49 million tonnes. The mine life works out to over 30 years at the target production of 2.0 million tonnes per year. The estimated cost of the project is ` 337.61 crore at May, 2011 price level, with internal rate of return (IRR) of 34%.

10.23 PRESENT STATUS

- The activities have picked up in real sense after getting the environmental clearance from M/o of Environment & Forests (MOEF) in December, 2009.

- After consistent follow up by the Ministry of Mines with Ministry of Coal, mining lease of the block has been recommended to Govt. of Odisha vide letter dated 14.06.2011 for approval.
- Presently, the Company is pursuing with MOEF for stage-I forest clearance.

The Brief Status of other recent activities indicated as under:

- Water allocation granted by State Water Resource Dept. in October, 2010.
- The final award register for private land acquisition in mining lease area is in preparation.
- Land acquisition for construction of R&R Colony is in advance stage. Tender document for appointment of an agency for construction of R&R Colony submitted by 3 parties are under evaluation.

4TH STREAM UP-GRADATION PROJECT OF ALUMINA REFINERY

Upgradation of 4th stream of alumina refinery from 5.25 lakh TPY to 7.0 lakh TPY and that of bauxite mines from 6.3 million TPY to 6.825 million TPY was approved by Board at an estimated project cost of ` 409 crore with 21.08.2008 as the “Zero Date”.

PRESENT STATUS

Cumulative physical progress achieved is 80% as of December, 2011. Backlog is attributed to the delay in start of civil & structural works due to late receipt of environmental clearance (obtained on 11.05.10) from MOEF.

50 MW WIND POWER PLANT

The Company has started work in June, 2011 for a 50 MW wind power plant in Andhra Pradesh at an investment of ` 274 crore, scheduled to be commissioned in March, 2012.

Expansion and Diversification

Expansion

Status of 2nd Phase Expansion. The Government of India accorded approval for 2nd Phase Expansion of mines, alumina refinery, aluminium smelter and captive power plant of NALCO on 26th October, 2004 at an outlay of ` 4091.51 crore with a completion period of 50 months from date of approval. The project cost has been revised to ` 4402 crore at November, 2008 price level by the Company. With the commissioning of 4th stream of alumina refinery in June, 2011, the 2nd phase expansion project stands completed. The capacity of the various project segments before and after 2nd phase expansion is given at Table 10.4.

Table 10.4

Sl. No.	Project Segment	Capacity after 1st phase Expansion	Capacity after 2nd Phase Expansion
A	Bauxite Mine	48 Lakh TPY	63 Lakh TPY
B	Alumina Refinery	15.75 Lakh TPY	21 Lakh TPY
C	Aluminium Smelter	3.45 Lakh TPY	4.6 Lakh TPY
D	Captive Power Plant	960 MW	1,200 MW

10.28 Greenfield Growth Projects in India:

- NALCO has planned to set a Greenfield smelter and power plant in Sundargarh district in Odisha at an estimated investment of ` 13,500 crore. As advised by the State Govt., NALCO is assessing water availability at the proposed location, based on which Company's proposal is likely to be approved.
- NALCO has been granted mining leases over Gudem and KR Konda bauxite reserves in Andhra Pradesh. Based on the above bauxite reserves, the Company plans to set up a 4.2 million tones per annum (MTPA) bauxite mines and 1.4 MTPA alumina refinery complex in Andhra Pradesh at an investment of ` 5,600 crore. Considering the sensitivity associated with bauxite mining in the tribal dominated areas, the Company is not undertaking any field activities, except for some CSR endeavours.
- NALCO is pursuing to set up an 1.0 million tonnes alumina refinery in Gujarat, based on supply of bauxite from Kutch region by Gujarat Mineral Development Corporation (GMDC).

Greenfield Growth Projects abroad:

NALCO is exploring to set up a 0.5 MTPA smelter and a 1250 MW CPP in Indonesia considering availability of abundant quantity of coal at economic price. The estimated investment for the project is ` 16,500 crore. The Company has prepared feasibility report and has opened a project office in Jakarta to take up the pre-project activities. Presently, the Company is finalising the coal sourcing arrangement for the project.

10.30 Diversification:

- NALCO has signed the Joint Venture agreement with Nuclear Power Corporation of India (NPCIL) to build Kakrapar - 3 & 4 nuclear power plant at Kakrapar Gujarat. The Company would be initially investing Rs. 894 crore towards 26% equity, which would be subsequently enhanced to 49%. The construction of the plant is at advance stage.
- NALCO, being committed to green power generation, plans to set up another wind power plant of 50 MW capacity on EPC basis in any wind potential State in India, for which it has invited commercial offers from wind farm developers. Similarly, the Company is also exploring to set up 15 MW solar power project on EPC basis.

10.31 New Schemes:

- NALCO is exploring to set up a specialty alumina plant at Damanjodi in Joint Venture (JV) with a firm having technology for production of specialty alumina products.
- NALCO has signed with a MoU with Indian Rare Earth Ltd. (IREL) for establishment of titanium complex in JV in the premises of Orissa Sand Complex of IREL at Chhatrapur in Odisha.
- NALCO will have 49% equity in the proposed JV. Presently, the Company along with IREL is in process of selection of appropriate technology for the project.
- NALCO has signed a MoU with Power Grid to set up aluminium conductor plant in JV.
- As a matter of backward integration, NALCO has proposed to set up a Caustic Soda plant in joint venture with GACL.

10.32 Energy Conservation

NALCO carries out the energy conservation measures exceedingly well in all its units. Its smelter unit has been awarded with prestigious National Energy Conservation Award by Ministry of Power in succession for last two years. NALCO is carrying out energy conservation measures through Small Group Activities (SGAs) by enhancing the energy efficiency in its different activities and processes.

The energy conservation measures adopted by NALCO in its different units during the year, are as under:

Automatic shut down / switching off of equipments and lights during idle time, installation of energy efficient lighting products (T-5 fluorescent fittings, electronic ballasts, etc.), installation of energy meters for effective monitoring and control of energy consumption, installation of variable frequency drives in various pumps and drives like makeup water pumps in boiler-4, power house-3, green liquor pumps, digestion and dilution pump, 23 various drives in refinery, cooling towers fans of CPP, cable belt and auxiliary system at mines, etc.

Reduction of DC energy consumption in pot lines, incorporation of magnetic resonator in HFO lines of furnaces to achieve better fuel efficiency, introduction of slotted anodes in pot lines for reducing the pot voltage, installation of modified Re-cuperator in melting furnace of caster-1 in rolling plant in the smelter plant.

Installation of heating coil in pre desilication heating tanks to decrease steam consumption & process dilution, installation of standby dump condenser to avoid water and heat energy loss in case of low process demand, optimisation of motor rating for inter stage coolers, installation of magna drive coupling in conveyor-6A in the alumina refinery.

Installation of energy saving blades in cooling towers of unit 1 and 6, on-line monitoring of high energy drains installed in unit #6, installation of intelligent power controllers in NALCO's captive power plant.

Introduction of solar LED street light general illumination, replacement of low capacity transformer by high capacity transformer based on load requirement to save power in Company's bauxite mines.

Being a Navratna Company, NALCO is committed for optimizing its process efficiency and reducing the energy consumption for its own benefit as well as in the greater interest of the nation at large.

10.33 Computerisation

NALCO leverages on information and communication technology (ICT) to strengthen and boost its business processes, so as to help deliver its strategic business objectives to increase sales, maximise operational efficiency, reduce operational risks and improve productivity.

NALCO's ERP project commenced from July, 2008, and by now all the modules have stabilised. It covers materials & contracts (MM) with supplier relationship management (SRM), sales & distribution (SD), production planning (PP) with supply chain management (SCM) module advanced planning & optimization (APO), quality, finance & controlling (FICO) and human resource management (HR) modules. Additional modules of SAP such as business intelligence (BI) and document management system (DMS) have also been implemented, and employee self service (ESS) is on the anvil. NALCO has migrated all its major functions into SAP environment across the organisation, including for the sales offices. In the area of maintenance management, NALCO uses the Ramco-e-Apps maintenance module, which has been implemented since 2000.

This provides a strong centralised information base integrating all functions and business processes of the Company and a knowledge base to assist the management with appropriate dashboards for monitoring all the processes and to be pro-active in their decision making. Further down the line, knowledge management will be implemented for organised storage and access of information and experience, using the data warehouse of ERP along with all non-SAP based data and information in the organisation. This will enable availability of information and knowledge to authorised users at a click, with simplicity of internet browsing.

New technologies like server virtualisation for enterprise services, link load balancing for internet links, etc, have been implemented. There are plans to use RFID technology for file tracking, and other uses like asset and material tagging, vehicle tracking, etc. Video conferencing, currently used at elementary level, is being popularised, and the infrastructure is being enhanced for wider coverage, so as to make video conferencing a regular tool in day to day working. Towards technical compliance to the internet world, NALCO is taking steps to migrate the internet facing elements to IPv6 technology by 03/2012.

In the area of e-governance, project for biometric based attendance and access control solution is in progress. E-tendering for export sales has been implemented with security measures like server secure socket layer (SSL) certificate and end user PKI digital certificate. After the stabilisation of SAP applications, processes like materials procurement, service tenders, and recruitment processes are under enhancement to go the e-way. Towards such intent, a consultant was appointed, and we now have a road map and action plan for e-tendering in the materials and services procurement arena. Against the green measures proposed by the Ministry, proposal for Board meetings on video conference and Company AGM on video conference are also on the anvil.

The in-house state-of-the-art data centre with 24x7 conditioned power supply and air conditioning along with the usual safety measures and monitoring systems at Corporate Office provides stable housing for Company's SAP and other servers and core network. This will be further strengthened with a disaster recovery site shortly, so as to effectively implement business continuity plan for the IT based processes.

NALCO has strengthened its data pipelines both to the Internet and to the works locations with fault tolerant high bandwidth links, to ensure un-interrupted data connectivity. This also enables tele-presence activities between Corporate Office and works locations. Shortly the local area networks (LAN) at all the works sites and Corporate Office will be replaced with high bandwidth and fault tolerant state of the art networks, which will support data as well as broadband applications.

10.34 Pollution Control and Environment:

NALCO is a careful organisation of its environment and has taken several steps for abating pollution and improvement of the environment. All the units of NALCO are certified to International Standard ISO14001:2004-Environmental Management System. NALCO is proactive and has adopted preventive strategies like 3R principle of reduce, reuse and recycle.

The Company has optimized its resource consumption thereby minimizing the waste and optimizing the operating efficiency in all its units. It has eliminated the use of Ozone depleting substance in its operation and substituted with better technology like vapour absorption machines (VAM) based chiller plant in CPP, CFC free cabin air conditioning system in PTMs, high efficiency fume treatment center at smelter plant.

All the units of NALCO have adopted zero discharge with respect to waste water management. The waste waters are treated in effluent treatment plants and then are reused in the process. All units of NALCO are provided with sewage treatment plant and the treated water is used for horticulture and gardening purposes. NALCO has also adopted rain water harvesting system in all its units.

Electrostatic precipitators with advance intelligent control equipments in power plants are being retrofitted by adding more fields to achieve higher efficiency in SPM emission level. NALCO has adopted high efficient ESPs of 80 mg/NM3 in its new units of CPP, which shows NALCO's proactive approach for abating pollution.

NALCO has taken up a project to fill the ash in the abandoned mine voids of Mahanadi Coalfields Ltd (MCL) to reclaim and restore the mined area.

For hazardous waste management, NALCO has taken utmost care as per the guidelines provided by statute. NALCO is having hazardous waste land fill for disposal of spent pot lining materials, incinerators, etc.

NALCO has taken up pilot scale cum demonstration project for carbon sequestration at captive power plant, which is unique in the country.

NALCO has not only planted massive trees in all its units but also has carried out massive plantation in its peripheral villages as well.

Efforts of NALCO has been recognized by different organization like MoEF, SPCB, CII, DFB, FIMI, etc. and NALCO has been awarded with prestigious award like, Indira Gandhi Paryavaran Puraskar, Indira Priyadarshini Brikshyamitra Award, Pollution Control Excellence Award, Best practices in ESH, Best Environment Management Award, etc.

10.35 RESEARCH & DEVELOPMENT

Setting up of NALCO Research & Technology Centre (NRTC) at Bhubaneswar:

Vision: To be a world class, state of the art research and development centre in the field of bauxite, alumina, aluminium, downstream products, power, waste utilization and allied areas.

Mission:

- To develop and strengthen technological expertise pertaining to bauxite mining, alumina refining, aluminium smelting and to continuously develop new products, improve quality and reduce cost.
- To explore technologies for scarce and other metals where NALCO would venture in future.
- To understand and adapt new and renewable sources of energy apart from improving continuously the efficiency of present thermal power generation.

In order to succeed in the primary mission, and balance the need for technical expertise to support present operations with development of technology to assure future competitiveness, a number of tasks that the NALCO Research & Technology Centre (NRTC) will need to accomplish, have been identified. These are as under:

- Identifying technical innovations in other fields and evaluating as possible improvements in the aluminium production processes.
- Acquiring in-house engineering expertise appropriate to the retro-fitting of existing power plants, refineries, smelters and casting centres as well as to commissioning of green field facilities.
- Examining routes to reduce energy and fresh water requirements in refining, smelting and fabricating processes.
- Developing technologies for the economic utilisation of industrial wastes.
- Identifying and prototyping the economic production of higher value products, e.g. alumina-derived chemicals.
- Creating/modifying control devices & algorithms to improve process efficiencies throughout the integrated production and guarantee product quality at all process stages.

A road map for implementation of NRTC with the details of R&D projects that are to be planned in the NRTC has been prepared with the help of an Ad-hoc Committee consisting of experts from outside and the technical consultant.

Thrust has been laid on patenting of process know-how developed in the Company either through in-house or collaborative R&D efforts. Till date 22 patents have been sent for filings which include 4 patents being filed in the current year. Board level technology committee meetings are being held once in a quarter to review the R&D activities of the Company including technological upgradation and innovative modification carried out in different units and benefits derived thereon for further improvements and the process and productivity.

Specific areas in which R&D Activities carried out by NALCO are :-

10.36 In-house R & D Activities

Alumina Plant

- Studies to establish the effect of fine seed addition on granulometry and to develop it as a tool to control granulometry.
- Studies to establish solubility of CaO from different sources of Lime.
- Studies related to use of CAIS as filter aid.
- Studies to establish impact of over flocculation in settler overflow.
- Commercialization of high temperature resin developed in-house.
- Impurity identification and salt removal studies starting with V2O5.
- Installation of heating bundles in pre desilication tank.
- Preparation of low alpha special alumina for ceramic Use.
- Study on impact of surface mined bauxite on process.
- Laboratory scale studies were carried out along with the suppliers of various flocculants for use in high rate thickeners and deep cone washers of new stream.

Smelter Plant

- Regular characterization of baked anode and monitoring of its quality.
- Improvement in quality of raw materials to carbon plant.
- Development of indigenous vendor for carbon lining paste.
- Anode bench scale studies.
- Regular metallographic studies of cast products for quality improvement.
- Impact of blending of different quality of CP Coke on anode quality.
- Effect of quality & quantity of butts on anode quality.
- Dendritic arm spacing (DAS) of cast billets vrs cooling water quality.
- Development of billet casting simulation model.
- Slotted anodes are being used in potline.
- Fuel oil savings by use of magnetic resonators in cast house furnaces.
- Bench scale/ pilot scale investigation of utilization of carbon portion of spent pot lining.
- Development of chequered sheet as a new product.

- Measurement of melt loss in cast house furnaces.
- Reduction of iron content in anodes through process improvement.
- Development of process for production of 99.9% pure HP-2 grade aluminium metal.

10.37 Collaborative R&D Activities:

Some of the collaborative R&D work in which substantial progress has been made during the year, are:-

- Pilot scale development of constructional blocks, bricks & chips from red mud in collaboration with JNARDDC, Nagpur.
- Plasma smelting of red mud for production of pig /cast iron and alumina rich slag in collaboration with IMMT, BBSR.
- Infra red thermography studies with JNARDDC, Nagpur.
- Development of heat treatment process for destruction of toxic cyanide and recovery of valuables (Sodium, Fluorides, etc. from spent pot-linings materials (SPL).
- Preparation of low ferric alum from waste aluminium dross.
- Development of light weight aggregates from red mud.
- Bench scale studies for development of glass ceramics from red mud.
- Lab scale study on alumina tri-hydrate productivity using catalyst by IMMT, BBSR.
- Development of nano alumina and aluminium composites for auto application with IIT, Kharagpur.
- Development of ceramic tiles from fly ash in collaboration with IIT, Kharagpur.
- Development of metal matrix composites with IIMT, Bhubaneswar.

10.38 Benefits derived as a result of the above R & D (in-house & collaborative):

- This helps to maintain desired level of seed surface area, thus control product quality (in terms of granulometry and soda incorporation) at the same time improving the liquor productivity and hence production.
- Helps to take corrective action whenever solids are high so that product CaO is not increased on this account.
- The tests once concluded will establish the effect of various sources of lime.
- Tests show improvement in filtration rate with over flocculation. A plant scale trial shall be taken up to establish the same.
- Use of the high temperature resin will result in huge savings in makeup water consumption in boilers and energy consumption.
- Impurity control and segregation of salt as value added byproduct and also reduction in lime consumed for causticisation.
- Elimination of sodic condensate dilution in process liquor, thus saving in steam and hence energy required for evaporation.
- Low alpha special alumina is a value added product.
- Split feeding helps to control soda in the product by reducing occluded soda.
- Addition of one more interstage cooler in precipitation circuit will result in improvement in liquor productivity by about 0.5 to 0.7 Kg/m³.

- Usage of reprocessed rejected paste has helped in a saving of revenue.
- Trials with indigenously developed ramming paste helped in development of indigenous vendors.
- Studies conducted in anode bench scale plant and regular characterizations of anodes have helped in process and anode quality improvements.
- Optimisation of boric acid addition in pots has resulted in reduced consumption of boric acid to the tune of approx 5MT/month i.e saving of approx ` 2 lakh/month.
- Usage of reprocessed rejected paste has helped in a saving of approx. 41 lakh for 15 pots lined with this material.
- Trials with indigenously developed ramming paste will help in development of indigenous vendors. Indigenous paste cost advantage is ` 20000/tonne of paste compared to imported supply.
- Studies conducted in anode bench scale plant and regular characterizations of anodes have helped in process and anode quality improvements.
- Inclusion analysis and metallographic studies have helped to improve product quality.
- 5 pots have been lined with reprocessed ramming paste whose life had expired. Cost savings is approx ` 13 lakh.
- 10 pots have been lined using 10 sets of SiC & semigraphite composite side block to reduce side lining failure.
- Expected benefit by improvement of oxidation behaviour of anodes would be approx ` 3 crore/annum.

10.39 Future Plan of Action and New Projects:

- Setting up of a world class NALCO Research & Technology Centre at Bhubaneswar.
- Demonstration cum pilot plant for production of construction bricks from red mud.
- Commercialisation of few R&D processes.
- Utilisation of fly ash in ceramic tiles manufacturing.
- Development of a process know how for extraction of alumina from PLK.
- Implementation of Bayer process simulation package for better process control and reduction in cost of production.
- Use of CAIS as filter aid in Kelly filtration to improve filtration.
- Reaction kinetics study for optimizing the process parameters.
- Reaction kinetics study of precipitation for improving productivity with minimal impurity occlusion.
- Industrial implementation of medium pressure digestion for better extraction of alumina and productivity.
- Salt removal studies to prevent scale formation in equipments and pipelines.
- Melt loss measurement in cast house furnaces.
- Trial with magnetic resonator for fuel oil saving.
- Trial with non-wetting castable lining of tapping ladles.

- Modelling billet casting process.
- Trials with new type cathodes & ramming mass for energy conservation & environmental advantages.
- Reduction of iron content in anodes.



Captive Power Plant of NALCO