

## **Hindalco Industries Limited**

### **Renukoot Sonebhadra UP**

#### **Company Profile**

Hindalco Industries Ltd., the Flagship Company of Aditya Birla Group, India's one of the premium business houses was incorporated in 1958 and commercial production commenced in 1962. Company's principal products comprise of Aluminium Ingots, Aluminium Billets, Aluminium Wire Rods, Sheet Products, Extrusions, Aluminium Foils and Aluminium Alloy Wheels. The Company's by products include Gallium Metal, Vanadium Sludge and Aluminium Dross.

Hindalco, at Renukoot, houses a fully integrated plant, comprising of 3 main plants i.e. the Alumina, Smelter & Fabrication Plants. Each plant employs varying Technology. With integrated facilities, output from various plants is used by next, along with varying raw materials. Company has its own captive power plant at Renuagar (30 Km away from Renukoot ) with installed capacity of 741.7 MW and 78 MW of Co Generation Plant at Renukoot itself.

Alumina Plant: - It was commissioned with an initial capacity of 40,000 MTPA, which has now increased, to 685,000 MTPA. The plant has been expanded in phases using new technology from time to time for energy efficiency and capacity enhancement. It employs the basic Bayer's process and the major raw materials for the plant are Bauxite, Steam, Caustic Soda and Furnace oil.

Aluminium Smelter: - It has 11 Potlines with 2067 Pots installed with annual production capacity of 3,45,000 MT. The Smelter employs the Hall Heroult Electrolysis Process for the extraction of Aluminium from Alumina. Basic raw materials for the smelter are Alumina, Power, Anodes and Aluminium Fluoride.

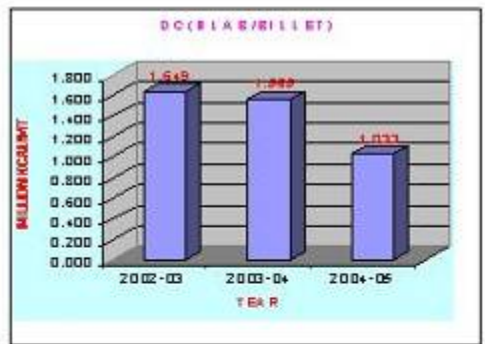
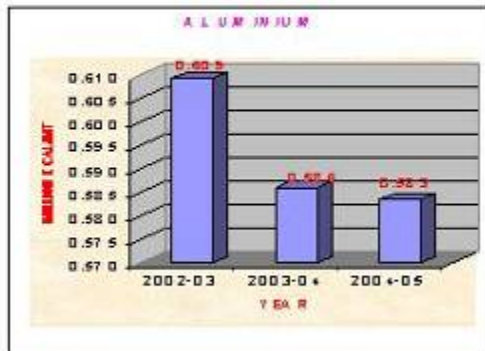
Fabrication Plant (Value Added Products): - The Fabrication Plant at Renukoot comprises of 4 Main Sections Remelt Shop, Cast House, Rolling Mills, Extrusion & Conform which produce Wire Rod, Sheets, Coils and Extruded Products.

Hindalco, an ISO 14001, ISO 9002 and OHSAS 18001 Company, and has bagged 13 prestigious International & National Awards for Business Excellence, Quality, Energy Conservation and its efforts for preserving the Environment in last 4 years.

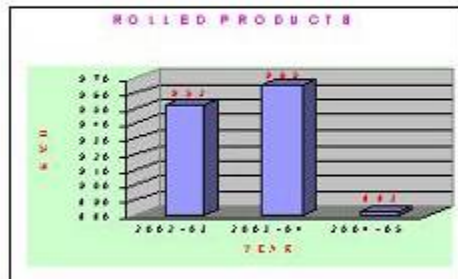
#### **Energy Consumption**

Manufacturing of Aluminium is a one of the most energy intensive process. The cost of Energy comprises about 40.78 % of the total input costs for producing Aluminium which has reduced from 41.1% of last year. Hindalco uses 3 type of Energy resources to manufacture Aluminium i.e. Coal, Oil and Electricity. Out of these three, electricity has the highest share (almost 77.78 % of total energy consumption). Total cost of energy for last year was Rs.699.44 crore, which includes Rs.95.746 crore for Fuel oil, Rs.543.72 crore for Electricity, Rs.54.387 crore for Coal & 5.2 crore for steam. Last year company consumed 450,549 MT of Coal, 79,719 KL of Fuel Oil and 56,144.64 Lakh kWh of Electricity. Due to sincere efforts in the direction of Energy Efficiency by the company there has been significant reduction in the consumption of energy as given in the summary sheet. Graphical representation of few areas is attached below: -

## SPECIFIC ENERGY CONSUMPTION (THERMAL) TRENDS



## SPECIFIC ENERGY CONSUMPTION (ELECTRICAL) TRENDS



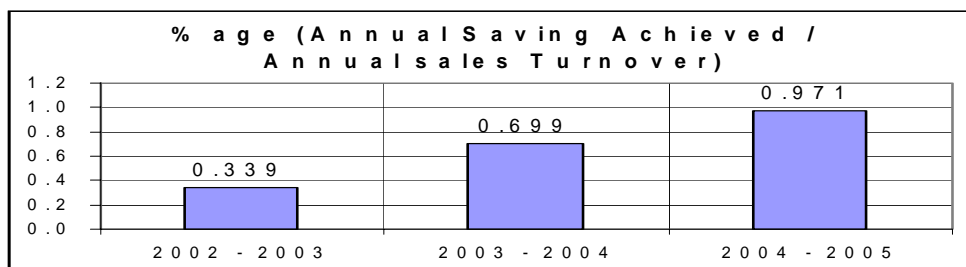
## Energy Conservation : Commitment, Policy & Set Up

Energy Conservation continues to be focus area of the Company. The company has launched the Energy Policy to underscore its commitment to Energy Conservation. A copy of the Energy Policy issued by Chief Officer – Operations (Aluminium & Power) is enclosed. To inculcate awareness on the importance of Energy Conservation not only to the employees of the company but also to the society, the following setup is followed.

- Setting up a dedicated Energy Cell with following agenda to enable the Company to reduce specific energy consumption on continual basis and thus becoming one of the lowest cost producers in the World.
  - to identify potential area for energy saving in consultation with department
  - to take care of latest technological developments in the field of energy conservation
  - to suggests measures for better energy efficiency for the implementation in the operating plant and new projects.
  - to monitor the quantum of energy saved on account of energy conservation initiatives.
- Arrange Energy awareness program for School Children.
- Energy Conservation program for Housewives on "Cooking Gas – Proper Utilization of LPG", "Saving Energy at Home".
- Training program on "Fan engineering" for staff.
- In-house training program for staff & workmen for "Improved work practices for fuel efficient operation of Furnaces", "Fuel & Furnaces" & "Cooling Tower".
- Company encourages continuous improvement through **small group activities** under aegis of WCM in areas of Cost reduction, energy efficiency, quality and productivity improvement.
- In line with "Energy Conservation Act -2001" the company has trained 10 engineer to acquire the certificate for "Certified Energy Manager/Auditor" awarded by BEE. The organization chart of The Energy Management is enclosed.
- The Company believes in all the modern techniques like TPM, Quality Circle, 5S, TQM, WCM etc. and is striving to become a World class Company in all its operations by creating awareness among employees towards energy conservation as well as resource conservation.
- The company has well-structured suggestion schemes to encourage employee to give their suggestions for energy conservation and employees are suitably rewarded for viable suggestions.
- Since the company has strong commitment towards Energy Conservation, the projects, which require investments, are normally approved. Company takes special care to allocate funds for these projects.

## Energy Conservation Achievements

The company has been receiving National Energy Conservation Awards, continuously since 1995. During 2002-2005 company has implemented 174 measures to improve Energy Efficiency (including capacity enhancement) by investing Rs. 522.80 Crore which resulted in a saving of energy worth Rs. 62.94 Crore /



Year and also increased production.

Year	No of Suggestions	Achievements of energy saving (per year basis)		
		Power Lac kWh	Thermal (M kCal)	Total Rs. Lac
2002-2003	44	171.03	218130.02	804.72
2003-2004	60	1226.74	31778.99	2094.68
2004-2005	68	1403.96	297826.63	3428.50
Total	174	2801.74	547735.64	6294.56

## Brief write-up of projects / measures Implemented during 2004-05

### Alumina Plant

#### 1. Revamping of evaporation unit- ii to increase steam economy.

##### Background & Observation

HID-II is the oldest evaporation unit, with feed forward type of arrangement, which is now a part of Evaporation Unit - II. Liquor is heated in series of evaporator bodies and after attaining 120°C Temp in LSH it is flashed in the flash chambers of the successive effects. HID-II had only one LSH and four evaporator bodies. When LSH was taken out of line for cleaning, one Evaporator body was converted into LSH. This affects the cleaning schedule of the remaining Evaporator body heaters and in turn heat transfer due to reduced heat transfer coefficient. In Evaporation unit-II, there are six evaporator bodies and two LSH in total. The maximum temperature attainable is 135°C using 100-psig steam.

An additional LSH in the HID II circuit was introduced, which has helped in maintaining the schedule of cleaning of the vacuum side Evaporator body heaters and resulted in better economy. Further it added more heat transfer area in Evaporation circuit by introducing another LSH for jacking up the Temp from 135°C to 145°C for more Evaporation with the same pressure rating steam thus enhancing the steam economy of the Evaporation unit.

After implementation of this scheme 9 TPH Evaporation rate increased and steam economy picked up from 2.0 to 2.03.



##### Technical & financial analysis

###### Steam Saving

Average Steam consumption before modification	= 2.00 TPH
Evaporation rate before modification	= 69.60 TPH
Average Steam consumption after modification	= 2.03 TPH
Evaporation rate after modification	= 74.21 TPH
Steam required for 74.21 Tons Evaporation with previous setup	= 37.11 TPH
Steam required for 74.21 Tons Evaporation with new setup	= 36.56 TPH
Saving of Steam	= 0.55 TPH
Coal consumption per ton steam	= 0.236 MT
Coal saved (0.55*0.236*24*356)	= 1109 MT/Year
Money Saved @ Rs.1207.13/MT	= 13.39 Lac/Year

###### Power Saving

Evaporation rate increase envisaged	= 9 TPH
Production rate envisaged	= 5563 MT/Year
Actual increase in Evaporation rate (74.21-69.60)	= 4.62 TPH
Production increase (annualized)(5563*4.62/9)	= 2853.7 MT/Year
Average actual power consumption for FY 04-05	= 405 kWh/MT
Calcined production of alumina for FY 04-05	= 662064 MT
Saving in Power ((662064*405/(662064-2853.7))-405)	= 1.75 kWh/MT
Saving in Power (1.75*662064)	= 1158612 kWh/Year
Money Saved (Rs.1.60/kWh)	= 18.54 Lac/Year
Total Money saved	= 31.93 Lac/Year

## **Investment Made**

Investment to the tune of **Rs.104 Lac** was incurred for procurement of the new adequate heat transfer area heaters.

## **Implementation**

Implemented in December' 04.

## **2. Integrated effort to use by product (hp steam) of our sister concern hi -tech carbon Renukoot in alumina plant process slurry heaters and thus to create an opportunity to generate more power at hil cogeneration**

### **Background & Observation**

Alumina plant is essentially an Alumina refining process from bauxite ore. It has integrated Boiler & Co-generation facility to cater to its thermal & electrical energy requirement. Power generation in Co-generation is more than the Alumina Plant requirement, hence surplus Power is used either for Smelter or banked in UP Grid based on the overall Power balance between the Plant requirement and the captive Renusagar Power plant running load.

In Alumina Plant Bauxite ore slurry is subjected to high pressure and temperature reaction with caustic soda. This reaction takes place in a High-pressure vessel commonly known as Digester. Temperature is attained in a series of heat exchangers using partly process-generated steam and High-pressure live steam from Boiler & Co-generation. The Power generation from the Co generation unit depends upon the High-pressure requirement in Alumina Plant, which is nearly, fixed leaving aside the minor variations in the process.

One of our sister concern, Hi Tech Carbon, producing petro grade carbon is also situated at Renukoot in the vicinity of the Hindalco. During the process of producing petro grade carbon Hi Tech generates high-pressure steam of 45 Kg/cm<sup>2</sup>g. This steam used to be reduced to 17 Kg/cm<sup>2</sup>g and taken in Alumina plant for utilizing its heat value.

During our expansion from 4.5 to 6.6 Lac PA we added one Boiler & condensing turbine with three extractions .To maximize Power generation from the turbine we would have to maximize the second extraction calling for stoppage of the steam taking from the Hi tech carbon. And in this new scenario Hi Tech would have to blow their steam in the atmosphere.

Meanwhile, Alumina plant was perforced to increase its plant liquor flow to increase its production even with deteriorating bauxite quality. And this has led to increase in high-pressure steam requirement causing reduction in Power generation at Co-generation in turn.

An integrated effort along with the Hi-Tech and Hindalco team has been instrumental to solve this problem and it was decided to lay a steam header for carrying high pressure by product steam of Hi-Tech Carbon (@30 TPH) to connect to Hindalco HP steam header.

This has created an opportunity to generate extra power to the tune of 3.7 MW.

### **Technical & financial analysis**

Steam consumption per MW (190/31.4)	= 6.05 MT
Average HP steam received from Hi-Tech During Jan-March 05	= 48816.9 MT
Power generated with Steam	= 3.736 MW
Additional energy produced (annualized)	= 31920000 kWh/Year
Money Saved (@Rs.1.60)	= 510.73 Lac

### **Investment made**

An investment of Rs.2.75 Crore has been done for laying HP steam line.

### **Implementation**

Implemented in December' 04.

**3. Installation of condensate pots in place of maintenance intensive steam traps to save steam skippage.**

**Background & Observation**

In one of our Evaporation units i.e. Evaporation-III we have feed forward type liquor arrangement where hot liquor flashes in flash chambers and produced vapor is condensed in next effect evaporator body. Condensate generated thereby used to move from one body to another through steam traps. These steam traps are very maintenance intensive and often had leakage, that is to say steam used to skip from one effect to another and since last effect being under vacuum and connected to barometric condenser, this usable heat energy used to skip in cooling tower.

It was proposed to have condensate pots at the out let of each effect with level control system to ensure that no steam or the usable heat is skipped in the cooling tower.

After implementation of the scheme 1 TPH steam consumption in Evaporation unit III is reduced.



**Technical & Financial Analysis**

Reduction in steam consumption after installation of condensate pot	= 1 TPH
Coal Saved ( $1*24*356*0.236$ )	= $1*24*356$ Ton/Year
Money Saved (@ Rs.1207.13/MT)	= 2016.384 MT/Year
	= Rs.24.34 Lac/Year

**Investment made**

One time Investment of Rs.27 Lac is incurred.

**Implementation**

Implemented in December' 04.

**4. Bypassing of the secondary cyclones & providing DSM screen in ball mill circuits to increase throughput**

**Background & Observation**

Ball mills are the close circuit wet grinding facility for the -1/2" crushed bauxite to bring down its size to -200 mesh around 60%. There are two cyclone stations Primary cyclones for classification and secondary cyclones for maintaining the % solids in the discharge slurry i.e.density.

A scheme was prepared for Ball mill # 7 wherein secondary cyclones were bypassed and a DSM screen was introduced in place of secondary cyclones. The rejects of the DSM screen is recycled back in the mill and remaining slurry is taken in the Desilication tank # 1 through GMD pump of the Ball mill circuit, thereby enhancing throughput by this de-bottlenecking for flow handling through secondary cyclones.

With this modification Ball mill loading has increased from 85% to 105%



### **Technical & financial analysis**

Initial Loading of Ball Mill # 7	= 85%
Loading of Ball Mill # 7 after modification	= 105%
Designed throughput of Ball Mill # 7	= 70 TPH
HP of Ball Mill # 7	= 2000
Initial throughput rate	= 59.5 TPH
Final throughput rate after modification	= 73.5 TPH
Energy consumption before modification	= 19.98 kWh/MT
Energy consumption after modification	= 16.17 kWh/MT
Energy Saving	= 3.81 kWh/MT
	= 280.035 kWh/Day
Annual energy saving (280.035*24*356)	= 2392619 kWh/Year
Money saving (Rs.1.60/kWh)	= 38.28 Lac/Year

### **Investment made**

= NIL

### **IMPLEMENTATION**

Implemented in the financial year 2004-05.

## **5. Chemical cleaning of the scaled process slurry heaters in place of inefficient & energy intensive mechanical cleaning.**

### **Background & Observation**

Scaling problem is a big nuisance for all the high temperature, pressure Alumina refineries across the world.

Renukoot Alumina plant is High temperature, pressure technology wherein bauxite slurry is heated in series of shell and tube heat exchangers. These heat exchangers get badly scaled causing poor heat transfer and in turn requiring high thermal energy requirement for the process. There is heater switch-over schedule also for taking out the scaled heater out of line after certain defined period and clean it with high pressure water jets mechanically which requires electrical energy and man hours. In spite of the established structure for scale cleaning in place scale was not getting cleaned fully calling for impact on thermal energy.

We explored the possibility of doing the chemical cleaning to overcome this problem. For that we have conducted series of lab experiments and bench scale trails with cleanflo-423 along with the inhibitor cleanflo-808. After successful completion of the trails a scheme was prepared and implemented.

### **Technical & financial analysis**

Last flash tank pressure of Unit-II	= 0.52 Kg/Cm <sup>2</sup> g
Last flash tank pressure of Unit-II after chemical cleaning	= 0.52 Kg/Cm <sup>2</sup> g
Total blow flow of the slurry flow	= 900 M <sup>3</sup> /Hr
Density of slurry	= 1.35 Kg/Litre
Specific Heat	= 0.76
Temperature gain	= 2 <sup>o</sup> C
Enthalpy saved (900*1.35*0.76*2)/706	= 2.616 TPH
Coal Saving (2.616*0.236)	= 0.617 TPH

Annual coal saving (0.617\*24\*356)  
Money Saved (@Rs.1207.13/MT)

= 5272 MT/Year  
= Rs.63.64 Lac/Year

**Investment made**

**= Rs.65.00 Lac**

**Implementation**

This facility is implemented in Feb-05.

6. **To overcome a problem of reduced power generation at co-generation end owing to high pressure drop and the inadequate supply of 100 psig steam to alumina plant.**

**Background & Observation**

After 6.6 Lac brownfield expansion in Alumina Plant, Our requirement for the LP steam increased to 85 tph and since the 7 Kg/cm<sup>2</sup> LP Steam had only one header having steam handling capacity of 70 tph only. We had to cater the requirement of Alumina Plant partly through extraction I & which is slightly at High Pressure and keeping extraction II pressure more than the desired in order to push the steam to Alumina end. All these actions were leading to less Power generation and thus the Energy loss.

It was proposed to lay a separate 7 Kg/cm<sup>2</sup> steam pressure header to accommodate the increased requirement of the Alumina Plant. This has facilitated Boiler Co-generation to take out all LP steam through second extraction of the turbine as required by the Alumina Plant for more generation of Power.

After implementation of this scheme 13.2 million unit Power generation increased.

**Technical & financial analysis**

Increase in power generation after laying a separate header  
Money Saved (@Rs.1.60/kWH)

= 13200000 kWh/Year  
= Rs.211.20 Lac/Year

**Investment made**

Investment of Rs.20 Lac is done for this scheme.

**Implementation**

During FY 04-06

7. **Modified the lime feed circuit by directly feeding the lime to the mud causticisation tank and bypassed the lime holding tank thus stopping the running of agitator and feed pump.**

**Background & Observation**

Lime is being used for mud & liquor in LC & MC Tank. To feed the lime in LC & MC tank, firstly lime is being stored in Lime tank located in Clarification area from where it is pumped to LC & MC tank with pump having 30 HP Motor. A 7.5 HP motor is also used for agitation of the lime solution.

During a brain storming session of SGA group it was decided to bypass the lime holding tank and connect the discharge line of this pump with the feed line so that lime solution can be fed directly to the LC & MC tank. With this modification continuous running of two motors of 7.5 HP & 30 HP respectively stopped.

**Technical & financial analysis**

Total HP of Motors (agitator and pump)  
Power saved due to stoppage of these two motors  
Energy saved (27.98\*0.80\*24\*356)  
Money Saved (@Rs.1.60/kWH)

= 37.5 HP  
= 27.98 kW  
= 190018 kWh/Year  
= Rs.3.04 Lac/Year

**Investment made**

= NIL

**Implementation**

Implemented in April' 2004

- 8. Reduction in steam consumption after feeding the lime in ball mills # 4 & 7 in place of adding it in the desilication tank # 6.**

**Background & Observation**

In Alumina Plant Digestion area, lime is being fed into Desilication tank # 6 for settling of slurry where discharge of all the Ball mills is also comes through DS Tanks # 1, 2, 3 & 4. Due to addition of lime in the DS tank # 6, it was observed that the density of slurry is getting reduced from 1.76 Kg/Ltr to 1.72 Kg/Ltr and temp of slurry is getting reduced to 85 degC from 88 degC thus increasing the steam consumption at pulp heater in which the temperature of slurry is being maintained at 130 degC.

During a brain storming session of SGA group it was decided to add the lime in the Ball Mill # 4 # 7 instead of adding it into the DS Tank # 6. After a detailed discussion scheme was finalized and implemented and now lime is fed into the Ball Mill # 4 & 7 and feeding liquor is adjusted accordingly. With this modification, consumption of steam has been reduced by 1.5 TPH.

**Technical & financial analysis**

Steam consumption before modification	= 10 TPH
Steam consumption after modification	= 8.5 TPH
Steam saved (1.5*24*356)	= 12816 MT/Year
Coal saved (12816*0.236)	= 3024.576 MT/Year
Money Saved (@Rs.1207.13)	= Rs.36.51 Lac/Year

**Investment made**

= NIL

**Implementation**

Implemented in April' 2004.

- 9. Modified the bad condensate circuit of clarification area mc unit so that dual operation of pump can be stopped.**

**Background & Observation**

Alumina Plant process bad condensate is being used at Boiler and Clarification MC Unit for heating the DM water & Liquor respectively. Bad condensate is pumped from Digestion area condensate pump to the Boiler and storage tank made for Clarification area. From bad storage tank this condensate is further being pumped to the Clarification area as per the requirement.

During a brain storming session of SGA group it was decided to bypass the storage tank and get tapping of 4" from the discharge header of condensate pump of digestion area and connect the same with discharge header of condensate storage tank of Clarification area so that the double pumping of condensate can be avoided.

**Technical & financial analysis**

Total HP of Motor stopped	= 25 HP
Power saved due to stoppage of these two motors	= 18.65 kW
Energy saved (18.65*0.80*10*356)	= 53115 kWh/Year
Money Saved (@Rs.1.60/kWh)	= Rs.0.85 Lac/Year

**Investment made**

= Nil

### **Implementation**

Implemented in May' 2004

- 10. Stopped the running of third pump of cyclone overflow in seed classification area by removing the V-711 valve and providing the 14" knife valve so that the level of both the cyclones overflow tanks can be equalized.**

### **Background & Observation**

Alumina Plant Precipitation area, there are three hydro-cyclones installed for seed classification purpose. Every hydro-cyclone consists of 20 cyclones. These hydro-cyclones are known as product, swing and coarse hydro-cyclones. Out of these three hydro-cyclones only two remain in operation at a time and the third one is kept as spare. Operation of cyclones varies according to seed charge and alumina production rate. Normally 8-10 cyclones of product and 15-17 cyclones of coarse are kept in operation. Overflow of Product cyclone goes to overflow tank (N) and overflow of coarse cyclone goes to overflow tank (S). Because the number of cyclones is more in coarse than the product due to which level of overflow tank (S) remains higher than the other one.

This causes the additional running of one more pump to avoid the overflow of Overflow tank (S) on the surface in addition to two pumps running for individual cyclones overflow tank.

To resolve the problem, a brain storming session has been held by the SGA group and it was decided to provide knife valve in the suction line of cyclone overflow tank pump which will act as equalizer between the two overflow tanks.

The scheme was finalized and implemented and with this modification now levels of both the tanks remain equal and intermittent operation of third pump is stopped.

### **Technical & financial analysis**

Total HP of Motor stopped	= 450 HP
Power saved due to stoppage of these two motors	= 335.70 kW
Energy saved (335.70*0.80*6*356)	= 573644 kWh/Year
Money Saved (@Rs.1.60/kWh)	= Rs.9.18 Lac/Year

**Investment made** = Nil

### **Implementation**

Implemented in April' 2004

- 11. Stopped the running of one sump pump, which was used to pump the spent liquor tank overflow.**

### **Background & Observation**

In Alumina Plant Precipitation area, there is a filtration unit used for separation of liquor and solids from slurry. There are two spent liquor tanks known as north and south besides nine disc filter out of which 4 or 5 remain in line. Spent liquor is being pumped into the feed box of TT-1 and TT-2.

It was observed that due to choking in pump discharge line flow of liquor is hindered causing the overflow of spent liquor tank resulting in extra running of sump pump. The problem was analyzed and it was found that it was happening due to non-cleaning of pipes timely. Timely cleaning of pipe is not possible because of single discharge header. Hence it was decided to lay an additional 8" dia header from the discharge pump so that regular cleaning pipe can be done.

Scheme was finalized and one additional header provided. With this modification overflow problem of spent liquor tank has been solved which resulted in stoppage of sump pump.

### **Technical & financial analysis**

Total HP of Motor stopped	= 20 HP
Power saved due to stoppage of these two motors	= 14.92 kW
Energy saved (14.92*0.8*24*356)	= 101981 kWh/Year
Money Saved (@Rs.1.60/kWh)	= Rs.1.63 Lac/Year

**Investment made** = Rs.0.50 Lac

### **Implementation**

Implemented during FY 2004-05.

## **12. Minimized the emergency overflow of sand classifier thus reduction in sump pump operation through optimizing the feed flow of settler according to flow coming from digestion**

### **Background & Observation**

In Sand classifier of Clarification area flow comes from all the four digestion. Overflow of sand Classifier goes to Settler and discharge (Mud) is thrown away. Over flow goes to settler is kept almost fixed and if there is any increase occurring in incoming flow to sand classifier from Digestion, the Sand classifier tank overflows on the ground causes unwanted running of sump pump.

Problem was analyzed and it was decided to simulate flow of sand classifier over with the flow of digestion to resolve the problem. Thought was implemented and thus stopped the operation sump pump.

### **Technical & financial analysis**

Wastage of energy due to operation of unwanted running of sump pump	= 100 kWh/Day
Energy saved (100*356)	= 35600 kWh/Year
Money Saved (@Rs.1.60/kWh)	= Rs.0.57 Lac/Year

**Investment made** = NIL

### **Implementation**

Implemented during FY 2004-05

## **13. Conversion of motor connection from delta to star**

### **Background & Observation**

During our audit we found that the motors of following equipment are running below 50% of rated kW:-

- 1- FCB Calciner bag filter fan - Rated kW- 90, Operating kW – 40
- 2-Tippler –II Coal crusher - Rated kW –210, Operating kW – 90
- 3-Ball Mill #2, 3 motor room ventilation fan, Rated kW- 18, Operating kW –6

All motors are normally connected in delta, which was converted into star for reduction in constant losses

### **Technical & financial analysis**

Fixed losses in motor as 2% of rated $0.02*(90+210+36)$	= 6.72kW
Reduction in fixed losses by conversion to star connection	= $0.6*6.72 = 4$ kW
Energy saved $((90*24)+(210*15)+(18*2*20))*0.02*0.65*356$	= 27907 kWh/Year
Money saved (@Rs.1.60/kWh)	= 0.45 Lac/Year

**Investment made** = NIL

### **Implementation**

Implemented in the financial year 2004-05.

## **14. Replacement of 25 HP ventilation fan with 800 Watt exhaust fan**

### **Background & Observation**

In our MCC room of Precipitation, a old ventilation fan having 25 HP motor was running continuously, to ventilate the hot air from the room, since very beginning and was not too effective, hence replaced with 800 watt exhaust fan which is serving the purpose with very much less consumption energy.

### **Technical & financial analysis**

Power consumption with ventilation fan	= $18 \times 0.70 \times 24 \times 365$
	= 110376 kWh/Year
Power consumption with exhaust fan	= $0.8 \times 24 \times 365$
	= 7008 kWh/year
Energy saving (110376-7008)	= 103368 kWh/Year
	= Rs.1.65 Lac/Year

### **Investment made**

=Rs.0.015 Lac

### **Implementation**

Implemented in the financial year 2004-05.

## **15. Replacement of 125 Watt MV lamp with 70 Watt Sodium Vapour Lamp**

### **Background & Observation**

Mercury vapour lamps have lower lumens per watt as compared to sodium vapour lamp; keeping in mind we are replacing our MV lamps of higher wattage with lower watt Sodium vapour lamps at the places where CRI is not so important. During last financial year, we have replaced such type of 30 numbers MV lamp of 125 watt with 70 watt SV lamp in our Alumina Plant area against damaged/failed.

### **Technical & financial analysis**

No. MV lamps replaced	= 30
Average glowing lamps	= 12 Hours
Energy saving per lamp (125-70)	= 55 Watt
Annual Energy Saving	= $55 \times 30 \times 12 \times 365 / 1000$
	= 7227 kWh/Year
	= Rs.0.12 Lakh/Year

### **Investment made**

As per our policy we are replacing these lamps against failed/damaged hence no impact of investment.

### **Implementation**

Implemented in the financial year 2004-05.

## **16. Replacement of 10-watt filament type indication lamps with led type lamp.**

### **Background & Observation**

Filament type indication lamps of 10 Watt are provided in our most of the panels and are less energy efficient and low life. So these are being replaced with 2 Watt LED type lamps, which are more energy efficient.

### **Technical & financial analysis**

No. Filament type lamps replaced	= 275
Average glowing lamps	= 12 Hours
Energy saving per lamp (10-2)	= 8 Watt
Annual Energy Saving	= $275 \times 8 \times 12 \times 356 / 1000$
	= 9398 kWh/Year
	= Rs.0.15 Lac/Year

### **Investment made**

= Rs.0.25 Lac

### **Implementation**

Implemented in the financial year 2004-05.

## **17. Replacement of old and inefficient agitator.**

### **Background & Observation**

There was a Desilicator tank installed in our Digestion area equipped with Old agitator and gearbox having 100 HP motor. This equipment used to run continuously. We have changed this inefficient agitator and gearbox with imported having only 60 HP motor thus saved the energy.

### **Technical & financial analysis**

Original Motor HP:	= 100 (75 KW)
New Motor HP	= 60 HP (45 kW0)
Rated kW saved	= 30 kW
Energy Saved taking 80% load	= 24 kW
Annual energy saving ( $24 \times 24 \times 356$ )	= 205056 kWh/Year
Money saved (@Rs.1.60/KWH)	= 3.28 Lac/Year

### **Investment made**

Available 100 HP motor is utilized.

### **Implementation**

Implemented in the financial year 2004-05.

## **18. Optimization of process parameter and loading in calciner to reduce the specific energy consumption.**

### **Background**

There are two Calciners in use in Alumina Plant. During the year lot of efforts have been made to reduce the specific fuel oil consumption like optimum loading of equipment, better oxygen control and better insulation of hot vessels. This resulted, reduction in specific fuel oil by 2.10 Ltr/MT over previous year consumption.



### **Technical & financial analysis**

Specific fuel consumption in FY 03-04	= 79.4 Ltr/MT
Specific fuel consumption in FY 04-05	= 77.3 Ltr/MT
Reduction in specific fuel consumption over FY 03-04	= 2.10 Ltr/MT
Alumina production in FY 04-05	= 662064 MT
Fuel oil saved	= 1390.33 KL/Year
Money saved (@Rs.12010.41/KL)	= 166.98 Lac/Year

### **Investment made**

= NIL

### **Implementation**

Implemented during FY 2004-05.

### **Reduction plant**

1. **Optimization of line load, reduction metal tapping interval & change of anode covering material to reduce the specific energy consumption in smelter**

#### **Background & observation**

The electrolytic production of aluminium in Hall - Herault cells is energy – intensive process accounting for nearly 40 % of aluminium production cost. Reduction in energy consumption can be achieved in two ways: improvement in current efficiency & reduction in cell voltage. During the FY 04-05, we have optimized the pot voltage by adopting following measures: -

- a) Line load has been increased from 62.396 to 63.549 kA.
- b) Tapping schedule reduce to 32 hours from 40 hours interval to have less metal in pot to reduce energy consumption.
- c) In all the pot lines anode-covering material has been changed to mixture of bath & aluminium from pure alumina to improve the current efficiency.



### **Technical & financial analysis**

Specific energy consumption FY03-04	= 14263 DCkWH/MT
Specific energy consumption FY04-05	= 142035 DCkWH/MT
Specific energy saved over last year	= 228 DCkWH/MT
DC to AC conversion factor	= 1.0269
Net Energy saved	= 234 kWh/MT
Metal Production in FY 04-05	= 343164.598 MT
Annual Energy saved	= 80300516kWH/Year
Money saved (Rs1.60/kWH)	= 1284.81 Lac/Year

### **Investment made**

= NIL

### **Implementation**

Implemented during financial year 2004-05.

## 2. Installation of scrap shredding & bailing machine to reduce the melt loss as well as specific oil consumption in slab casting.

### Background & Observation

Scrap shredding & Bailing machine has been installed for bailing the loose aluminum scrap coming from different sources for re-melting in the furnaces of cast House. The press was installed keeping in mind that after pressing the loose scrape the bulk density of the scrap will increase leading to less oxidation and fuel oil consumption. This has resulted in saving of melt loss of 0.10 % on input solids and reduction of fuel oil by 0.5 liter per ton.



### Technical & financial analysis

Fuel oil saving by installation of Balling Press Machine	= 0.5 Lt/MT
Slabs Production (FY04-05)	= 112807 MT
Total Oil saving	= 56.40 KL/Year
Price of Fuel Oil	= Rs.12010.41/KL
Total Saving per year	= Rs.6.77 Lac/Year

In addition to energy saved, Rs.33.35 Lac has been also saved in account of melt loss reduction.

Thus total saving = 40.12 Lac/Year

Investment made =131.60 Lac

### Implementation

Commissioned during 04-05.

## 3. Installation of condensate recovery pot in paste plant

### Background & Observation

In all our five pitch melting tanks, 44 Kg/Cm<sup>2</sup> steam is being used after reducing its pressure to 35 Kg/Cm<sup>2</sup>. Average consumption of steam is about 5 TPH. In the circuit of steam line lot of inverted bucket type steam traps were used to remove the condensation. After passing the steam through all the condensate was being drained into the drain.

To recover the energy of condensate steam, a project has been made and implemented. The project consist of 5 numbers condensate pot attached with each melting tank and two flash vessel tanks in which condensate is flashed to get the steam of 17.5 Kg/Cm<sup>2</sup> and 3.5 Kg/Cm<sup>2</sup> steam, Finally the residue condensate is being pumped to Boiler house as make up. Flashed steam is being used in heating of oil pipe and jackets. With the installation of condensate recovery pot consumption of steam has been reduced by 0.5 TPH.

### Technical & financial analysis

Steam consumption reduced by installation of Condensate recovery pot = 0.5 TPH  
Annual Steam consumption reduction (0.5\*24\*350) = 4200 MT/Year  
Annual Coal Saved (@0.236/MT) = 991.20 MT/Year  
Money saved (Rs.1207.13/MT) = 11.97 Lac/Year

Investment made = 50.00 Lac

### Implementation

Commissioned during 04-05.

## 4. Replaced 40 Watt Lamp with 1 Watt Led Crane CRP

### Background & Observation

40-Watt Incandescent lamps were provided for C.R.P indication in all the cranes of Pot Room and Baking Furnaces. These lamps were replaced with LED. Power consumption in LED's is approx 1 Watt. Hence saved power consumption.

### Technical & financial analysis

No. of Lamps replaced = 488  
Power saved per lamp (40-1) = 39 Watt  
Energy saved (488\*39\*24\*365/1000) = 166720 kWh/Year  
Money Saved (@Rs.1.60/kWh) = 2.67 Lac/Year

Investment made =Rs.1.32 Lac

### Implementation

Implemented during financial year 2004-05.

## 5. Modification in kaizen gallery lighting circuit for separation from the main light.

### Background & Observation

Kaizen gallery lights were glowing continuously as the circuit was connected with main light of Potroom godown. In this gallery there were 8 MV lamps of 250 Watt, 2 MV lamps of 125 Watt and 14 tube lights of 36watt each. Now the circuit has been separated from the main light and glowing hours of these lights is controlled as per requirement. On an average 20 hours/day ON time of these lights have been reduced.

### Financial analysis

Connected load in kaizen gallery = 2.754 kW  
ON time saved = 20 Hours/day  
Energy saved (2.754\*20\*365) = 20104 kWh/Year  
Money saved (@Rs.1.60/kWh) = Rs.0.32 Lac/Year

Investment made = NIL

### Implementation

Implemented during FY 04-05.

## 6. Rationlization of illumination level in rodding room

### Background & Observation

During the audit of illumination it was found that the illumination level is high in Rodding Shop. Hence it was to replace the some existing higher wattage lamps with lower wattage. In this connection 13 MV lamps of 250 watt and 55 numbers MV lamps have been replaced with 150 watt sodium lamp and 250 watt MV lamp respectively.

### Technical & financial analysis

No of 250 W MV lamp replaced with 150 SV Lamp	= 13
No of 400 W MV lamp replaced with 250 MV Lamp	= 55
Power Saved (100*13+150*55)	= 9.55 kW
Energy saved (9.55*14*365)	= 48800 kWh/Year
Money saved (Rs.1.60/kWh)	= 0.78 Lac/Year

Investment made = NIL

Taken out lamps have utilized in others places against failure.

### Implementation

Completed during FY 04-05.

## 7. Rationlization of illumination level in cathode plant

### Background & Observation

During the audit of illumination it was found that the illumination level at operators desk in Cathode Plant is high. Therefore it was to replace the some existing higher wattage lamps with lower wattage. In this connection one 125 Watt MV lamps and one 200 watt ordinary lamp have been replaced with two 36 watt tube light.

### Technical & financial analysis

Reduction in load due to replacement	= 253 watt
Glowing time	= 24 hours/day
Energy saved (253*24*365/1000)	= 2216 kWh/Year
Money saved (Rs.1.60/kWh)	= 0.04 Lac/Year

Investment made = NIL

Taken out lamps have utilized in others places against failure.

Implementation Completed during FY 04-05.

## 8. Implementation of closed loop control of potline- 1, 2, 3, 8, 9, 10 & 11 DSS main fan inlet dampers by monitoring motor current & other process parameters for energy saving.

### Background & Observation

In our Smelter Plant Dry scrubbing system is installed for fume treatment coming from the pot cells. For the said purpose, in each line, there are 3 main fans installed out of which 2 fans remain in operation continuously. Adjusting dampers provided in the suction of the duct controls flow of the fan. But it was observed that accurate adjustment of dampers was not possible as per the flow causing extra power consumption even if there is minor shift of damper position. Hence it was decided to fix the current of motor and keep the damper in auto mode. Now the flow requirement of fan is calculated first according to number of running pots which almost remains same for long period and current is being fixed keeping damper in auto mode. Programming in PLC is being changed accordingly.

Average current drawn by the motor before and after has been monitored and it was found that there is a saving of on an average 3.7 Amps in each motor.

#### Technical & financial analysis

No of motors in operation in which the system has been applied	= 14
Voltage	= 6600 Volt
Average reduction in current	= 3.5 Amps
Power saved ( $1.732 \times 6600 \times 3.7 \times 0.82 \times 14 \times 24 \times 365 / 1000$ )	= 4253432 kWh/Year
Money saved (Rs.1.60/kWh)	= 68.05 Lac/Year
Investment made	= NIL

#### Implementation

Implemented during FY 04-05.

9. Provided door limit switch in pot line # 5 to 7 DSS blower room light to avoid the unwanted glowing of lights

#### Background & Observation

It was observed that lights of DSS room of line- 7 to 8 are glowing continuously. To avoid the unwanted glowing of light, circuit has been modified and provided a limit switch. All the tube lights have been connected with the limit switch except one in each room.

#### Technical & financial analysis

Number tube lights connected with limit switch	= 15*3
Wattage of each tube light	= 36 Watt
Expected glowing time reduced	= 18 Hours/day
Energy saved ( $15 \times 3 \times 18 \times 365 \times 36 / 1000$ )	= 10643 kWh/Year
Money saved (@Rs.1.60/kWh)	= Rs.0.17 Lac/Year
Investment made	= 0.06 Lac

#### Implementation

Implemented during FY 04-05.

10. Modification in compressor house hot well pump system.

#### Background & Observation

In Plant-2 old compressor house there are numbers of reciprocating compressors installed for fulfilling the requirement of compressed air of different users. Also there is Cooling tower attached with this compressor house having a hot well. The hot well pump sends the hot water to the cooling tower. Recently due to installation of centrifugal compressors, the running of reciprocating compressors has reduced thus reduction in hot water circulation. Previously one hot well pump having 60 HP motors was used to run continuously and one pumps having 60 HP motor was kept in auto mode. Now we have provided a small pump having 10 HP motor, which runs continuously and other pump have 60 HP motor remains in auto mode and operates after water level goes up after certain level.

#### Technical & financial analysis

Power consumption with earlier set up	= 475.917 kWh/Day
Power consumption with new set up	= 332.983 kWh/Day
Energy saved	= 142.934 kWh/Day
	= 52171 kWh/Day
Money saved (Rs.1.60/kWh/Year)	= Rs.0.83 Lac/Year

Investment made

Rs.1.00 Lac

Implementation

Implemented during FY 04-05.

11. To optimize the running of office air conditioning equipments of pot line – 9 to 11.

Background & Observation

In winter season office has only need of blower but because of electrical interlock of Cooling tower fan and water pump motors these pumps also used to run whereas these equipment are required only for compressor.

It was decided to run the air-conditioning equipment intermittently depending on office working duration, the existing circuit has been modified to optimize running of cooling tower fan and water pump motors in winter season; thus saving the unnecessary running hours of cooling tower fan & pump motor

Technical & financial analysis

Load of fan and pump motor	= 3*155.30 kW
Running hours saved	= 840 Hours/Year
Energy saved (3*155.30*840)	= 391356 kWh/Year
Money saved (Rs.1.60/kWh/Year)	= Rs.6.26 Lac/Year

Investment made

= NIL

Implementation

Implemented during FY 04-05.

12. Separated potline # 9 dss area lighting circuit from receptical to save energy.

Background & Observation

In pot line- 9 Lunchroom we are using tube lights, ceiling fans, exhaust fans, scrubber fan and scrubber pump motors for proper illumination and ventilation. This equipment run continuously which is wastage of energy. We modified the control circuit with existing Allen Bradley PLC, programmed it in such a way to run all equipment only during lunch/tea time and remain off when no person in lunchroom. The system will remain 'ON' for following time periods.

'ON' time

09.00 A.M. to 10.00 A.M.

03.00 P.M. to 04.00 P.M.

11.30 P.M. to 01.30 P.M.

Technical & financial analysis

Load of equipment of Pot line –9 lunch room

1.	C.T.Motor	(3.75 KW)
2.	Pump Motor	(7.5 KW)
3.	Tube lights	(12x36 Watt)
4.	Ceiling fans	(4x60 Watt)
5.	Exhaust fans	(2x85 Watt)
6.	SV lamp	(70 Watt)

Power consumption prior to modification = 88989 kWh/Year

Power consumption after modification = 15010 kWh/Year

Energy saved = 73979 kWh/Year

Money saved (Rs.1.60/kWh/Year) = Rs.1.18 Lac/Year

Investment made = 0.05 Lac

Implementation

Implemented during FY 04-05.

13. Provided logo in the circuit of pot line # 10 DSS area light & controlled as per requirement to avoid the unnecessary glowing of light.

Background & Observation

There are 56 numbers sodium vapour lamps of 70 watt provided in the Pot line # 10 DSS area. It was observed that due to manual control, this light remains ON during daytime also. Hence it was decided to provide small PLC and do programming so that these lights may get ON/OFF automatically during desired period. The scheme was finalized and implemented and saved approx. on an average 6 hours of unnecessary glowing of light.

Technical & Financial Analysis

No of Lamps	= 56
Wattage of lamp	= 70 Watt
Energy saved (56*70*6*365/1000)	= 8585 kWh/Year
Money saved (Rs.1.60/kWh/Year)	= Rs.0.14 Lac/Year

Investment made = 0.05 Lac

Implementation

Implemented during FY 04-05.

14. Pot line # 7 & 8 auxiliary MCC light controlled through limit switches.

Background & Observation

It was observed that tube lights (12x36watt) of Pot line- 7 & 8 auxiliary MCC room are glowing continuously. To avoid the unwanted glowing of light, circuit has been modified and has been provided a limit switch. All the tube lights have been connected with the limit switch except two in each room. Now the 8 tube lights remains off when no job/person is in MCC room.

Technical & financial analysis

Number tube lights connected with limit switch	= 8
Wattage of each tube light	= 36 Watt
Expected glowing time reduced	= 18 Hours/day
Energy saved (8*18*365*36/1000)	= 1892 kWh/Year
Money saved (@Rs.1.60/kWh)	= Rs.0.03 Lac/Year

Investment made = 0.02 Lac

Implementation

Implemented during FY 04-05.

- 15.Reduction in compressed air consumption by modification in point feeder air line circuit in pot line-1.

### Background & Observation

In our pot cells of Smelter alumina is fed into pot automatically as per the signal of Celtrol. According to celtrol, point feeder operates and alumina goes into pot. There is two point feeders provided in each pot. These point feeder cylinder and piston operates pneumatically i.e. by compressed air. The compressed air pressure required to operate the cylinder is about 4 Kg. The operating time of cylinder is very less as compared to holding time. The pressure remains same in both the cases i.e. during operation of the piston and holding of the piston. Higher pressure during holding time call for air leakage through the seals of piston. To overcome this problem a regulating valve has been provided in circuit of air line of each pot whose main function is to reduce the pressure to 2 Kg/CM<sup>2</sup> from the 4 Kg/CM<sup>2</sup> thus reducing the air leakage leading to conservation of compressed air.

### Technical & financial analysis

Reduction in compressed air consumption	= 1 cfm/pot
Number of pots in line-1	= 166
Average power consumption for compressed air	= 0.003 kW/cfm
Energy saved (1*166*0.003*60*24*365)	= 261749 kWh/Year
Money saved (@Rs.1.60/kWh)	= Rs.4.19 Lac/Year
INVESTMENT MADE	= Rs.9.60 Lac

IMPLEMENTATION

Implemented during FY 04-05.

### **16. Modification in gutter alumina handling system.**

### Background & Observation

In Pot room, gutter alumina is collected in buckets and shifted at gutter alumina handling plant for cleaning and reprocessing. In gutter alumina handling plant the alumina is being sucked by blower which is passes through a screen and bag house. In the system it was felt that the suction header is too long causing reduction in transfer rate. After checking the feasibility it was decided to reroute the suction header so that the suction header can be reduced. The scheme was finalized and implemented. After this modification the transfer rate has increased from 1.583 MT/Hour to 1.90 MT/Hour. Thus reducing the running hours of the equipment by 4 hours in a day.

### Technical & financial analysis

Motor rating of fan	= 20 kW
Reduction in running hours	= 4 Hours/day
Energy saved (taking 80% loading)	= 23360 kWh/Year
Money saved (@Rs.1.60/kWh)	= Rs.0.37/Lac
<u>Investment made</u>	=Rs.0.80 Lac

### Implementation

Implemented during financial year 2004-05.

### **17. DSS Bag house diaphragm solenoid valve hoses replaced.**

### Background & Observation

In Potroom, DSS bag house rubber hoses is being used in compressed air circuit of pulsing system. The failure rate of these hoses are very high causing the leakage of compressed air thus wastage of costly energy. To reduce the failure rate of the hoses, material of hose has been changed from rubber to silicon after consulting different vendors. After replacement of the hose material failure rate has reduced leads to compressed air consumption by 50 cfm.

### **Technical & financial analysis**

Reduction in compressed air consumption	= 50 cfm
Average power consumption for compressed air	= 0.003 kW/cfm
Energy saved ( $50 \times 0.003 \times 60 \times 24 \times 365$ )	= 78840 kWh/Year
Money saved (@Rs.1.60/kWh)	= Rs.1.26 Lac/Year

**Investment made** = Rs.0.81 Lac

### **Implementation**

Implemented during FY 04-05

## **18. Elimination of vibration screen from secondary silo of pot line # 1 to 3.**

### **Background & Observation**

In potroom, alumina glues to main air slide while being fed in the pot hoppers from secondary silo. There are six vibrating screen having 7.5 HP motor of 20 TPH capacity installed for screening of alumina in Potroom Plant-1 are run continuously. During an SGA meeting it was decided that we could eliminate all the these vibrating screens by providing a single screen at Day bin of Alumina Plant from where the alumina comes to the Potroom. The scheme was finalized and one new vibrating screen of 60 TPH capacity and having only 3 HP Motor is installed and eliminated all the six vibrating screen of secondary silo.

### **Technical & financial analysis**

Motor rating of vibrating screen of secondary silo	= $6 \times 5.6$ kW
Motor rating of new vibrating screen installed at day bin	= 2.25 kW
Energy consumption with earlier screen ( $6 \times 5.6 \times 0.7 \times 24 \times 365$ )	= 206035 kWh/Year
Energy consumption with new screen ( $2.25 \times 0.7 \times 24 \times 365$ )	= 13797 kWh/Year
Energy saved	= 192238 kWh/Year
Money saved (@Rs.1.60/kWh)	= Rs.3.08 Lac/Year

**Investment made** = Rs.5.0 Lac

### **Implementation**

Implemented during FY 04-05.

## **19. Belt conveyor inter locking & optimum loading to save operating houses**

### **Background & Observation**

There is three pot lines in Plant-1 smelter where alumina comes through a master conveyor. From master conveyor it goes to different lines through conveyor installed in-between the lines. In line consist of Bag filter provided on the top of main silo. Alumina plant feeds the alumina to Plant-1 and Plant-2 both. In our earlier practice we operate the conveying circuit of both the plants simultaneously. The Capacity of alumina conveyor of plant -1 is 60 TPH where as the capacity of Plant-2 conveyor is 100 TPH. Seeing the capacity of the conveyor it was decided to transfer the alumina from Alumina Plant to Plant -1 or Plant -2 one at time. After implementation of this practice almost 50% running hours of motors of Plant-1 has been reduced.

### **Technical & financial analysis**

No of motors in use in Plant-1 alumina conveying system	= 11
Total Connected load in the circuit	= 111.725 kW
Power consumption with earlier practice	= 1392 kWh/Day
Power consumption with new practice	= 651 kWh/Day
Energy saved ( $(1392-651) \times 365$ )	= 270465 kWh/Year
Money saved (@Rs.1.60/kWh)	= Rs.4.33 Lac/Year

**Investment made**

= NIL

**Implementation**

Implemented during FY 2004-05.

**20. Compressed air saving at master belt conveyor tail pulley.**

**Background & Observation**

To blow off the spillage alumina powder from the tail pulley compressed air is being used. As the master conveyor is at a substantial height due to which almost the entire time air valve is kept open even if the conveyor was running. Hence it was decided to interlock the blowing of compressed air with the running of conveyor motor. To control the compressed air consumption for the said purpose, a solenoid valve has been provided and system has been interlocked with conveyor running. Now compressed air is only blows when the conveyor runs thus saving the costly compressed air consumption.

**Technical & financial analysis**

Reduction in compressed air consumption	= 150 cfm
Average power consumption for compressed air	= 0.003 kW/cfm
Energy saved (150*0.003*60*16*365)	= 157680 kWh/Year
Money saved (@Rs.1.60/kWh)	= Rs.2.52 Lac/Year

**Investment made**

= Rs.0.05 Lac

**Implementation**

Implemented during FY 2004-05.

**21. Modification at secondary silo bag houses to eliminate the bag house.**

**Background & observation**

In Plant # 1 Smelter there are three secondary silos from where alumina is fed to the pot cells. These each silo consist of a bag house to arrest the alumina blowing during filling of the silo. During a SGA group meeting it was decided that this bag house could be eliminated after connecting the duct of this silo with main DSS duct. Scheme was prepared and implemented thus running of three motor connected with fan of bag house is stopped

**Technical & financial analysis**

Eliminated motor	= 3
Motor rated kW	= 11 kW
Energy saved (3*11*0.7*24*365)	= 202356 kWh/Year
Money saved (@Rs.1.60/kWh)	= Rs.3.24 Lac/Year

**Investment made**

= Rs.1.00 Lac

**Implementation**

Implemented during FY 04-05.

**22. Replacement of heater type air drier with refrigerated type air drier.**

**Background & observation**

In our compressor house of Reduction Plant -2, heater type air drier of 2500 CFM capacity each was being used for supplying the dry air to the different user. Heater type drier has a system of purging the air, which account appx 3% of the dry air. More power consumption in heater type dryers was a major

concern for us. Hence these dryers have been replaced with a 6000-CFM capacity refrigerated type air drier.

### **Technical & financial analysis**

Energy consumption with heater type air drier	= 756864 kWh/Year
Compressed air loss due to purging (3% of 6000 CFM)	= 180 CFM
Equivalent power of this air	= 283824 kWh/Year
Total Energy consumption for 6000 cfm dry air with heater type drier	= 1040688 kWh/Yr
Energy consumption for 6000 cfm dry air with refrigerated type drier	= 133152 kWh/Year
Energy saved	= 907536 kWh/Year
Money saved (@Rs.1.60/kWh)	= 14.52 Lac/Year

### **Investment made**

= Rs.28.42 Lac

### **Implementation**

Implemented during FY 2004-05.

## **23. Elimination of idle running of ai welding machine bag filter fan.**

### **Background & Observation**

AI welding machine is used to weld the copper rod with stub, stub to stub and also for copper-to-copper welding. During the welding smoke is generated which is being sucked by fan having 10 HP Motor, named bag filter fan, installed for this purpose. It was observed that this fan runs continuously even if welding is taking place. Hence it was decided to interlock this fan with the hydraulic pump running operation of the AI welding machine to avoid the manual error of non-stopping of the fan. Now this fan has been interlocked with the hydraulic pump operation and saved approximate 6 hours unnecessary running of the fan per day.

### **Technical & financial analysis**

Reduction in running hours of the fan	= 6 hours/day
Rated kW of the motor	= 7.5 kW
Energy saved (7.5*0.7*6*365)	= 11498 kWh/Year
Money saved (Rs.1.60/kWh)	= Rs.0.18 Lac/Year

### **Investment made**

= NIL

### **Implementation**

Implemented during FY 2004-05.

## **24. Modified the lighting circuit of potroom crane platform so that during night 3 bulbs can be put off except one bulb.**

### **Background & Observation**

In our crane platform of Pot room, there are four lamps of 125 Watt provided which are connected with the roof light. These lights glow with the roof light. But it was observed that there is no use of these lights during night as no work being performed on the platform during night. Now separate switch has been provided so that three lamps of each platform can be put OFF during night.

### **Financial analysis**

No of lamps in use in Plant –2 Crane platform	= 128
No of lamps kept OFF during night	= 96
Wattage of lamp	= 125 Watt
Glowing time saved	= 12 hours/day
Annual energy saving	= 52560 kWh/Year

Money saved (@Rs.1.60/kWH) = Rs.0.84 Lac/Year

**Investment** = Rs.0.01 Lac

**Implementation**

Implemented during FY 2004-05.

**25. Modification in alumina handling system in line # 4 pilot plant to conserve compressed air.**

**Background & Observation**

In pilot plant of line # 4, enrich alumina comes into the silo from DSS and from this enrich alumina is being fed to the main air slide which is connected with pot air slid. Now the circuit has been modified and DSS out put is connected with main air slide and bypasses the conveying system of silo to main air slide to conserve the compressed air.

**Technical & financial analysis**

Reduction in compressed air consumption	= 200 cfm
Average power consumption for compressed air	= 0.003 kW/cfm
Energy saved (200*0.003*60*20*365)	= 262800 kWh/Year
Money saved (@Rs.1.60/kWH)	= Rs.4.20 Lac/Year

**Investment made** = 0.25 Lac

**Implementation**

Implemented during FY 2004-05.

**26. Use of metal handling cruce for left over metal in the snif furnace during alloy change instead of making the solid cake.**

**Background & Observation**

In our slab casting there are two melting cum holding furnaces and one Snif furnace. Snif furnace is used for degassing of molten metal during casting process. During change of alloy composition we need to drain the metal and make solid cake, which is further charged in furnace for melting. Both the furnaces run simultaneously. Normally when casting is done with one furnace, the metal preparation is done in other one. It is rare to have the same alloy in both furnace and that's why almost in all the casting we have to drain the left over metal of Snif furnace. It was decided to use molten metal handling cruce for taking the left over metal of Snif and charge it back into the same furnace in molten condition thus reducing process scrap generation and wastage of energy.

**Technical & financial analysis**

Average left over metal take out from the Snif furnace	= 153 MT/Month
Oil consumption for melting the solid aluminuim	= 45 Ltrs/MT
Fuel oil saved (45*153*12)	= 82.62 KL/Year
Money saved (Rs.12010.41/KL)	= Rs.9.923 Lac/Year

**Investment made** = Rs.1.80 Lac

**Implementation**

Implemented during FY 2004-05.

## 27. Reduction of ingot alloy rejection in pig casting

### Background & Observation

In Pig casting unit EC grade and Alloy ingot casting is being done. It was noticed that the rejection is too high in the case of alloy ingot. To sort out problem a meeting among the officers of operation and technical took place for the purpose of solving this problem. During the meeting all the parameters were reviewed and it was concluded that high rejection is mainly due to cracking and presence of oxide bubbles. The reasons were investigated and decided to optimize the metal temperature and metal depth in the mould. Decided practices were implemented and it is found that 2.28% rejection has been reduced.

### Technical & financial analysis

Reduction in rejection	= 2.28%
Average monthly production of alloy ingot	= 1102 MT
Reduction in rejection	= 25.13 MT/month
Fuel oil saving (@45Ltr/MT)	= 13.57 KL/Year
Money saved (Rs.12010.41/KL)	= Rs.1.63 Lac/Year

### Investment made

= NIL

### Implementation

Implemented during FY 2004-05.

## 28. Modification in control system of cooling tower fan of pig ingot casting unit

### Background & observation

Cooling tower has three shells, which are used to feed the cold water to the mould cooling of pig casting. The cooling tower is placed approx 300 meters away from the main unit. It was observed that all the three fans run continuously even if desired temperature is achieved. To optimize the running of fans of cooling tower, water temperature display has been provided in the panel view and provided start and stop push button on instrument panel to enable the operator to stop the fans as per requirement. After this modification it was noticed that running of two fans reduce by 12 hours per day.

### Technical & financial analysis

Motor HP of cooling tower fan	= 30 HP
Current drawn by the fan	= 22 Amp
Energy saved $(1.732 \times 415 \times 22 \times 0.8 \times 12 \times 2 \times 365 / 1000)$	= 110819 kWh/Year
Money saved (@Rs.1.60/kWh)	= Rs.1.77 Lac/Year

### Investment made

= 0.05 Lac

### Implementation

Implemented during FY 2004-05.

## Fabrication Plant

### 1. Provided v.v.f drive for 50mm shear hydraulic motor in bliss hot mill

#### Background & Observation

In Hot Mill, there is a 50-mm shear used to cut the head and tail end of the slab. Maximum times it runs unnecessarily. It was decided to stop the motor during idle time and run at 100 % speed when required. In 15 minutes rolling cycle of Hot Mill, only around 2.5 Minutes is the shear time. Keeping in the above objective VVF Drive has been installed for 50 mm Shear machine hydraulic motor.



**Technical & financial analysis**

Energy Consumption with 100 % Load (4 hrs) = 160 amp →  $1.732 \times 415 \times 160 \times 0.80 \times 4 / 1000$   
= 368 kW/day  
Energy Consumption, No Load condition (20 hrs) = 59 amp →  $1.732 \times 415 \times 59 \times 0.17 \times 20 / 1000$   
= 144 kW /day  
After Installation of VVVF drive  
Energy Consumption with 100 % Load (4 hrs) = 368 kW/day  
Energy Consumption, No Load condition (20 hrs) = 0 kW/day  
Energy Saving =  $(368 + 144 - 368) = 144$  kW/ day  
=  $144 \times 360 = 51960$  kWh / Yr.  
Monetary Equivalent =  $1.60 \times 51960 = \text{Rs.}83052 = 0.83$  Lakh

**Investment made** = RS. 4.05 Lakh

**Implementation**

Implemented during financial year 2004-05.

**2. Revamping of annealing furnaces-1 & 2**

**Background & Observation**

In Fabrication Plant # 1, there are five Annealing Furnaces. The annealing process removes stresses, softens Aluminium by altering mechanical properties, refines the grain structure and produces a definite microstructure.

The Furnaces are running for last 40 years in this condition and skin temperature was recorded 80 – 100 Degree C. To improve energy consumption and cycle time, it is recommended that the insulation of these furnaces needs to be changed to achieve the outside surface temperature of 55 to 60 Degree C.

The re – lining of furnace # 1& 2 is completed during December 04 & January 05 respectively.

**Technical & financial analysis**

Avg. Specific Energy Consumption of both furnaces before lining = 195.12 kWh / MT  
Avg. Specific Energy Consumption of both furnaces after lining = 175.48 kWh / MT  
Energy Saving = 19.64 kWh / MT  
Average production = 24994 MT  
Monetary Saving on actual production through both furnaces =  $\text{Rs.}19.64 \times 24994 \times 1.60$   
= **Rs.7.85 Lakh/ Yr.**

**Investment made** = Rs.61.17 Lakh

**Implementation**

Implemented during December 2004 & Jan 05

**3. Provide v.v.f drive for cpt compressor motor in davy cold mill**

**Background & Observation**

CPT Compressor is installed to deliver compressed air to Cold Mill. It was running at full speed. It was consuming 1054 kWh / day. To control speed of motor as pressure requirement a V V F Drive has been installed in CPT Compressor motor

### **Technical & financial analysis**

Power consumed by CPT Compressor Motor running at 50 HZ in fully loaded condition i.e. 13 hrs	= 54 kW
Power consumed by CPT Compressor Motor running at 50 HZ in unloaded condition i.e. 11 hrs	= 32 kW
Power Consumption per Day (kWh)	= $54 * 13 + 32 * 11 = 1054$
Power Consumption after installation of VVF Drive	= 760 kWh / day
Power saving	= $(1054-760) = 294$ kWh/day
	= $294 * 350 = 102900$ kWh/Yr.
Monetary Saving (considering 350 days working)	= $102900 * 1.60$
	= Rs.1.65 Lakh

### **Investment made**

= Rs.2.87 Lakh

### **Implementation**

Implemented during financial year 2004-05.

#### **4. Fuses provided for isolation of heater in annealing furnace # 1 to reduce cycle time due to grounding of heaters**

##### **Background & Observation**

Earlier 3 no fuses were provided for each bank of Heaters in Annealing Furnace. So during grounding of 1 heater 2 no fuses had to be taken out for isolation. This isolated all the 6 heaters of the bank. This resulted in increase of cycle time and more consumption of energy for heating the same load. The heater can only be changed after isolating it from main supply. It was decided to provide separate fuse for set of 2 heaters. Now two fuse have to be taken out which will isolate only two heaters in that bank & other 4 heaters will be in service.

##### **Technical & Financial Analysis**

Cycle time reduced by 1 hours after implementation which resulted the stoppage of fan and blower motor for one-hour in each cycle.

Energy saved $(4 * 40 * 0.8 + 2 * 2.2 * 0.8) * 240$	= 31565 kWh/Year
Monetary Saving (@Rs.1.60/kWH)	= Rs.0.51 Lac/Year

##### **Investment Made**

=Rs.0.079 Lac

##### **Implementation**

Implemented during financial year 2004-05.

#### **5. Reduction in speed of fume exhaust fan of davy cold mill during roll change & mill stoppage**

##### **Background & Observation**

The Fume Exhaust fan of Davy Cold Mill is running at full speed round the clock to exhaust the fumes generated during rolling.

As during stoppage the Mill like at PM time, shutdown of the mill and roll change time, no fume generates, hence it was decided to reduce the Motor speed during Roll Change & other mill Stoppage time by reducing the supply frequency from 50 Hz to 28 Hz. Necessary changes done in Software in PLC & Fume Exhaust Motor AC Drive to reduce the speed of fan during stoppage time of mill to save the energy.

##### **Technical & Financial Analysis**

Power consumed by Fume Exhaust Fan Motor running at 50 HZ	= $0.415 * 1.732 * 0.85 * 166$
	= 101.42 kW
Power consumed by Fume Exhaust Fan Motor running at 28 HZ	= $0.235 * 1.732 * 0.85 * 66$

Energy Saving	= 22.83 kW
Average NRT of Davy Mill.	= 101.42 – 22.83 = 78.59 kW
The Roll Change time & other Mill stoppage time.	= 22 Hours
	= 2 Hours/Day
	= 722 Hours/Year
Energy Saving	= 722*78.59 = 56742 kWh/Year
Monetary Saving	= Rs.56742*1.60 /Year
	= Rs.0.91 Lakh/Year

**Investment Made** = NIL

**Implementation**

Implementation of above practice is done from the month of August 2004.

**6. Provide off delay timer in tension leveler line to avoid the idle running of feeding roll dc motor during line run**

**Background & Observation**

In Tension leveler line Feeding roll DC Drive was continuously running. This drive is used to run the feeding roll only at the time of sheet feeding. Rest of the time operator used to keep the feeding roll open. Secondly the Edge trimmer DC Drive was running continuously even if the trimming is not required.

We have modified the software accordingly so that now Feeding roll DC drive stopped when the feeding roll is in open position as well as Edge trimmer DC Drive stopped when trimmer is in fully out position.

**Technical & Financial Analysis**

Current taken by the armature of feeding roll drive (AC Side) earlier	= 4.0 A
Energy saved armature side (1.732 * 0.415 * 4.0 * 0.85)	= 2.44 kW
	= 2.45*18*355
	= 15655 kWh/Year
Current taken by the armature of Edge trimmer drive (AC Side) earlier	= 9.0 A
Energy saved armature side(1.732 *0.415 * 9.0 * 0.85)	= 5.5 kW
	= 5.5*10*355
	= 19525 kWh/year
Monetary Saving (15655+19525)*1.60	= Rs.0.56 Lakh/Year

**Investment Made** = NIL

**Implementation**

Implemented during financial year 2004-05.

**7. Timer provided in caster for automatic control of lights**

**Background & Observation**

In Caster area shed light ON / OFF system was manual. It was observed some times the lights were glowing unnecessarily causing wastage of energy To overcome the problem and minimize the human error of non switching OFF the lights it was decided to install timer for better controlling. Now after provision of timer lights of this is being made ON/OFF automatically as per time setting.

**Technical & Financial Analysis**

Lighting Load during manual control	= 26 amp.
Energy consumed by lighting load (1.732*0.415*26*0.83)	= 15.51 kW
Time Saving 2 Hrs daily by providing Timer (15.5*2)	= 31 kWh/day

Monetary Saving (11315\*1.60)

= 31\*365  
= 11315 kWh/Year  
= Rs.0.181 Lakh/Year

**Investment Made**

= Rs.0.02 Lakh

**Implementation**

Implemented in March 05.

**8. Increase in through put of Properzi Mill by increasing mould size, mill speed & NRT**

**Background & Observation**

In Remelt Shop, there is 3 Properzi Mill to produce re – draw conductor and alloy rod. The mould size (diameter) of Casting Wheel was 1800 mm and speed was 2.8 rpm. To increase through put and for better energy efficiency, the following modification have been done:-

1. Increased Casting mould size (diameter) from 1800 mm to 1900 mm.
2. Increased Casting Wheel speed from 2.8 rpm to 2.85 rpm.

Also by improving operating practices the NRT of mill also increased from 21.05 to 21.42 hours/day  
After implementing the above practices and modification specific fuel consumption has reduced by 0.5 Liter/MT



**Technical & Financial Analysis**

Reduction in Specific Fuel Consumption  
Actual Production in 2004 – 2005  
Fuel (Furnace Oil) Saving

= 0.5 Lt./MT  
= 64161 MT  
= 0.5\*64161/1000  
= 32.08 KL/Year  
= 3.85 Lakh/Year

Monetary Saving (F Oil Cost @ Rs.12010/KL)

**Investment Made**

= Rs.1.0 Lakh

**Implementation**

Implemented in Financial Year 2004 – 2005.

**9. Modification in recuperator to increase its efficiency**

**Background & Observation**

In Properzi Area, there are 6 Melting cum Holding Furnaces to cater the molten metal requirement to produce Re – draw rod. To recover waste heat to save fuel, on line Recuperator has been installed in each furnace to pre – heat combustion air. Initially pre heat combustion air temperature of each furnace was recorded more than 250 degree C but later on this has reduced below 200 deg C. Reduction in combustion air temperature was reduced mainly due to reduction in effectiveness of the recuperator. The problem was analysed and it was found that effectiveness of recuperator has reduced due to non-cleaning of tubes of recuperator which was not possible in short duration of PM. Cleaning of recuperator was not possible with out taking it out from the chimney which requires the shutdown of the furnace. To cope up this problem, a brain storming session was organized and it was decided to provide an inspection door in each furnace for on line cleaning of recuperator tubes. By this effort, now on line tube cleaning is feasible and with regular cleaning the effectiveness of the recuperator has increased.



### **Technical & Financial Analysis**

Pre – Heat air temperature before modification	= 200 °C
Pre – Heat air temperature after modification	= 250 °C
Gain in temperature	= 250-200 = 50 °C
As per thumb rule, 1 % fuel can be saved by increasing combustion air temp. 22 degree C	
Hence, Saving in Fuel	= 2 %
Actual reduction in specific fuel consumption after modification	= 1 Lt./MT
Actual Production of Re – Draw rod in 2004 – 2005	= 64161 MT
Fuel (Furnace Oil) Saving (64161*1)/1000	= 64.161 KL/Year
Monetary Saving (F Oil Cost RS 12010/ KL)	= 64.161*12010/100000
	= Rs.7.70 Lakh/Year.

### **Investment Made**

= Rs.0.30 Lakh

### **Implementation**

Implemented in Financial Year 2004 – 2005.

### **Boiler & Co-generation**

1. **Boiler # 1 coal feeder (n & s) :- on & off switch was provided in the circuit for the 100 watt bulb**

### **Background & Observation**

In our Boiler # 1 volumetric coal feeder there were four Nos. 100 W lamps used for inspection of coal flow. It was observed that all the bulbs use to glow continuously for inspection of coal flow twice a shift for 5 minutes each, rest of the time it was glowing unnecessary due to non-availability of ON/OFF switch at the coal feeder

Hence it was decided to provide ON/OFF switch so that instead of glowing continuously it should be made ON/OFF as & when required. ON/OFF switch has been provided in the circuit.

### **Technical & Financial Analysis**

Power Consumption	= 100*4*24*365 / 1000
	= 3505 kWh / Year.
Power consumption after providing on/off switch	= 100*4*(1/2 hr) *365/1000
	= 73 kWh / Year.
Energy saved	= 3232 kWh / Year
Monetary Saving (3505-73)*1.60	=Rs.0.55 Lakh/Year

### **Investment Made**

= Rs.0.0025 Lakh

### **Implementation**

Implemented during financial year 2004-05.

2. **Boiler # 1, 2 & 3 door limit switch provided in mcc room (3 nos. mcc) total tubes of 40 watt- 95 nos.**

**Background & Observation**

In Boiler no.1, 2 & 3 MCC (ESP, DM PLANT, & BOILER) ROOM, All the tube lights used to glow continuously for 24 hours.

It is decided to incorporate door limit switches in 3 nos. of MCC doors. Sufficient nos. of tube lights will glow only when some one will enter in the MCC room as per requirement. By this modification glowing time has been reduced by 16 hrs.

**Technical & Financial Analysis**

Power Consumption earlier	= 95*(40+15)*24*350 = 43890 kWh / Year.
Power Consumption after providing Limit switch	= 95*(40+15)*8 hr *350 = 4630 kWh / Year
Energy saved	= 29260 kWh / Year
Monetary Saving	= (43890-14630)*1.60 = Rs.0.468 Lakh / Year.

**Investment Made** = Rs.0.015 Lakh

**Implementation**

Implemented during financial year 2004-05.

3. **Cogen stage- ii in 50 mva transformer - 8 nos. fans (500 watt) were always running. by circuit modification fan will start only at 68<sup>o</sup>c and stop at 60<sup>o</sup>c in auto**

**Background & Observation**

In co-generation 2, 8-nos. radiator fans (500w) of 50 MVA Transformer were running continuously to maintain the proper cooling of Transformer. After brain storming it is decided to provide thermostat in line to set the temp. in such a way that fans will start at 68 degree C & stop at 60 degree C to restrict wastage of energy.

It is observed that after modification fans are not running. It is assumed that fans will run during peak summer day when surrounding temperature will be high..

**Technical & Financial Analysis**

Earlier power consumption in fans	= 500*8*24*340/1000 = 32640 kWh/Year.
Power consumption after modification	= 500*8*12* 60/1000 = 2880 kWh/Year.
Energy saved (32640-2880)	= 29760 kWh/Year.
Monetary Saving	= (32640-2880)*1.60 = Rs.0.476 Lakh/Year.

**Investment made** = Nil

**Implementation**

Implemented during financial year 2004-05.

4. **Cogen stage - ii 20 nos. 125 watt lights circuit changed and provide manual on/off switch as & when required.**

**Background & Observation**

In co-generation - 2, 20 nos. of 125 W lights used to glow continuously. Provision for ON / OFF Switch has been incorporated to glow light as & when required to save energy.

### **Technical & Financial Analysis**

Power Consumption before modification	= $125*20*24*365/1000$ = 21900 kWh/Year
Power Consumption after modification (ON Time 16 hr)	= $125*20*16*365/1000$ = 14600 kWh/Year
Energy saved (21900-14600)	= 7300 kWh/Year
Monetary Saving (21900-14600)*1.60/100000	= Rs.0.117 Lakh/Year.

**Investment Made** = NIL

### **Implementation**

Implemented during financial year 2004-05.

## **5. By using energy saving lamps (26 watt x 2 nos. CFL) in place of 125 watt of MVL (6 nos.)**

### **Background & Observation**

In outside office of Boiler area, 6 nos. 125 W high-pressure mercury Lamp was installed. Two nos. CFL of 26 Watt have provided in place of 125W mercury vapor lamps to save power.

### **Technical & Financial Analysis**

Power Consumption with 125 W mercury Lamp	= $125*6*8*365/1000$ = 2190 kWh/Yr.
Power Consumption with 2 nos.26 W mercury Lamp	= $(2*26)*6*8*365/1000$ = 911 kWh/Yr.
Energy saved (2190-911)	= 1279 kWh/Year
Monetary Saving	= $(2190-911)*1.60/100000$ = Rs.0.02 Lakh/Year

**Investment Made** =Rs.0.108 Lakh

### **Implementation**

Implemented during financial year 2004-05.

## **6. Installation of energy efficient centrifugal compressor in boiler & co-generation.**

### **Background & Observation**

Compressed air is used in Boiler & Co-generation for performing the different operations like operating control valve, pulsation in bag house and instrumentation purpose etc. To meet the compressed air requirement in Boiler & Co-generation, there are four reciprocating compressors of 775 cfm each. Keeping energy saving objective in the mind, two energy efficient centrifugal compressors of 3300-cfm capacity each were installed last year.

### **Technical & Financial Analysis**

Compressed air generation with Reciprocating compressor (taking 90% volumetric efficiency and considering 3 and ½ compressor running)	= $775*0.9*3.5$ cfm = 2441 cfm
Per day power consumption for above air generation	= $132*0.8*3.5*24$ kWh/Day = 8870 kWh/Day
Presently one centrifugal compressor and one Reciprocating is used to run at time	
Air Generation with present setup (taking 90% Volumetric efficiency)	= $(3300+775)*0.9$ cfm

	= 3668 cfm
Power consumption with new set up	= (536+132)*0.8*24 kWh/Day
	= 12825 kWh/Day
Power requirement for generating 3668 cfm with old setup i.e. with all reciprocating compressors	= 13329 kWh/Day
	= 3668*8870/2441 kWh/Day
	= 13329 kWh/Day
Energy saved (13329-12825)	= 504 kWh/Day
Annual energy saving (345 working days)	= 173880 kWh/Year
Money saved (rs.1.60/kWh)	= Rs.2.78 Lac/Year
<b><u>Investment Made</u></b>	= Rs.157.18 Lac

### **Implementation**

Implemented in July' 2004.

## **7. Installation of co-generation unit # 2.**

### **Background & Observation**

During our expansion from 4.5 to 6.6 Lac PA our steam requirement has increased to about 250 TPH including low & high pressure where as our steam generation capacity was 300 TPH. All the time this requirement of steam in Alumina Plant was not possible with set up of two Boilers & one Co-generation unit. Hence it was decided to install a additional Co-generation unit to fulfill the steam requirement as well as to generate power. As per the decision, a Boiler of 150 TPH capacity along with 41 MW turbine has been installed in FY 04-05. Now the extraction of turbine i.e. about 45 TPH extracted steam is being used in our Alumina Plant in addition to power generation.

### **Technical & Financial Analysis**

Enthalpy of this steam	= 618012 Kcal/MT
Steam utilized	= 45 TPH
Enthalpy utilized	= 27810540 Kcal/Hr
Calorific value of coal	= 3576 Kcal/Kg
Steam saved ((21814380/(3576*1000))	= 7.777 MT/Hr
Coal Saved (7.777*24*356)	= 66447 MT/Year
Money saved (@Rs.1207.13/MT)	= Rs.802.10 Lac/Year

**Investment Made** = Rs.15835.22 Lac

### **Implementation**

Implemented in July' 2004.

## **8. Installation of vam air conditioning system in boiler & co-gen area.**

### **Background & Observation**

During installation of Co-Generation unit # 2 it was felt that installation of VAM air conditioning system could be done, as low-pressure steam will be available. Keeping this in mind to utilize the low pressure steam, a scheme formulated and 320 TR Capacity air conditioning system has been installed and stopped the operation of existing air conditioning system of same capacity having the electrical operated compressor.

### **Technical & Financial Analysis**

Electrical energy consumption in earlier set up	= (183+30)*0.8*24*365 kWh/Year
	= 1492704 kWh/Year
Electrical energy consumption in earlier set up	= 60*0.8*24*365 kWh/Year
	= 420480 kWh/Year
Electrical Energy saved	= 1072224 kWh/Year

Money saved (Rs.1.60/kWH) = Rs.17.16 Lac/Year

**Investment Made** = Rs.151.89 Lac

**Implementation**

Implemented in July' 2004.

**8. Installation of hydro turbine for operating chemical dosing pump operation using the head available in make up water of cooling tower**

**Background & Observation**

It was difficult to maintain the desired temperature of turbine exhaust steam at 49.5 Deg C due to lower vacuum in condenser. The lower vacuum in condenser was mainly due to the fouling of condenser tubes. It was investigated and found that fouling of condenser tube is mainly due to improper mixing of chemicals causing improper water treatment in cooling tower. To improve the chemical mixing location has been changed from bottom to top distribution tray. Now for lifting the chemical a pumping system has been installed. During installation of pump required for chemical dosing a thought was generated to install Hydro turbine for operating chemical dosing pump using the head available in make up water of cooling tower. The same has been fabricated in house and connected with the chemical-dosing pump. Now the same system is being utilized and proper mixing of chemical in cooling tower water is done leading to reduction in fouling of condenser tubes and maintaining the exhaust temperature. Average 2 deg C temperature has been reduced after implementation of new practice and 60 kW generation increased. With installed hydro turbine, we have saved the power in the tune of 0.373 kW required for chemical dosing pump operation. Now the chemical dosing pump is being driven by the in house fabricated hydro turbine.

**Technical & Financial Analysis**

Energy saved required for pumping the chemical	= 0.373*24*320 kWh/Year
	= 2865 kWh/Year
Generation increased	= 60 kW
	= 60*24*320 kWh/Year
	= 460800 kWh/Year
Total energy saved	= 463365 kWh/Year
Money saved (Rs.1.60/kWH)	= Rs.7.41 Lac/Year

**Investment Made** = Rs.0.02 Lac

**Implementation**

Implemented in Dec' 2004.

**Utilities**

**1. Energy saving at refractory godown cum mould making area.**

**Background & Observation**

There are two godown cum refractory shuttering/mould making areas of following dimensions 30M X 15 M and 18.5 M X 17.5 M where wooden and steel mould for refractory casting of various plants are made round the year. As it is covered with asbestos shed and brick side wall, then lighting arrangements are as follows:

Total Tube lights = 48 Nos., Metal Halide = 2 No, HPMV = 6 Nos.

It was being observed that some portion (30 % of total area) earmarked for mould preparation activity and for this job, it is required to switch on about 30 tubes and 2 halogen in the daytime.

As an energy saving initiative, to utilize sunlight, transparent Fibre Reinforcement Plastic (FRP) sheets were replaced in two areas of the roof shed considering the sunlight direction and focusing to regular job area. It eliminates the switch on of about 20 tubes in daytime and clean sky season.

### **Technical & Financial Analysis**

No. of working hours per day	= 8 hours
No. of working days per year	= 300 days
No. of average clear sky days	= (300-60)= 240 days
Total no. of hours not to on tube lights	= 8 x 240 = 1920 hours
No. of tube lights (40 watt each) and 2 halogen ( 400 watt each)	
Power Saved ((30 * 40 + 2* 400)* 1920/1000))	= 3840 kWh /Year
Total cost of energy saved	= Rs.3840 X 1.60 = Rs.0.061 Lakh / Year

**Investment Made** = Rs.0.06 Lac

### **Implementation**

Implemented during financial year 2004-05

## **2. Reduction of surface heat loss from salt bath furnace at R & D shop**

### **Background & Observation**

There is a salt bath furnace where heat treatment of tools and tackles are carried out through immersing the job in melted salt inside the crucible shape furnace. Furnace is protected by refractory and insulation and heat is generated electrically.

It was being observed that the temperature at the outside of the furnace seems very high resulting in radiation heat loss to the extent of  $946\text{W} / \text{M}^2$  and time taken to raise operation temp is found to be more. This observation insists to reduce heat loss through refractory to counter the above problem.

The refractory lining thickness is reviewed and explored for better insulating material to protect heat loss. The refractory lining has been redesigned and implemented with in-house resources.

### **Technical & financial analysis:**

Before modification heat loss found to the extent of	= $946\text{W} / \text{M}^2$
After modification heat loss found to the extent of	= $191\text{W} / \text{M}^2$
Total energy loss saving through wall / Hr	= $(946-191) = 755\text{W} / \text{M}^2$
Total working hours in a year	= 7000 Hr
Total Area	= $3.458 \text{M}^2$
Total energy saving	= $3.458 * 755 / 1000 * 7000$ = $18275 \text{kWh} / \text{Year}$
Monetary Saving ( $18275 * 1.60 / 100000$ )	= Rs.0.292 Lakh/Year

### **Investment Made**

Negligible as cost of insulation per unit volume is equal to that of earlier refractory material and implemented at the time of life matured of earlier Refractory.

### **Implementation**

Implemented during financial year 2004-05

## **3. Reduction of specific energy consumption for bauxite unloading in wagon tippler.**

### **Background & Observation**

The Wagon Tippler handles major Raw Material (Coal and Bauxite) for Alumina Production and substantial amount of energy is consumed in the total circuit of unloading, crushing and conveying such raw materials.

To reduce energy consumption, following areas have been identified and executed: -

1. Reduced cycle time of unloading
2. Avoid and minimize ideal running of equipment
3. Avoid and minimize under loading of the equipment
4. Tippler is switched off during removing of choked materials
5. Monitoring and optimization of lighting system.

### **Technical & Financial Analysis**

Average energy consumption with earlier practice	= 2.500 kWh / MT
Average energy consumption after execution of above practices	= 2.444 kWh/ MT
Power Saving (2.5-2.44)	= 0.056 kWh / MT
Total material handled per year	= 26,73,000 MT
Energy Saving (26,73,000*0.056)	= 1,49,688 kWh/Year
Monetary saving (1,49,688* 1.60)	= Rs.2.395 Lakh/Year.

### **Implementation**

There is no specific investment was made but by increasing awareness and close monitoring the task had been performed.

### **Implementation**

Implemented during financial year 2004-05