



Hindalco Industries *Limited*

BELGAUM ALUMINA PLANT

Integrity
Commitment
Passion
Seamlessness
Speed

S.V.Nesargi

Rajesh Badiger



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Overview

- Start up in 1970 : 70 KT alumina
- Location : West Coast Area : ~ 1100 acres
- Alumina plant expanded in phases

<u>KTPA</u>	<u>Yr</u>	<u>Drivers</u>
– 110 ▶ 160	73-74	Smelter exp.
– 160 ▶ 220	92-93	Alumina export
– 220 ▶ 260	96-97	Alumina/Hyd exp
– 260 ▶ 383	98-06	Debottleneck projects & Process Optimisation

- Current Strength - 791
- ISO 9001, 14001 & OHSAS 18001 certified



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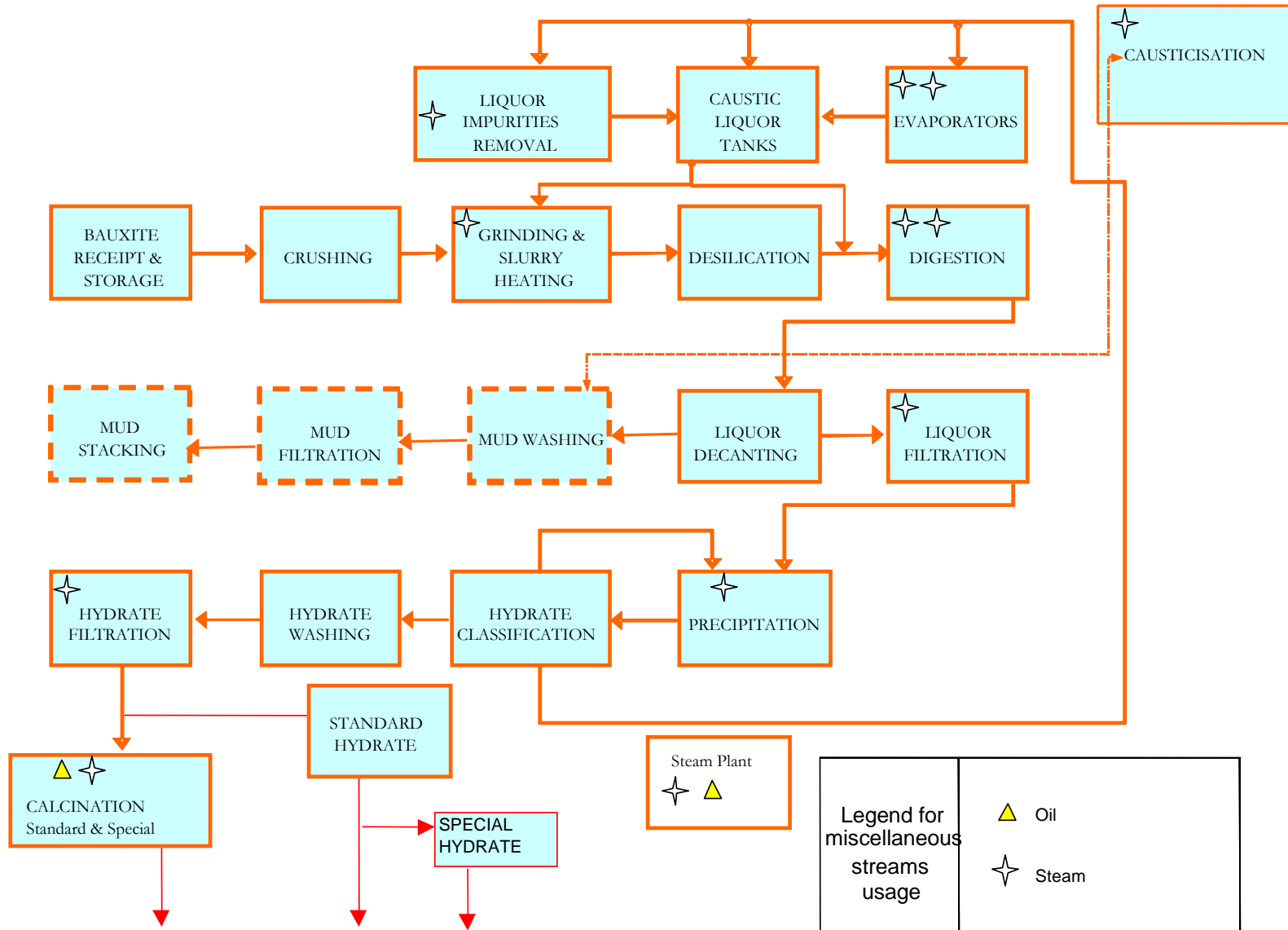
Speed

Key Process Features

- Medium temperature alumina plant for gibbsite extraction(139 deg. C)
- Predesilication
- Conventional gravity mud settlers/Washers
- Mud filtration & Dry mud stacking
- Kelly filters for liquor filtration
- Semi-Continuous precipitation
- Calcination-Rotary Kilns
- Evaporation & Oxalate Removal Units
- Side stream causticisation

Process Flow Diagram-Alumina plant Belgaum

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For Sales

Legend for miscellaneous streams usage	
	Oil
	Steam



ADITYA BIRLA GROUP

Integrity

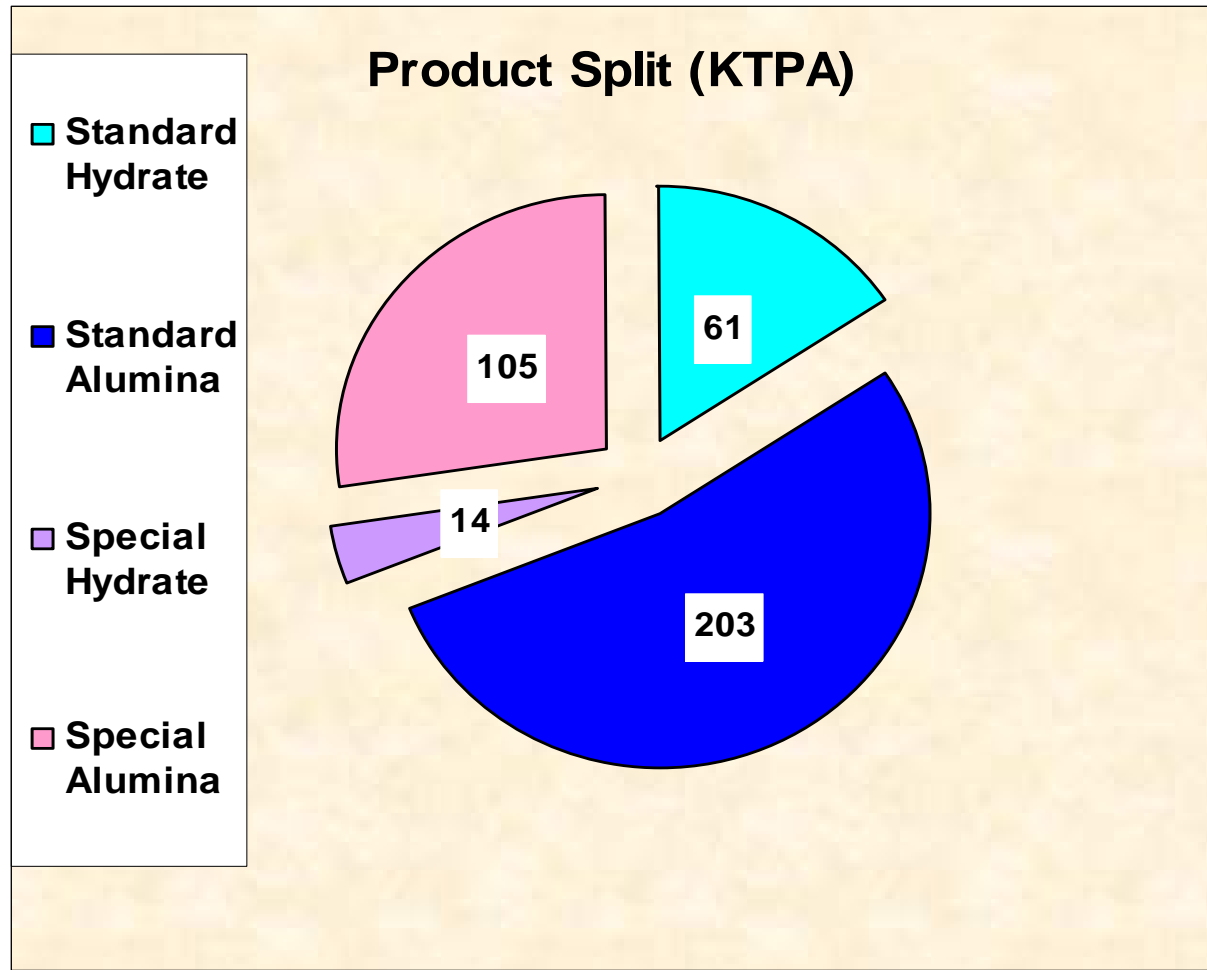
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Product Split



Sales

Export	Domestic	Group plants
70%	20%	10%



Energy Consumption

Primary Sources of energy

- 1) **Furnace oil** - 84 KT/yr
- 2) **Power** - 83 MU/yr*
- 3) **Diesel** - 1.3 KT/yr

* Major portion (82 MU) is sourced from SEB ; No CPP
CD/MD : 15/12 MVA

Usage points:

• Furnace oil :

Generation of steam - to heat up the process stream

Calcination - to provide heat energy in calciner

• Electricity : Widely used to operate the pumps, Ball mills compressors and other equipments.

• Diesel : Used to operate DG set for critical loads

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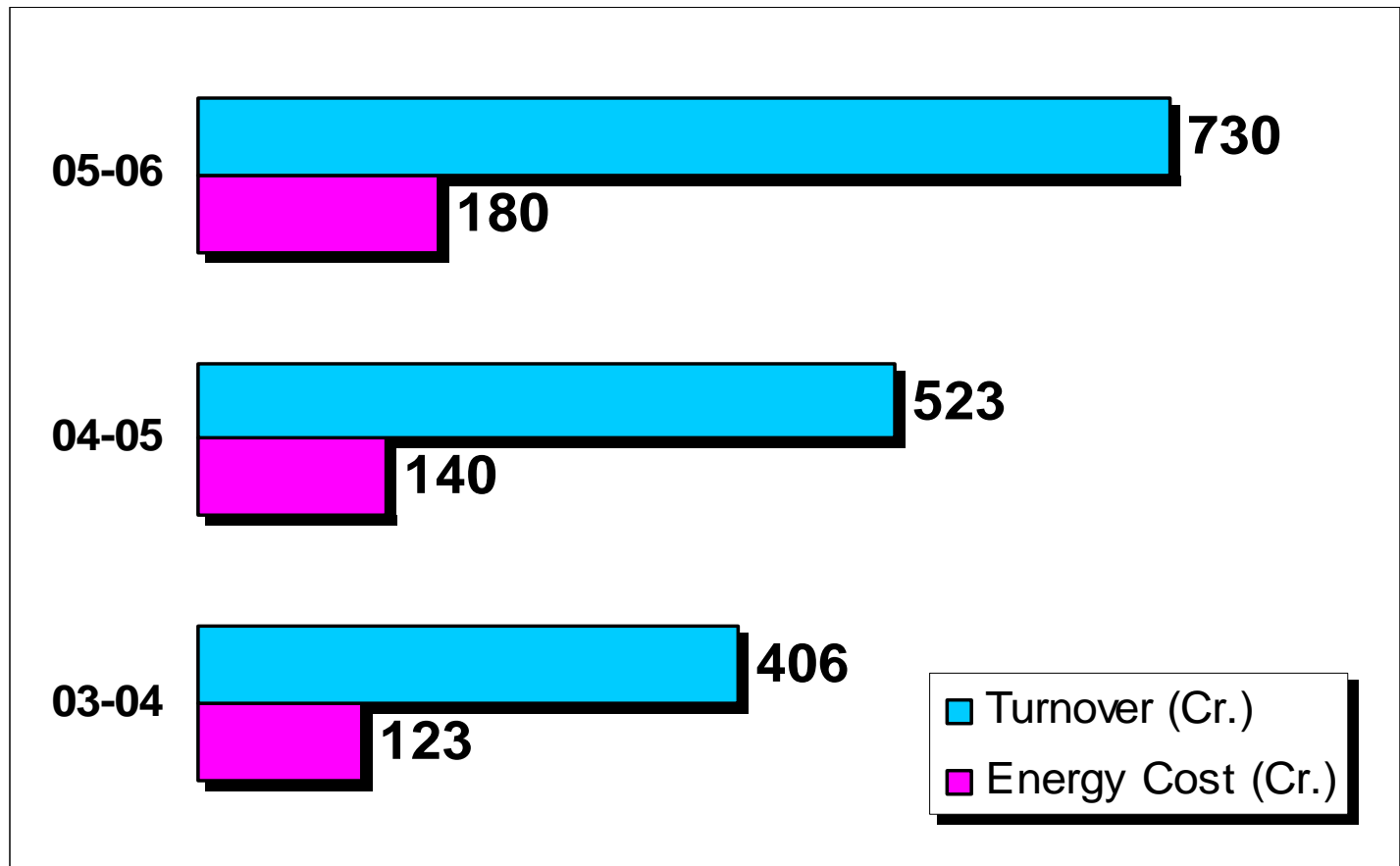
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Energy Cost





Integrity

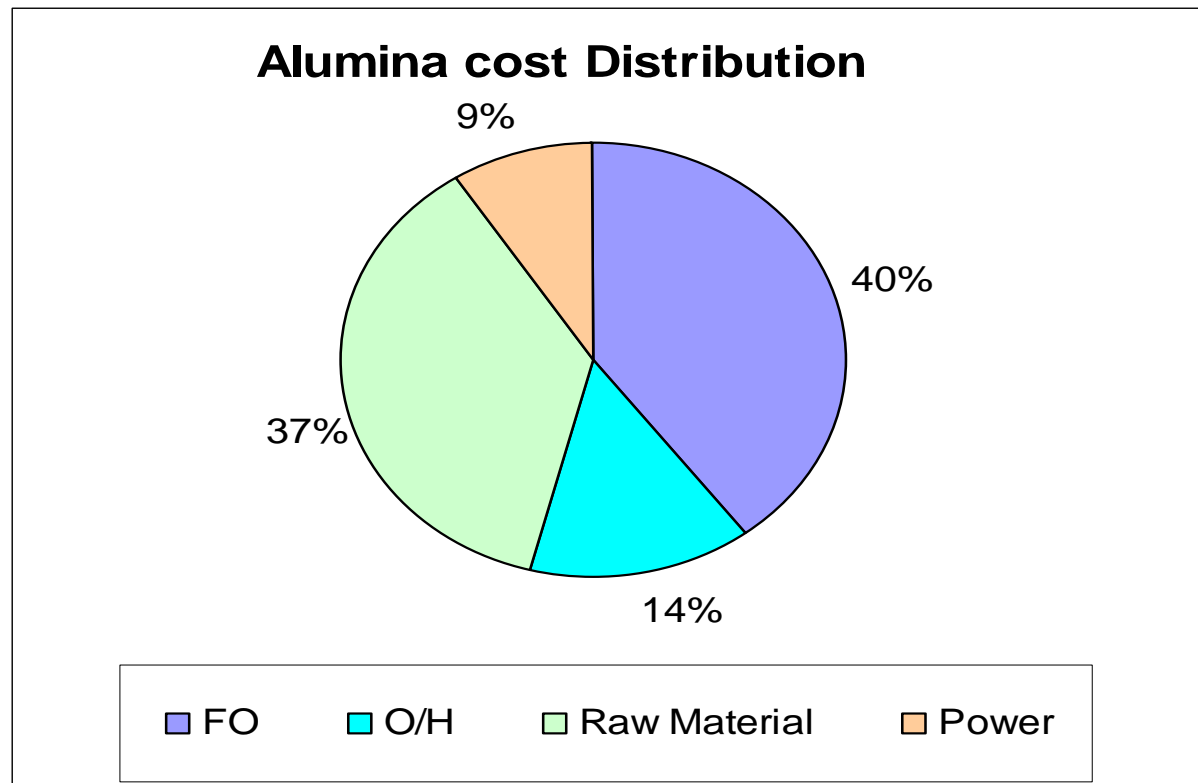
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Product cost analysis



Energy cost is about 50% of the product cost.

CHALLENGES AHEAD:

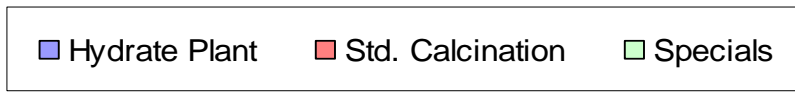
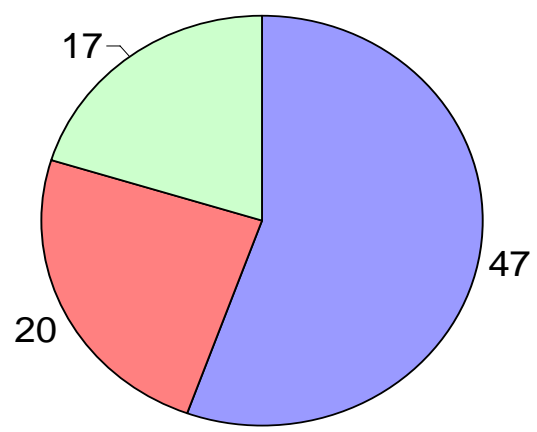
- > Increasing fuel oil prices,
- > New plants world over with higher scale of economy & state of the art technology.



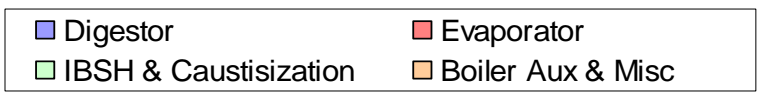
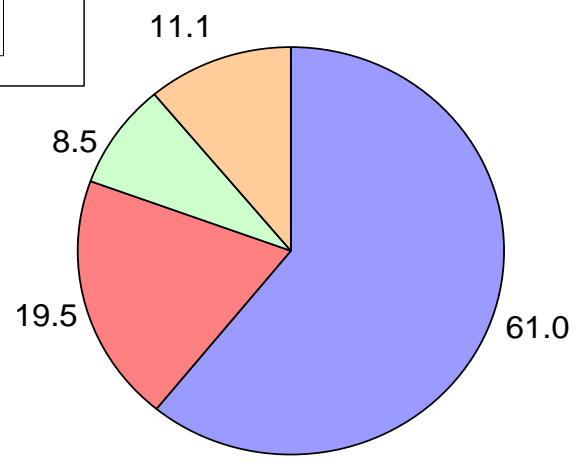
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Thermal Energy Distribution

Fuel Oil Distribution (KTPA)



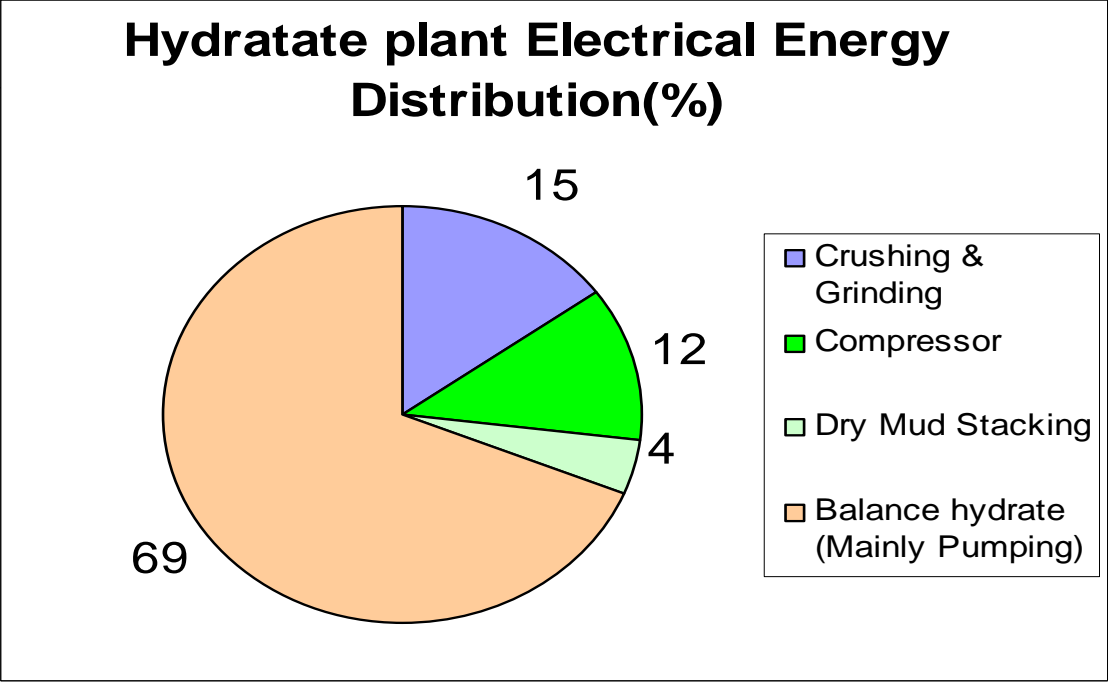
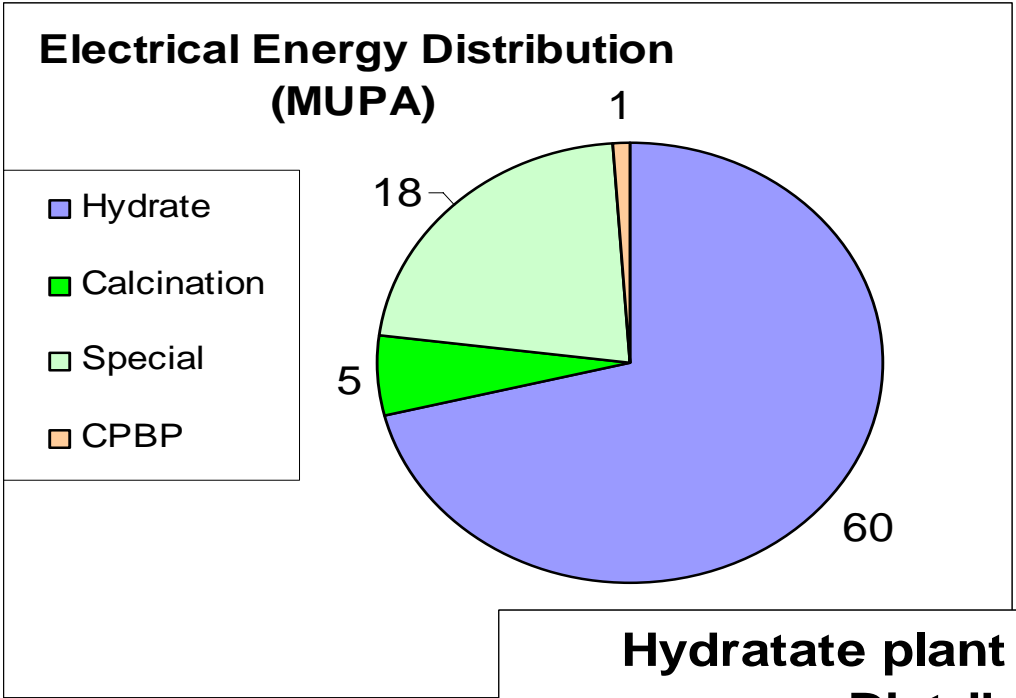
Steam distribution (%)





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Electrical Energy Distribution





Best Practices on Energy Conservation

- ✓ **Continual Improvement in production volume and productivity**
- ✓ **Automation & closed loop controls through DCS**
- ✓ **Process optimization**
- ✓ **Conducting regular energy audits through external & internal agencies & Implementation of the recommendations**
- ✓ **Usage of Variable speed drives (VFDs)**
- ✓ **Resizing of process pipelines**
- ✓ **Replacement of low efficient pumps and motors**

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Best Practices on Energy conservation

- ✓ Introduction of efficient burners
- ✓ Introduction of eco-ventilators & FRP CT Fans
- ✓ Introduction of Energy efficient lighting
- ✓ Routine insulation check
- ✓ Effective Predictive & Preventive maintenance practices.
- ✓ Computerised power monitoring system (under commissioning stage)

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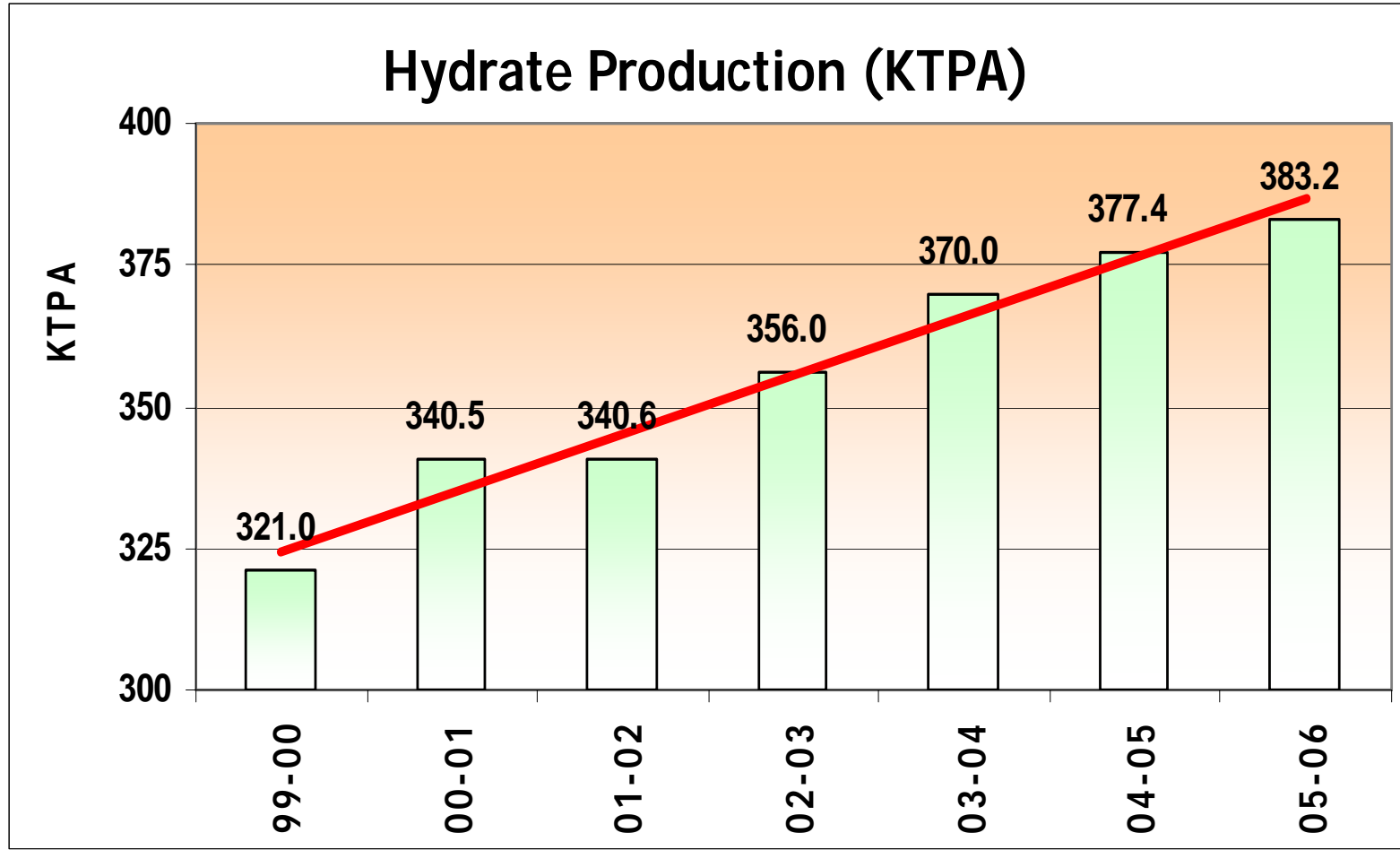
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KEY PERFORMANCE INDICATORS



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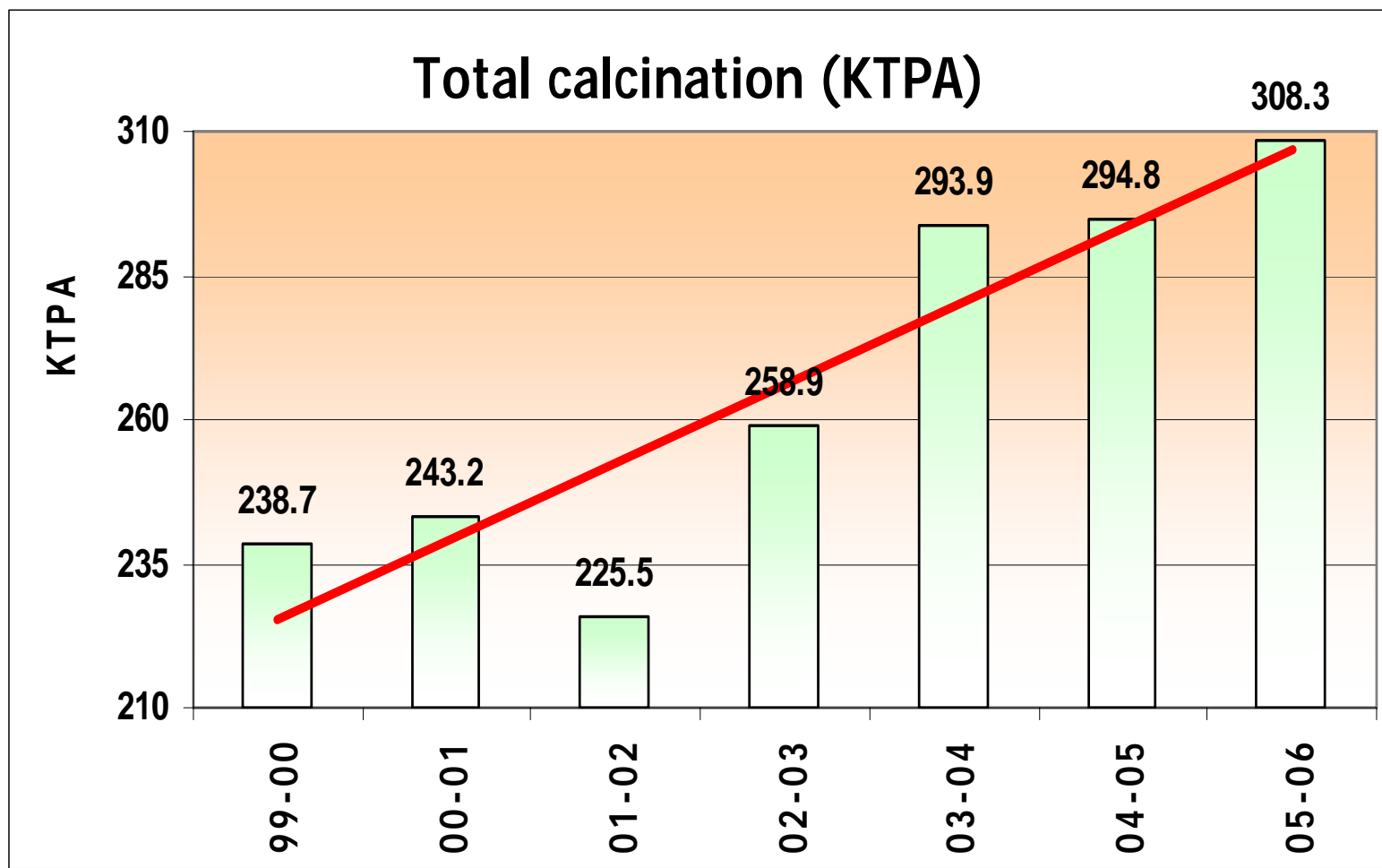
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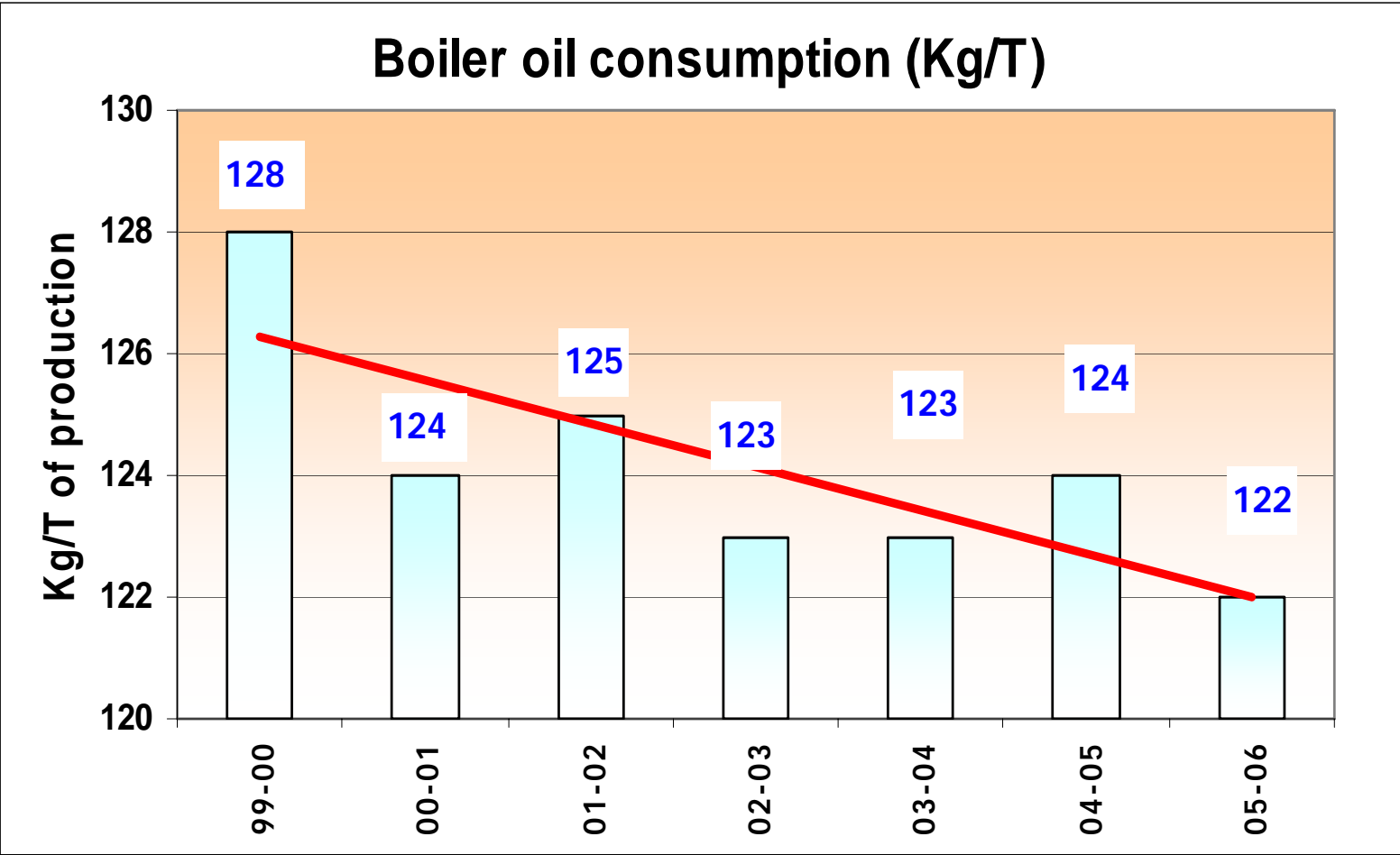
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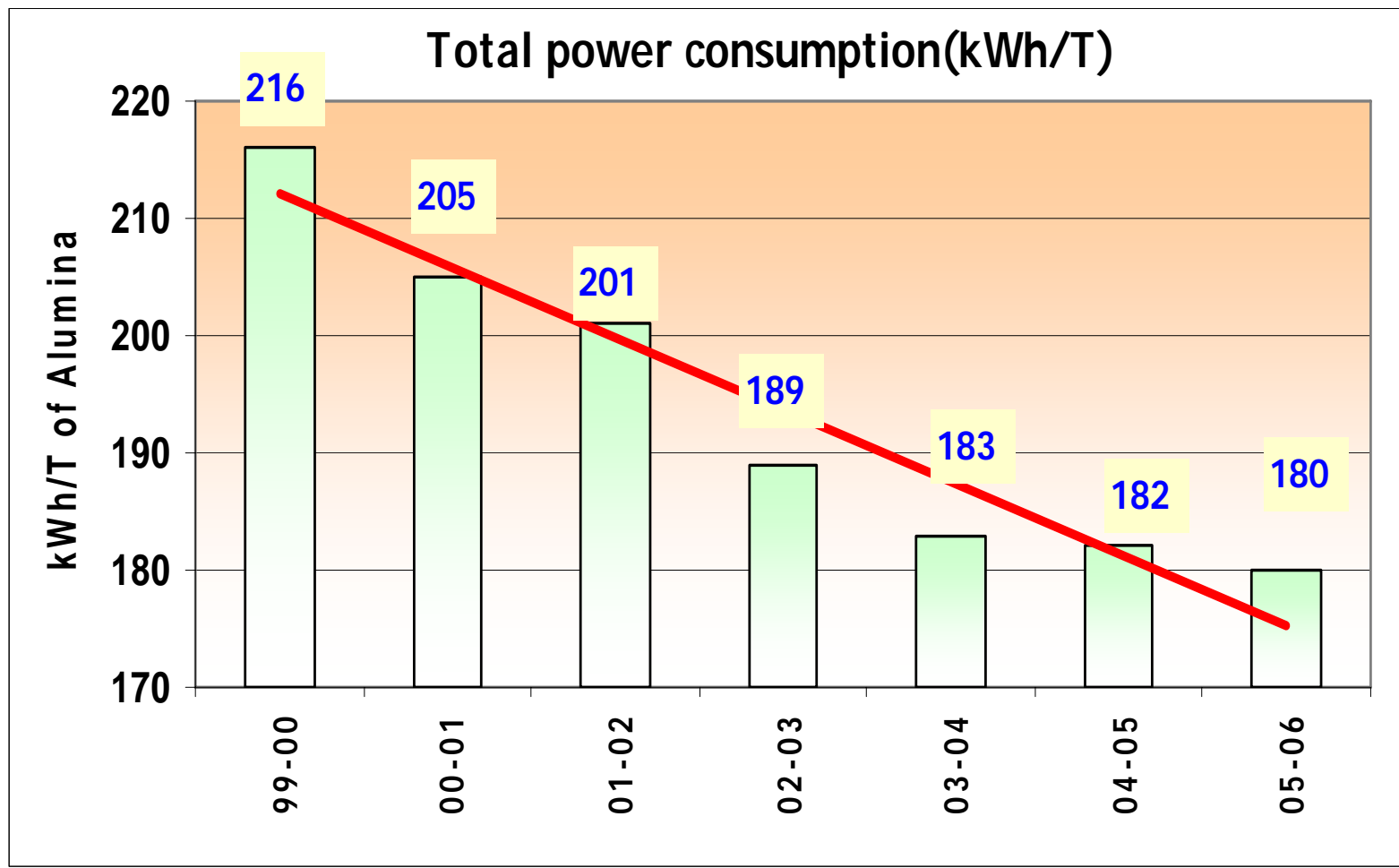
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CASE STUDIES



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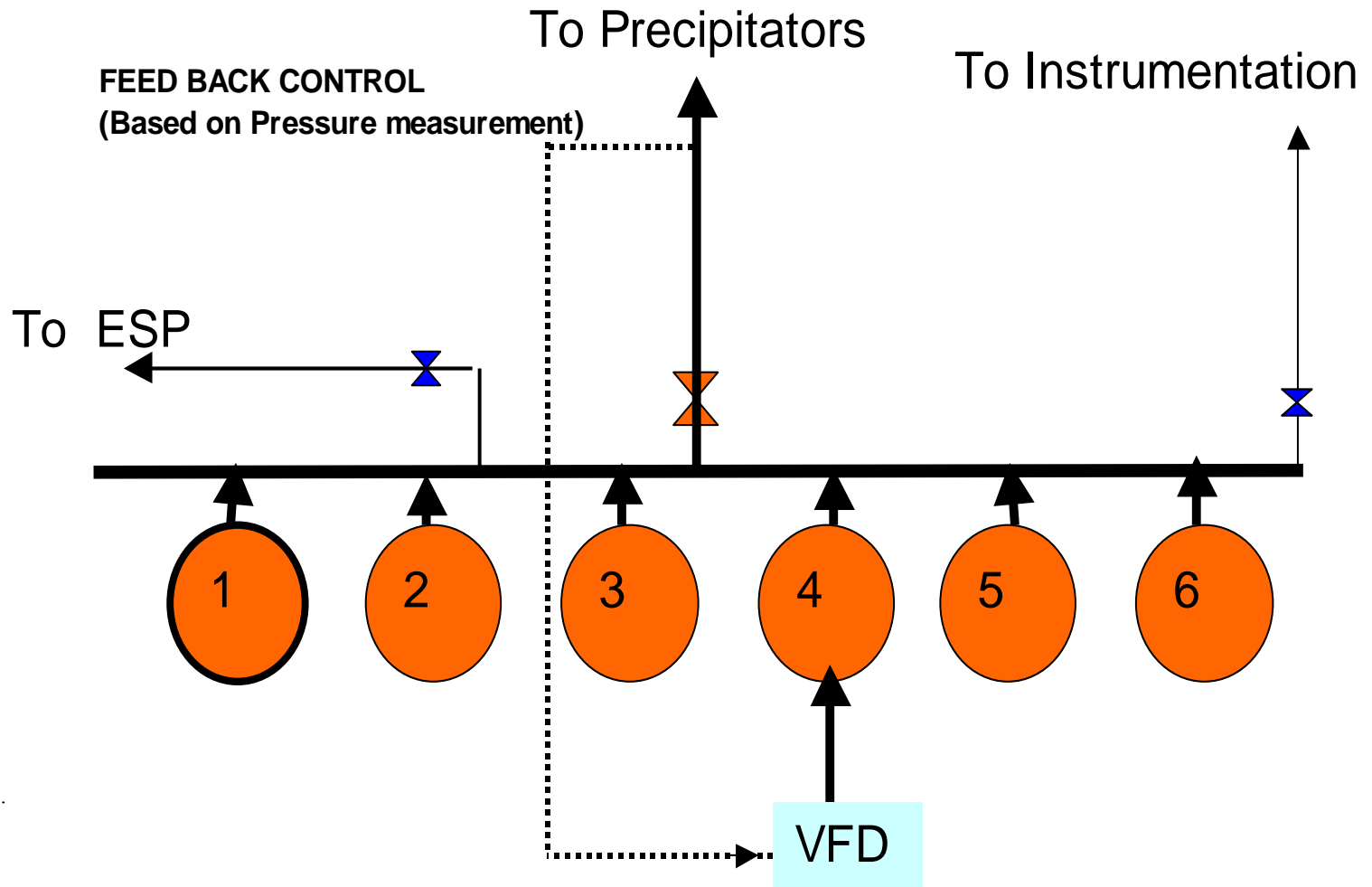
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List of case studies

1. Optimization of compressor operation
2. Provision of VFDs in place of control valves
3. Changing of existing fluid couplings with VFDs & installation of energy efficient pumps
4. Introduction of efficient lighting
5. Mud filter vacuum optimisation
6. DG automation
7. Economiser & VFD for boiler no. 3
8. Cast steel economizer tubes to cast iron gilled & increased heat transfer area in boiler no.- 4.
9. Burner modification in boiler no. 5
10. Improvement of digester heat recovery
11. Calcination capacity & efficiency improvement
12. Mud filter capacity & efficiency improvement
13. Improvement initiative in evaporators - Proposed

1. Optimization of compressor operation

Hydrate plant



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1. Optimization of compressor operation

Savings:

Area	Reduction in energy consumption (kW)	Savings (Rs/annum)
Hydrate Plant	90	36.0 lakhs
Micron master	50	16.2 lakhs
Material handling	50	16.2 lakhs

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2. PROVISION OF VFDs IN PLACE OF CONTROL VALVES

- 1) **Background** : Flow control through control valves
- 2) **Observation**: Energy inefficiency due to throttling
- 3) **Technical & Financial Analysis**:
VFDs for energy efficient flow control.

Savings:

- a) Washers overflow pumps : 1.75 lakh kWh/annum
- b) Special filling pumps : 2.20 “
- c) Evaporator liquor pumps : 1.10 “
- d) Barometric water pumps & : 5.90 “
cooling tower fan modifications

Total savings : 10.95 lakhs kWh/annum
: Rs. 47.2 lakhs/annum

Total investment, Rs. 15.0 lakhs



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3. CHANGING OF EXISTING FLUID COUPLINGS WITH VFD & INSTALLATION OF ENERGY EFFICIENT PUMPS

1)Background :

Fluid coupling for pump speed control and old inefficient pumps.

2)Observation:

Poor flow control &
Higher maintenance requirements

3)Technical & Financial Analysis:

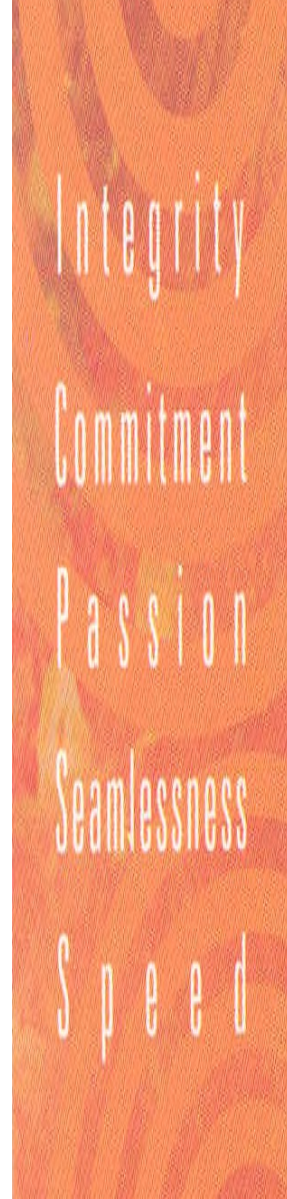
Replacement with VFD & new energy efficient pumps.

Savings : 8.2 Lakh kWh/annum

Rs. 37.5 Lakhs/annum

Investment :Rs 40 lakhs





4. Introduction of Energy Efficient lighting

1) Background :

- Old lighting systems and manual controls.
- Higher supply voltage in the night.

2)Observation:

- Energy inefficiency in lighting system and control.
- Variation in lighting voltage and energy loss.

3)Technical & Financial analysis

- Use of efficient lights, electronic chokes and light sensors.
- Installation of Energy saver.

Savings : 1.7 lakhs kWh/annum

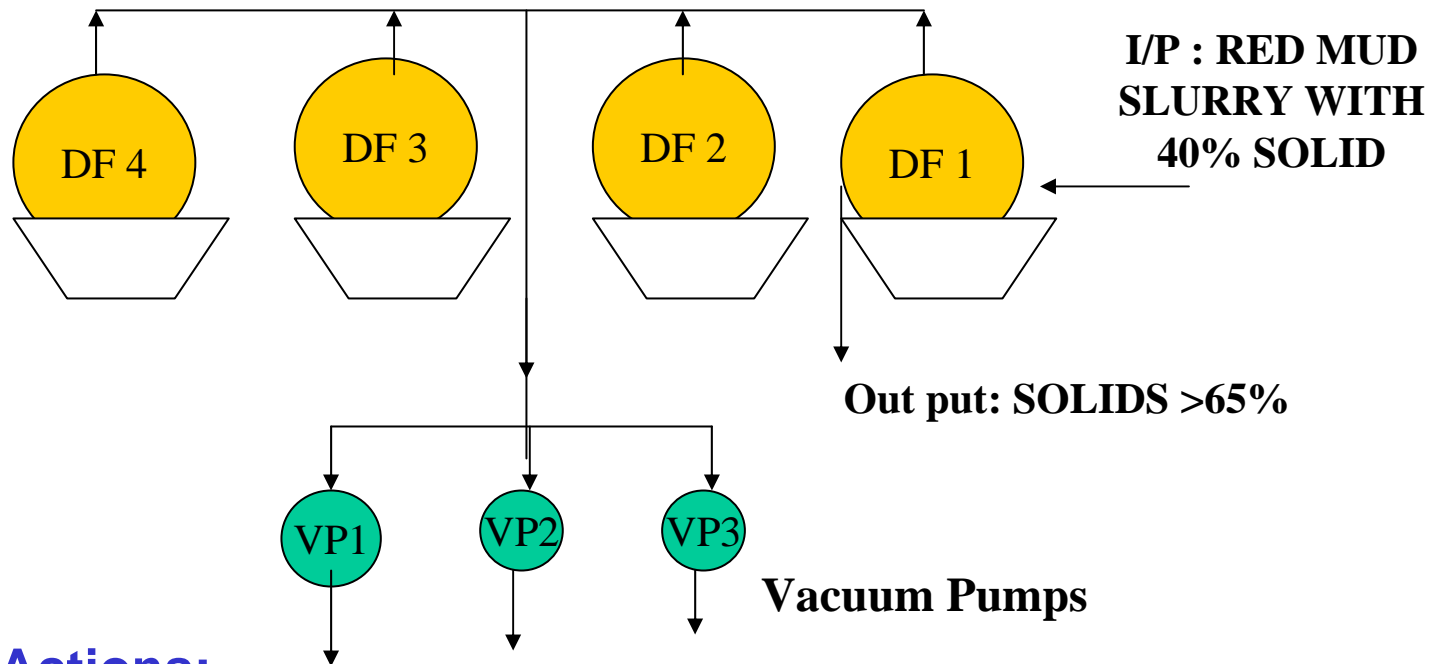
Rs.7.2 Lakhs/annum

Investment :Rs 5 lakhs





5. Mud filter vacuum optmisation



Actions:

- Modifications in vacuum system
- Optmisation of vacuum level from 520 to 470 mm Hg. without affecting process efficiency/throughput

Result : Operation of single vacuum pump in place of two pumps.

Savings : 3 KWh/T of Alumina = Rs. 39 lakhs/annum

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6. DG Automation

Earlier scenario:

Continuous operation of ~700 KW critical load Fed through DG

- Cost of Power on DG - Rs. 11.50/Kwh
- Cost of Grid supply - Rs. 4.50/Kwh

Fossil fuel burning and limitations in exhaust gas heat recovery & Waste lube oil generation

Present operation:

PLC & Controller based automation of DG set for rapid starting & supply/load side management.

Critical load kept on grid supply on normal hours & in case of grid supply failure, power for the critical loads is restored within 15 sec from DG.

Savings : Rs 4.0 Cr./annum

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7. Economiser & VFD for Boiler No. 3

1) Background :

- Higher flue gas temperatures.
- Damper control for combustion air

2) Observation:

- Considerable quantity of heat is lost to atmosphere.
- Energy inefficiency

3) Technical & Financial Analysis:

Scope for installation economiser and VFD for energy efficiency.

Savings : 310 T/annum fuel oil

1.7 Lakh kWh/annum

Rs. 41.6 Lakhs/annum

Investment : Rs 33 lakhs





8. Cast Steel Economizer Tubes to Cast Iron Gilled & Increased heat transfer area in Boiler No.- 4.

- Increased reliability and availability from cast iron gilled tubes. Expected life is about 10 years. (earlier 2 years)
- Enhanced heat recovery from flue gasses. Feed water temp increased by 15 deg. C

About 480 T/annum fuel oil savings

(Rs.53 lakhs /annum at 11000 Rs/T oil)

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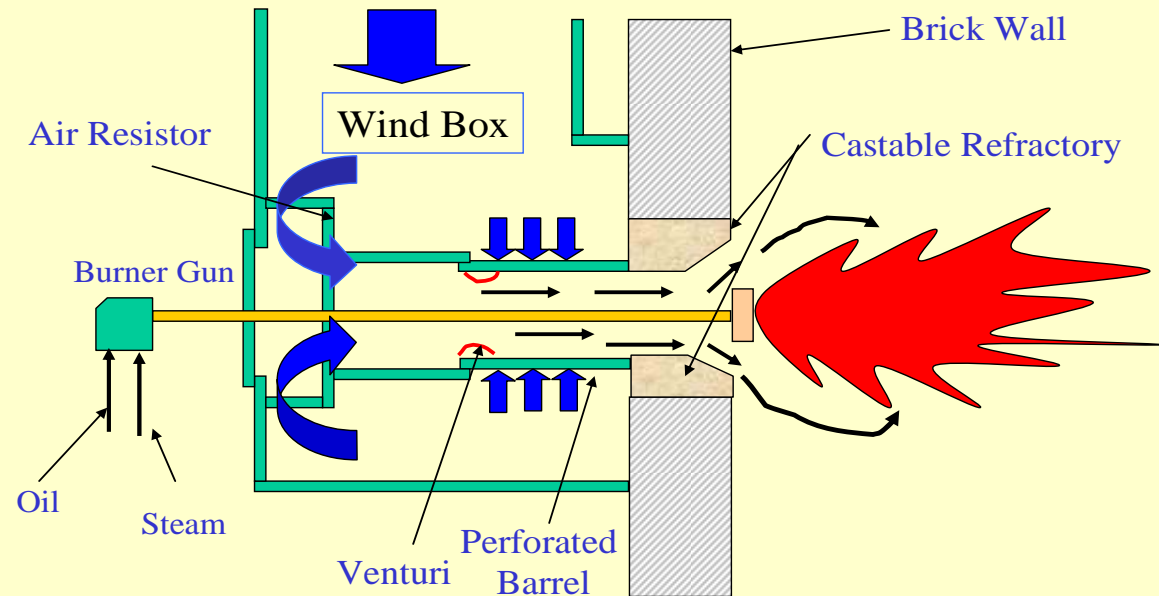
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9. BURNER MODIFICATION IN BOILER NO. 5

Boiler No.5 Burner Modification



About 250 T/annum fuel oil savings

(Rs. 27 lakhs /annum at 12000 Rs/T oil)

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Few other modifications in Boiler house

- **Installation of automatic blow down system for Boiler no.4 & 5**
- **Insulation of Boiler chimney**
- **Upgradation of Main steam Header 10" to 16" Ø.**

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10. Improvement of digester heat recovery

Background :

The digested slurry is flash cooled to atmospheric conditions before decantation. This heat is transferred to the liquor feeding to digester.

Problem faced:

- Slurry carry over into heater chest.
- Poor Heat transfer leading to insufficient heat recovery – some times leading to flash over
- Vapor purging in spent liquor heaters to avoid flashing
- Higher steam consumption

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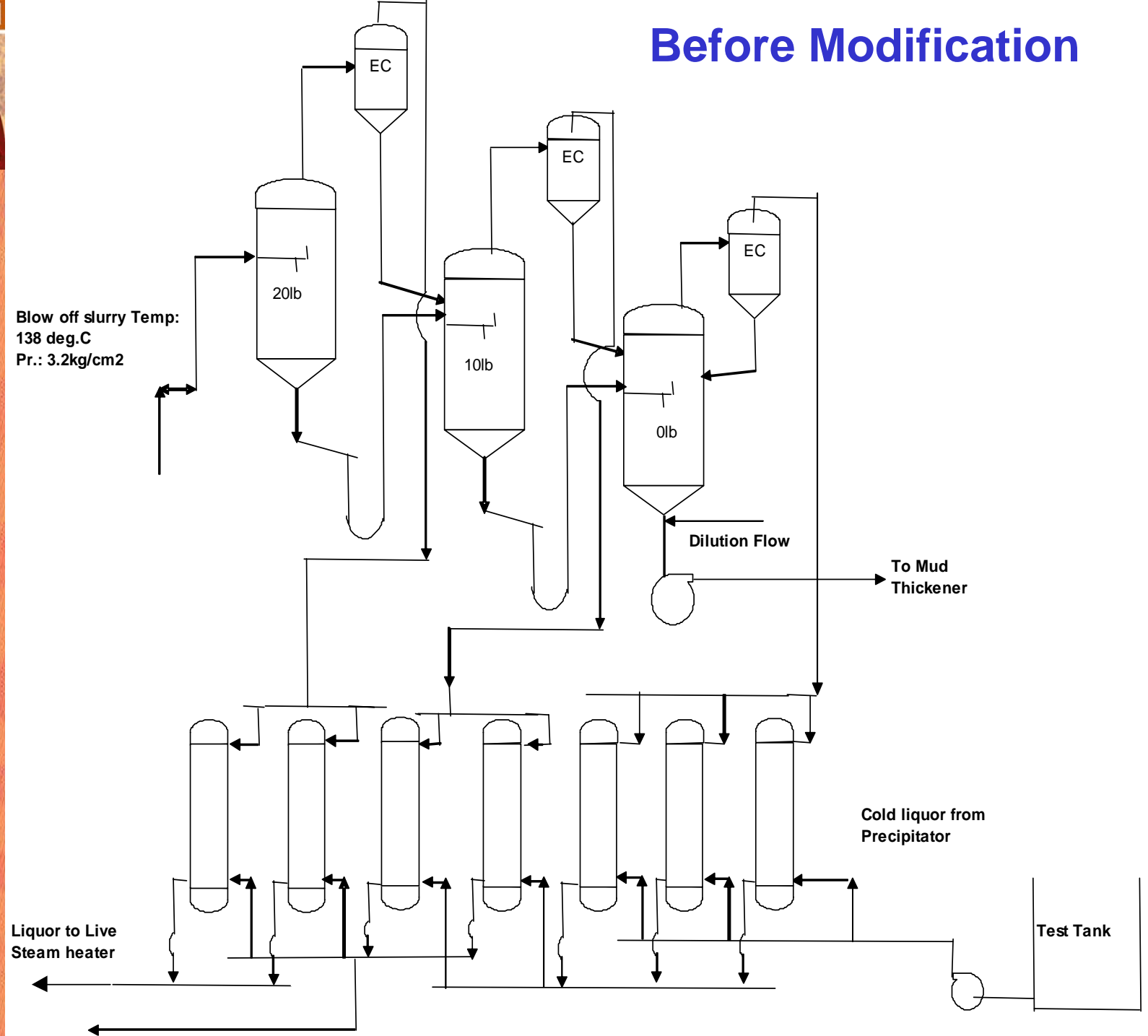
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Before Modification





10. Improvement of digester heat recovery

Analysis revealed :

- Very high vapor velocities is causing the entrainment.
- By adding one more flash stage more heat can be recovered
- Better design (Bottom entry) can eliminate slurry entrainment.

Hence a fourth stage of flashing was added and all flash tanks were converted to bottom entry with an investment of Rs. 2.7 Cr.

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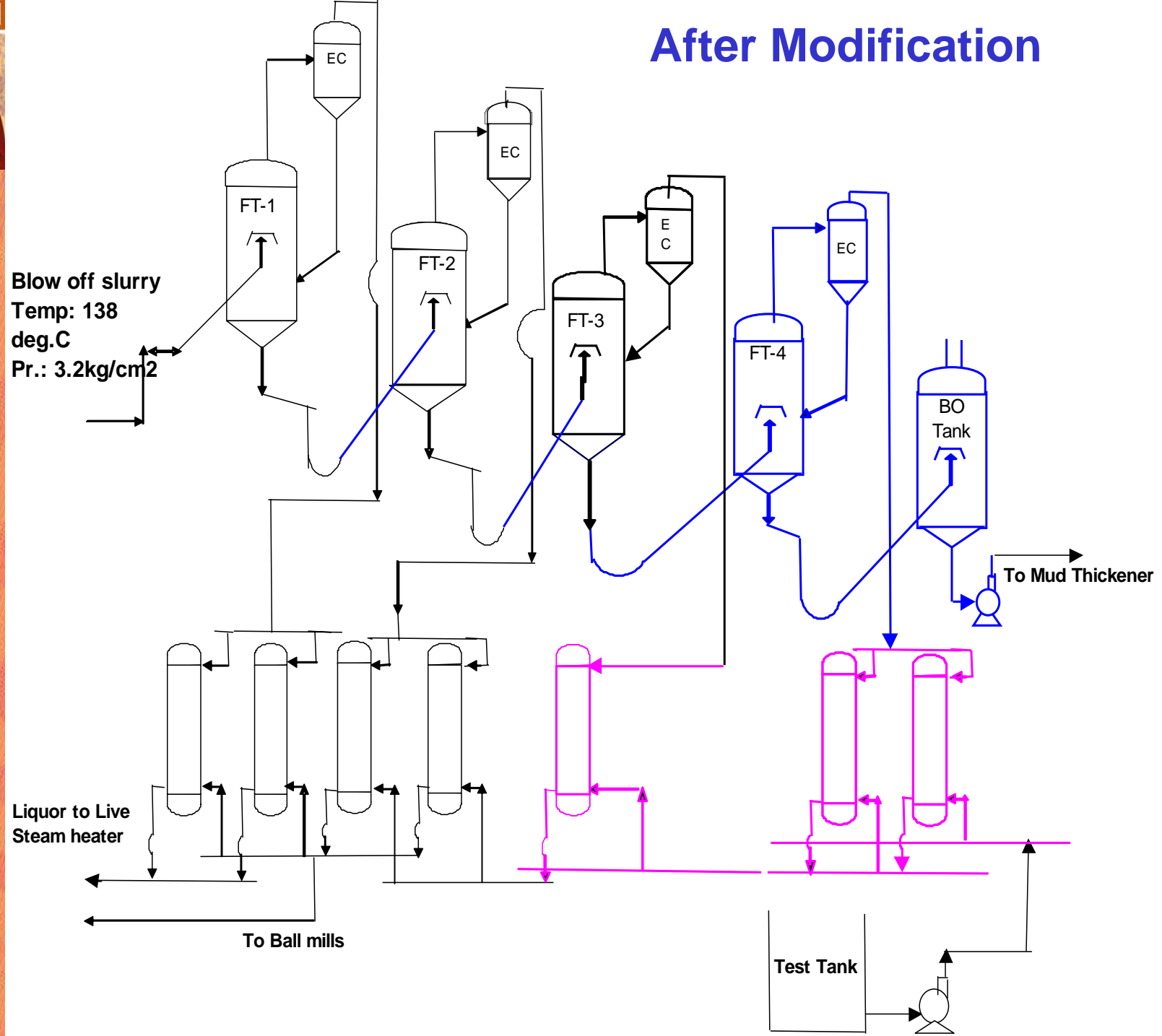
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After Modification





10. Improvement of digester heat recovery

Results :

- Heat pick up across the regenerative heaters increased by ~2 Deg C
- Mud entrainment eliminated
- The new flash tanks provided opportunity to increase the heat recovery in spent liquor heaters (inlet cold liquor)
- Reduction of ~2 Kg/T in boiler oil recorded
i.e. **760 T/yr Fuel oil savings**
- Annualised savings of ~ Rs. 1.2 Cr. per annum

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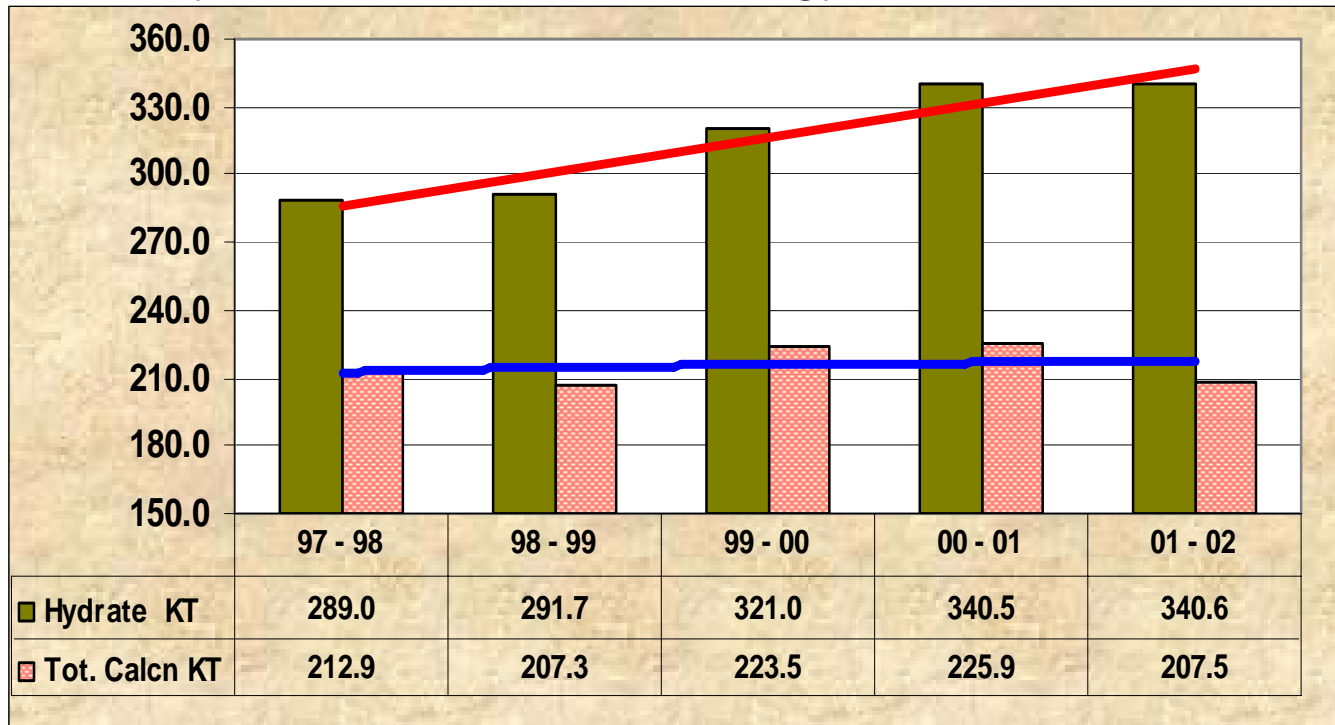
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11. Calcination Capacity & Efficiency improvement

Concerns:

- Increasing gap between hydrate plant and calcination capacity
- Rotary calciners - Old technology



Opportunities:

- Profit realization on Alumina is higher compared to Hydrate
- Market was expected to be in the positive price cycle for alumina



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11. Calcination Capacity & Efficiency improvement

a. Efficiency and capacity improvement.

Process and mechanical audit of kilns - FLS Minerals

Improvement in

- heat exchange surface
- combustion conditions
- product cooling capacity
- optimisation of alumina bed level
- VFDs for better operational controls.

Results achieved:

Increase in Kiln-1 throughput – 20 to 24 TPH

Reduction in Kiln-1 oil consumption -101 to 98.3 kg/T

Savings:

Oil : 460 T / annum.

Electrical energy : 50000 kWh/ “

Investment : Rs. 80 lakhs



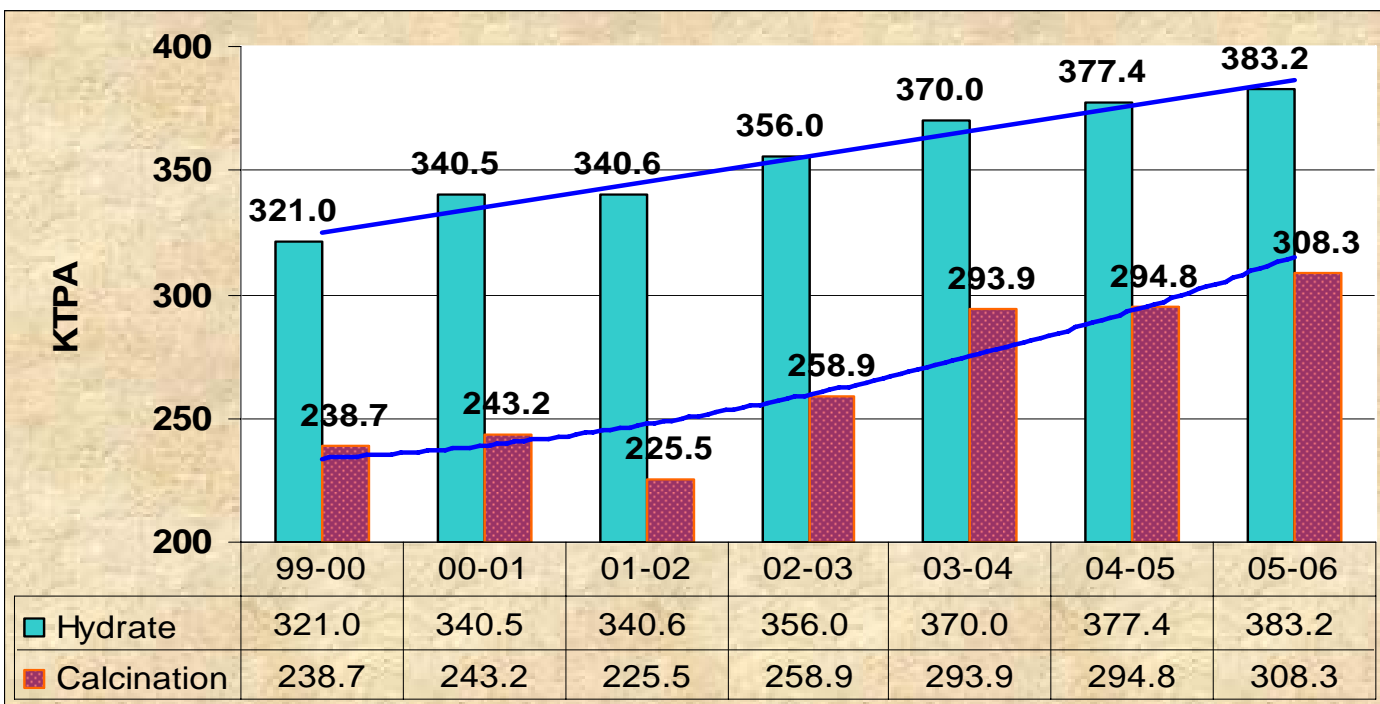
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11. Calcination Capacity & Efficiency improvement

b. Kiln Availability improvement : Visit to Alcan Gove plant for study of operation and maintenance practices

Changes in castable laying and heat curing methodology, operational and maintenance practices.

Increase in Kilns availability (three kilns) for 80% to 90%.





12. Mud filter capacity & efficiency improvement

Concerns:

- Increased production levels leading capacity limitation in mud filters.
- Depleting ore quality, calling for increased mud load per T of product hydrate.

Options:

- Installation of new additional filters
 - *New equipments, civil & structural requirement- costly
- Capacity upgradation existing to meet the proposed requirement
 - * Can be suited to proposed requirements & minimal civil and structural costs.

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12. Red mud filter capacity & efficiency improvement

Actions:

- Interactions with equipment suppliers i.e. BOKELA.
- Successful trials to suitably upgrade the existing filters.
- Project implemented on one of the filter successfully.

Investment : Rs. 15 lakhs.

Savings:

- **Electrical energy savings, 1.7 lakhs kWh/annum per filter**
- **Increased red mud handling capacity, by about 70% with minimum capital expenditure.**

Implementation is complete on 2nd filter & planned on 3rd filter.

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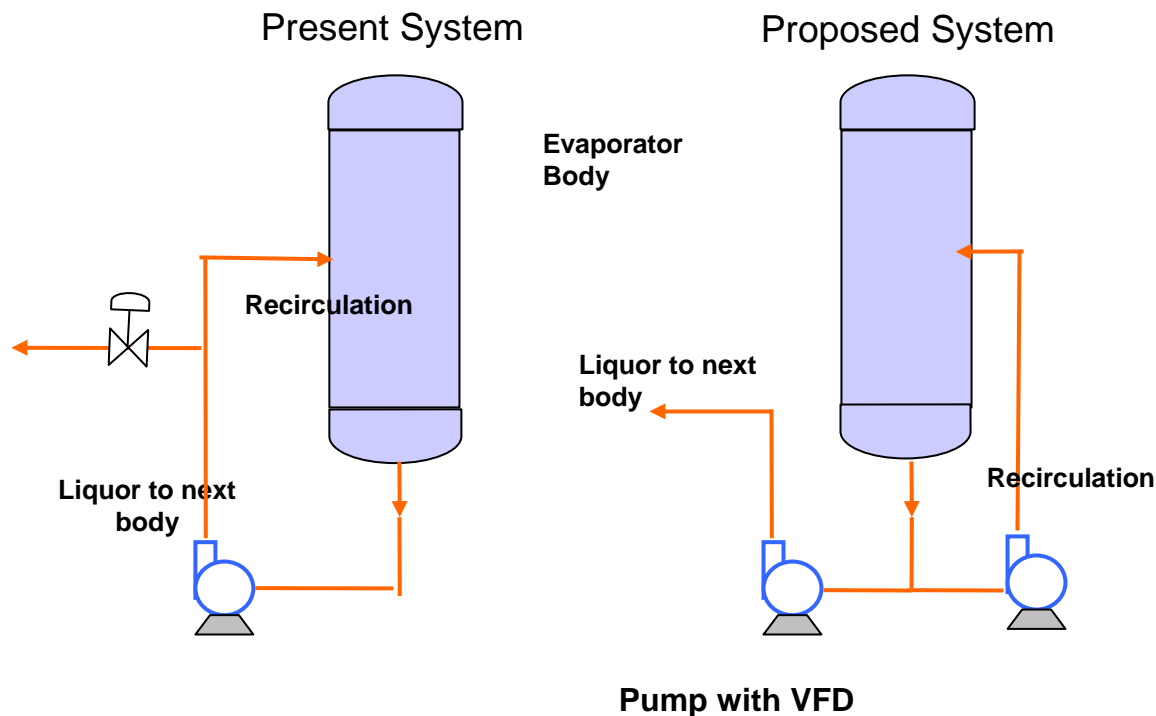
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13. Improvement proposed in Evaporators



- Variable flow in the evaporator based on water removal requirements.
- Flow control through use of control valves : Energy inefficient.
- No. of applications : 12 Bodies, 250 KWh peak power requirement.
- Load/Flow variations almost by 50%.
- Trials with separation of application and VFD for liquor transfer pump
- Potential overall energy savings : 60 kWh (Rs. 20 lakhs/annum)

Implementation planned in 06-07



RECOGNITION OF ENERGY CONSERVATION MEASURES BY 'PCRA'



**PETROLEUM CONSERVATION
RESEARCH ASSOCIATION** (SUB-REGIONAL OFFICE)
(UNDER THE MINISTRY OF PETROLEUM AND NATURAL GAS, GOVT. OF INDIA)
"Encore", Jawahar Road, Vyttila, Cochin - 682 019
Ph : 0484 - 302980, email-cjayaraman@hotmail.com

6-7-02

To

Sri.Govindaraju
Manager Operations(Steam Plant)
Indian Aluminium Company Ltd.,
Belgaum.

Dear Sir,

We would like to express our sincere gratitude for the kind courtesy extended to us ^{pre-} during our visit to your factory during 20-22nd of June.

We are happy to note that your organization has taken dedicated, sincere efforts in the field of energy conservation, especially petroleum conservation.

Your efforts to conserve petroleum product in the boiler plant by successfully implementing most of the known conservation measures such as excess air control, insulation of equipment/line/flanges, optimizing steam header size, arresting steam leaks and adopting modern measures like variable speed drives and programmable logic controls etc. are praiseworthy. Actions taken by you to display the process/equipment details and cost of each and every consumable item in the plant are commendable.

We shall submit a detailed report on our ^{Study} visit, including suggestions to improve energy efficiency, at the earliest.

Thanking you,

Yours faithfully

JAYARAMAN.C
STATE CO-ORDINATOR

Highlights of the certificate

“ Your efforts to conserve petroleum products in the Boiler Plant by successfully implementing most of the known conservation measures such as Excess Air control, Insulation of equipment / Lines / Flanges, Optimising steam header size, Arresting steam leaks & adopting modern measures like variable speed drives and programmable logic control etc. are praise worthy / Commendable”

Oil is not going to last much longer, Use it with wisdom

PCRA Project Secretariat : 10 Bhikaji Cama Place, New Delhi - 110 066

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Environment Management Initiatives

1. Vegetation of Red mud dumping area -

Belgaum is the 1st successful plant in the world.

2. Recycling of process effluent.

3. Fugitive dust emission control from red mud ponds.

4. Particulate & gaseous emission control.

5. Treatment of domestic effluent.

6. Solid waste management

7. Technical support for water harvesting to the surrounding community.

8. Green belt cover within & surrounding to plant site.

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Energy Conservation : Investments & Returns

Energy Saving project implemented	Annual Electrical Savings		Annual thermal savings		Total Annual Savings	Invest. Made
	Units	Rs Million	Tons of FO	Rs Million	Rs Million	Rs Million
2003-04	2021777	9.02	310	3.4	12.42	6.45
2004-05	1257154	5.67	0	0	5.67	14.73
2005-06	975413	6.08	863	14.3	20.38	44.63
2006-07 : Planned	1976533	8.89	1027	41.5	50.39	27.69

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Energy conservation : Plans for 2006-07

Sl No	Title of Energy Saving project implemented	Year of Implementation	Annual Electrical Savings		Annual thermal savings		Total Annual Savings	Invest. Made	Payback months
			Units	Rs Million	Tons of FO	Rs Million	Rs Million	Rs Million	
1	Installation of dedicated cooling tower for compressors	2006-07	293333	1.32			1.32	1.69	15
2	Installation of lighting energy savers/chokes	2006-07	140000	0.63			0.63	0.40	8
3	Installation of LT capacitors 2000KVAR	2006-07	223200	1.00			1.00	1.20	14
4	Conversion of V belt to poly V belt - 30 Nos drives	2006-07	350000	1.58			1.58	3.00	23
5	DG automation	2006-07			937	40	40.00	9.90	3
6	Energy efficient pumps with VFDs for 13A Evaporator set.	2006-07	450000	2.03			2.03	4.90	29
7	Turbo feed water pumps for boiler	2006-07	520000	2.34			2.34	3.60	18
8	Unax cooler modification for product heat recovery form				90	1.50	1.50	3.00	24
	Total for 2006-07		1976533	8.89	1027	41.50	50.39	27.69	

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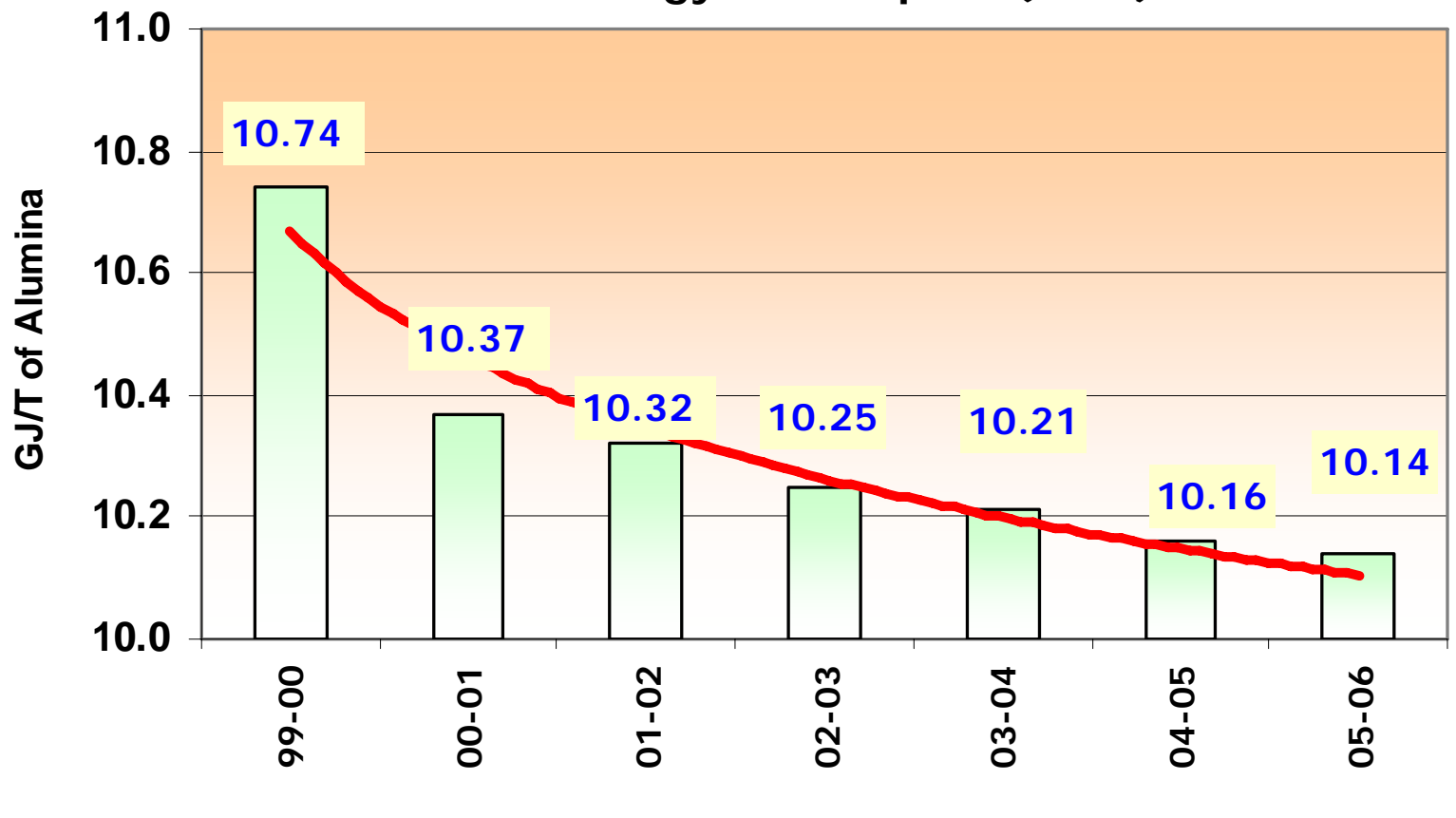
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Total Energy consumption(GJ/T)



With continual efforts to reduce energy consumption, we are
-the least Sp.energy consuming Alumina plant in India &
-the 5th least Sp.energy consuming Alumina plant in the world.



• Achievements & Recognitions

<u>2001</u>	ISO 14001: 1996 EMS Certification from BVQI
<u>2001</u>	ISO 9001: 2000 Certification from BVQI for BRDC, Alumina Plant & CPBP
<u>2001</u>	1 st Prize in National Award for Energy Conservation (Aluminium) from Ministry of Power, Govt. of India.
<u>2002</u>	Star Trading House recognition for the company
<u>2002</u>	Excellence in R&D – 1 st Prize in Process Industry category conferred to Belgaum Works by DST & CSIR
<u>2003</u>	Greentech Environmental Excellence Gold Award.
<u>2003</u>	OHSAS 18001:1999 ,Certification from BVQI
<u>2003</u>	Greentech Safety Excellence Gold Award.
<u>2004</u>	Chairman's Bronze award for World Class Manufacturing
<u>2005</u>	ISO 14001: 2004 EMS Certification from BVQI

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We would like to Thank

ICC

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Thanks
&
Everyone gathered here