



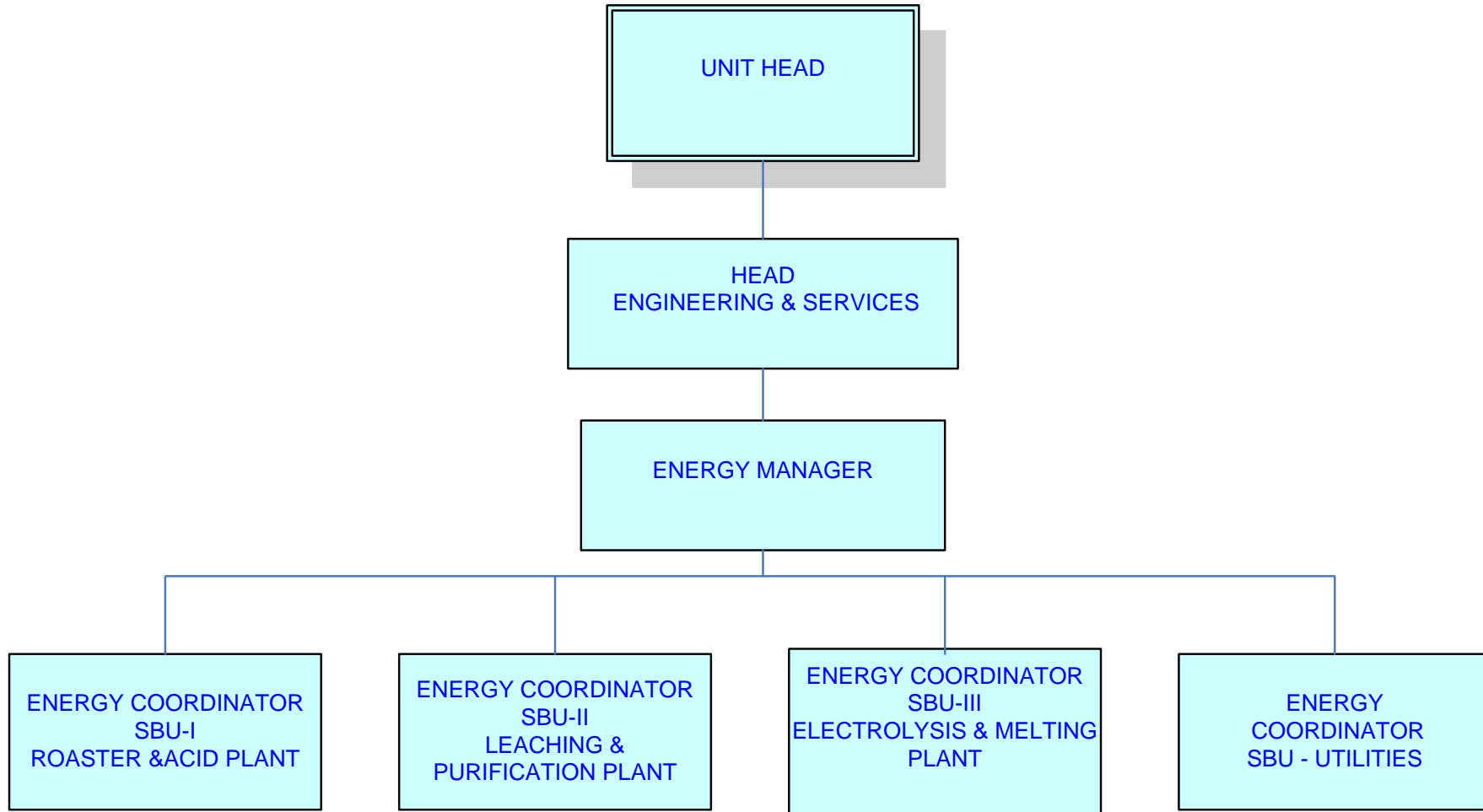
Details of ENCON Projects implemented (2005-06, 2006-07 & 2007-08)

Hindustan Zinc Limited, Visakhapatnam

Energy Conservation Commitment:

- Zinc Smelter Visakhapatnam considers Energy Saving as a **key value driver**. Energy cost contributes **55%** of cost of manufacturing.
- Energy conservation week is celebrated every year in order to renew our commitments towards conservation of energy for sustainable development.
- To give further fillip to our energy conservation efforts, company has adopted **Six Sigma approach** as **locomotive** to drive the energy saving efforts.
- Energy Management Policy formulated and communicated to all stake holders.
- Energy Conservation Cell constituted with Energy Manager to make a focused approach towards energy conservation.

Energy Conservation Set up



Energy Conservation Efforts: 2005-06 to 2007-08

- Reduction in Energy Consumption by adopting
 - Six Sigma Methodology.
 - Quality Circle / small group activities.
 - Small improvement projects to all Engineers.
- Energy Audit by external agencies.
- Benchmarking with Sister units & international Zinc Manufacturers.
- Formulation of Energy Policy & set Up.
- Increase in Zinc Metal throughput to reduce specific Energy consumption.
- Adoption of energy efficient operations and energy efficient technologies /equipment, wherever practically feasible.

Major ENCON Projects

Implemented during

2005-06, 2006-07 & 2007-08

1.Reduction of power consumption in compressor house

This project comprises group of initiatives which are as follows

- Optimisation of Air consumption on supply side by segregating Low pressure (LP-5-5.5 kscg) & High pressure (HP 6-6.3kscg) Headers and Installation of Screw Compressor for Instrument air. lead to reduction on 15 cum/min air consumption.
- Usage of mechanical agitator 0.75 kW in place of compressed air usage at 6 kg/cm² pressure in DM plant for Alkali preparation tank for agitation of alkali solution.



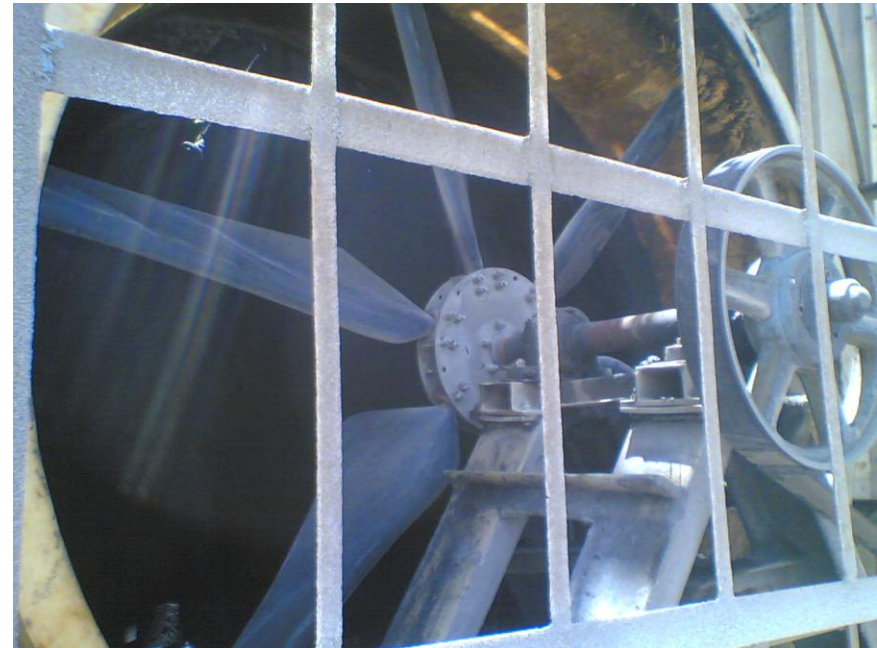
1.Reduction of Power Consumption in Compressor House

- In TGT plant compressed air at 6kg/cm² was being used in different tanks for process reaction **Actions:**, One portable air blower of 300 mm WC & 300 cum /hr was installed to curtail the improper use of air.
- Conversion of two Nos pneumatic level Indicators to Electronic Level indicators.
- Hooking of supply side Air lines with Air receivers with installation of Air Receivers to act as Buffer
- Total Annual saving : 5.814 lacs kWh and Rs.17.44 lacs @ Rs.3 / kWh
- Investment: Rs. 7.10 lacs



2A.Reduction in power consumption in Forced Draught Cooling Tower Fans

- Four nos forced draught Spent Electrolyte Cooling Tower fans in Zinc Electrolysis Plant are converted to Hollow FRP blades (Aerodynamic Effi.) of Parag Make from Solid FRP blades.
- Installation of Polyester FLAT Belt Drive in One Electrolytic Fan supplied by ELGI Ultra tech
- Load Before : 54 kW
- Load after :31 kW
- Total Annual saving :1.93 lacs kWh
and Rs.5.80 lacs @ Rs.3 / kWh
- Investment: Rs. 2.10 lacs



2B .Reduction in power consumption in Induced draught Cooling Tower Fans

- Two Nos Induced draught fans in Hamon Thermo pack cooling tower are replaced with Aero Tech Engineers make Hollow FRP Blade, from solid FRP blade
- Load Before : 52 kW
- Load after :33 kW
- Total Annual saving :1.60 lacs kWh and Rs.4.80 lacs @ Rs.3 / kWh
- Investment: Rs. 1.24 lacs

	Before	After
Fan dia.	4270 mm	4270 mm
Hub dia.	1660 mm	650 mm
No.of Blades	8 Nos	6 Nos
Angle	12 deg.	6 deg.
volume Flow	68.09 cubic m/sc	82.25 cubic m/sc
Power	52 kW	33 kW



3.Reduction in power consumption in Leaching &Purification Process.

Background :

Zinc extraction process involves Roast-Leach-Electro-winning method (hydro-metallurgy). Zinc extraction process is power intensive and hence any reduction in power consumption contributes a lot to the profitability of the organization.

Project Objective : To reduce the power consumption in Leaching & Purification process from 162.32 kWh to 150kWh per MT of gross Zinc ingot thereby saving of Rs 16.59 Lacs annually.

Methodology Used : Six Sigma approach :

DMAIC i.e. Define ,Measure, Analysis ,Improve & Control

Project start date : 10.03.2007

Project Completion date : 31.08.2007

3.Reduction in power consumption in Leaching &Purification Process

- Following the six sigma roadmap, brain-storming sessions were conducted to identify the factors contributing to more power consumption in Leaching & Purification process.

Major factors identified are as under:

- Ideal running of equipments - Idle running of various centrifugal and pit pumps, agitators and screw conveyors
- Motor running at low power factor - 15 Nos. of motor were running with low power factor (<0.7)
- High pumping power due to high head of the pumps
- High HP motors - Running at higher loads
- Excessive bends in the pipeline resulting in chocking and high power consumption
- Pumping of solution instead of using gravity flow.

3.Reduction in power consumption in Leaching & Purification Process

Counter measures implemented to address the above major factors are given below :

S No	Identified factor	Countermeasure	R/Hrs			Savings in kWh
			Pre's	Exp'd	Red'n	
1	49 Tank filtrate solution is flowing to 06 pit and then pumped with 06 pit pump	Diverting the flow to CL05 tank by providing Gravity pipe and pumping to Neutral leaching instead of NZ 05 to reduce 06 pump running	12	8	4	32
2	Continuous running of Main screw conveyor	Running indication near Purification Chargehand table so that it can be stopped whenever filter presses are not being cleaned	24	6	18	19.8
3	Continuous running of RPP01 tank agitator	Interlocking with level so that it stops at low level. Agitator should stop at 25% and start at 35%	24	12	12	99.6
4	15 Nos of motors in L&P are running at Power factor less than 0.7	A) JT4 motor should be replaced with energy efficient motor of same power	24	24	0	31.2
		B) D7 U/F pump 17 should be replaced with energy efficient 15HP motor (presently 20HP)	24	24	0	62.4
5	Lighting power reduction	Mechanical room lights (400W and 250W) will be replaced with tube lights	24	24	0	5.7

3.Reduction in power consumption in Leaching &Purification Process

S No	Identified factor	Countermeasure	R/Hrs			Savings in kWh per
			Pre's	Exp'd	Red'n	
6	D8 Under flow pump is running even after HBF stops	Interlocking with HBF Belt running	24	23	1	6
7	Condensate water pump for TGT is running continuously	Condensate tank pumps suction is to be interconnected and TGT pump is to be operated as and when required	24	6	18	23.4
8	Jarosite neutralisation	A)SFT Lime ball mill bypassing. B)Providing extra water line C)Vibrator to lime hopper				217
9	Jarosite pumps motors are of different capacity	11-23 40HP motor is to be replaced with 30HP	24	12	12	15.6
10	SFT Jarosite pumps are running continuously	Second pump (11-23) Auto running with level is to be provided. Stops at 30% and Starts at 50%.	24	12	12	140.4
11	Control of SFT Jarosite lagoon tank area pit pump	Auto control with high and low level to avoid unnecessary extra running	4	2	2	9
12	Purification agitators are running during purification stoppages	44,45,46,47 agitators should be stopped if purification is stopped	24	23	1	74

3.Reduction in power consumption in Leaching &Purification Process

S No	Identified factor	Countermeasure	R/Hrs			Savings in kWh per
			Pre's	Exp'd	Red'n	
13	CL05 agitator is running continuously	It is to be stopped when it is not filled with ball mill	24	15	9	20.7
14	D8 Overflow pumps head is high	Trimming of D8 Overflow pumps	12	12	0	23.04
15	RP01 pumps are running continuously	RP01 pumps are to be interlocked with Head tank level. Pumps stop with 80% head tank high level	24	22	2	20
16	Purification steam condensate pump is running when purification is stopped	On/Off control to be provided at purification Chargehand area	24	23	1	1
17	Running of NLT0 agitator	RP01 is to be diverted to NLT1N and NLT0 agitator is to be stopped	24	0	24	432

3.Reduction in power consumption in Leaching &Purification Process

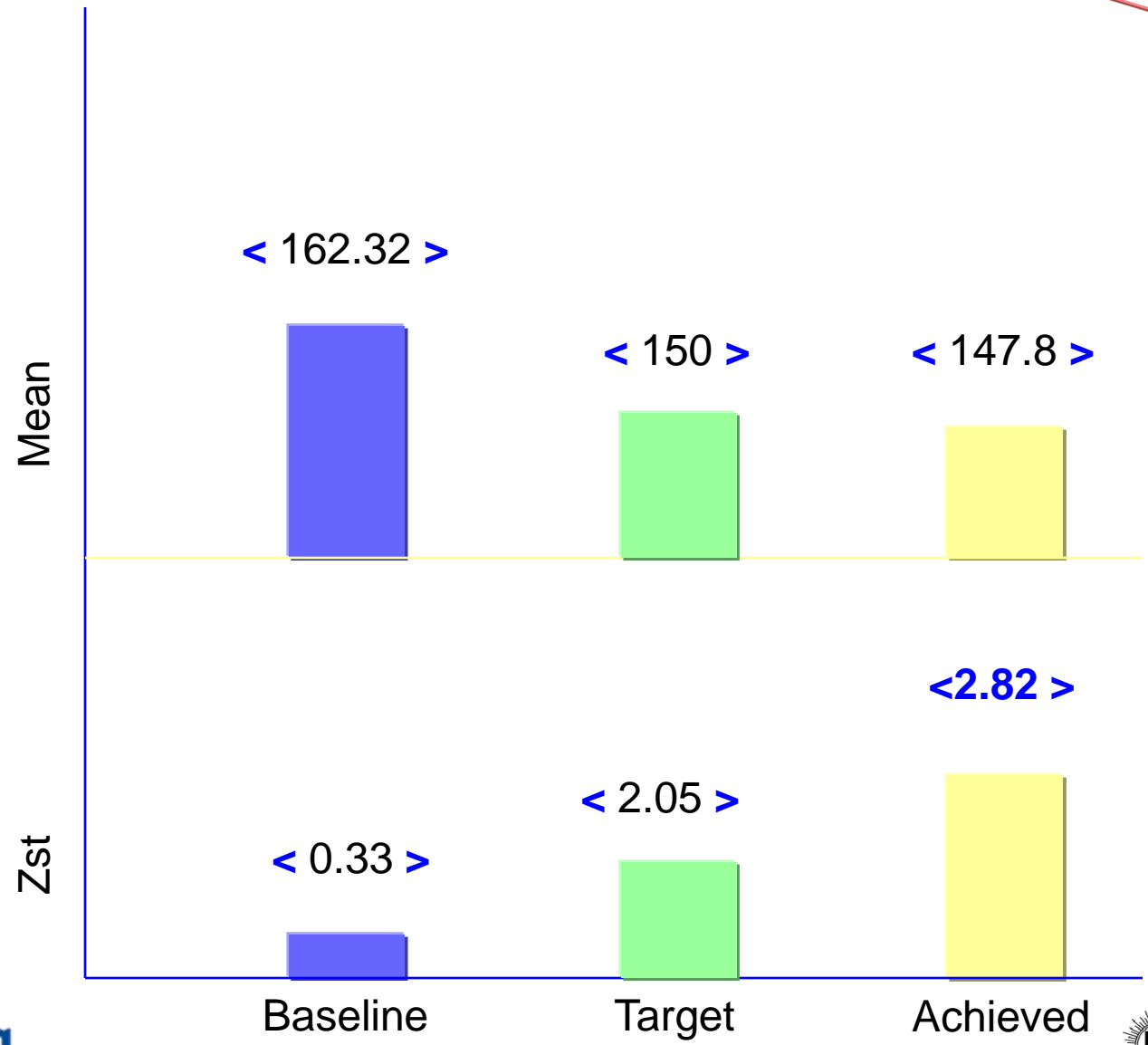
■ Benefits Achieved :

By implementing the aforesaid measures, specific power consumption in Leaching & Purification process was reduced from 162.32 KWH/MT to 147.80 KWH/MT. This resulted in savings as given below:

Total Investment	:	Marginal
Annual Savings in Units	:	9.20 Lac Units
Annual Savings		Rs. 27.60 Lacs

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New Process Performance

Verify
Process
Improvement



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4. 100% NOF transfer to surge tank by gravity utilizing the available gradient

In Leaching plant Thickener overflow solution was used to pump to a Reaction tank by two Nos 18.5 kW pump with 20 Mtr. Head

Actions :

- Gravity launder arranged to Reaction tank by available gradient & one pump is in running as per Peak load requirements of the process .This also resulted in Stoppage of 18.5 kW pump & reduction of running hours of the second 18.5kW pump.



4. 100% NOF transfer to surge tank by gravity utilizing the available gradient

- Trimming the impellers of second pump (18.5kW) was done from 300mm to 270mm.
- Power Saving : 15.7 kW due to stoppage
4.5 kW due to Trimming of Impeller.
- Total Annual saving : 1.70 lacs kWh and Rs.5.09 lacs @ Rs.3 / kWh
- Investment: Rs. 0.55 lacs

5.Optimisation of Zinc Electrolysis spent circulation pump running hours

Reduction of running hours of Zinc Electrolysis Plant spent circulation pump motor 37kW and optimization of Pumping power.

Two pumps of a Circulation tank run continuously and Identified problems are starvation of one pump operation & less through put from both pumps

Actions :

96C pump (37kW) suction and delivery lines MOC changed from 6"HDPE to 6"FRP lines resulting in more **through put** and resulting in further running hours reduction of 96A pump motor 37kW (from 17 hrs to 10 hrs)



5.Optimisation of Zinc Electrolysis spent circulation pump running hours

Actions :

- Installation of ultrasonic level controller, with auto Control operation to 96A pump motor (60HP) to avoid the running of pump in starvation
- Load & Running hours before: 27 kW & 24 hrs
- Load & Running hours after level controller: 27 kW & 17 hrs
- Load & Running hours after 96C pump line modification: 27 kW & 10 hrs.
- Total saving: 378 units/day
- Total annual saving: 1.36 lacs kWh and Rs.4.08 lacs @ Rs.3 / kWh
- Investment: Rs. 0.85 lacs



6. Change of MOC of Pipe to CORZAN CPVC Pipe in Leaching & Purification Plant .

- In leaching & Purification Section the Pumping of Zinc Sulphate solution at 80 deg C is Done through 220 M Piping Net work of 6" is in SS316. The process identified issues are accretion formation in side piping, corrosion failures, Stresses due to temperature of Solution . This lead to More Pumping power ,More maintenance , High Down time costs ,Less Through put.



- Two Pumps of 22 kW are continuously running For a through put of 90 cum/hr. & Two 22 kW pumps for intermittent transfer of solution

6. Change of MOC of Pipe to CORZAN CPVC Pipe in Leaching & Purification Plant .

Actions:

- The entire Piping Net work was replaced with CORZAN CPVC Pipes (Sch-80) of ASRTAL POLYTECHNIC Ltd. Chlorinated PVC Pipes proved less Coefficient of Friction, Ease of Maintenance, Excellent resistance to Corrosion. And Obviously Zero Maintenance / Cleaning of pipes & Failure while in operation
- The Through-put from existing pump restored as per Designed Conditions and only single pump operation achieved in place of two.
- The maintenance of Line Cleaning and failures of Pipes Have reduced marginally
- Power Saving : 36kW due to stoppage of Two pumps.
- Total Annual saving : 3.02 lacs kWh and Rs.9.07 lacs @ Rs.3 / kWh
- Investment: Rs. 1.50 lacs

7. Optimisation of Running Hours of Spent Pumps

•Reduction in Operation of Spent Circulation Pumps at Zinc Electrolysis plant in Pumping of Spent Leaching & Purification Section

Back Ground :

- 47/48 & 49/49 A pumps are used in the application of Spent Electrolyte (10 gpl solids) Pumping. The MOC of pump is in 100 mm NB HDPE pipe
- Two Pumps of 20 kW are continuously running For a through put of 45 cum/hr. at a Head of 25 M



7. Optimisation of Running Hours of Spent Pumps

Actions:

- The Pipe MOC changed to to CORZAN CPVC Pipes (Sch-80) of ASRTAL POLYTECHNIC Ltd. Chlorinated PVC Pipes proved less Coefficient of Friction, Ease of Maintenance
- Due to Less Coefficient of Friction, less Chocking of lines observed and The pumping Power reduced.
- only 47/48 Single pump operation achieved and 49/49 A pump isolated from service
- Power Saving : 15.5kW due to stoppage of one pumps.
- Total Annual saving : 1.30 lacs kWh and Rs.3.90 lacs @ Rs.3 / kWh
- Investment: Rs. 0.55 lacs

8. Installation of Energy savers for plant lighting.

- During last two year, 17 Nos Energy savers has been installed with 18kVA capacity at different location for plant lighting circuit along with the balancing the lighting load in all phases.
- Installed capacity :18 kVA x 17 Nos.
- Power Saving : 26.7kW.
- Total Annual saving : 1.17 lacs kWh and Rs.3.51 lacs @ Rs.3 / kWh.
- Investment: Rs. 5.80 lacs



Also Resulted in 20% lighting spares consumption annually.

9. Optimization of Main Receiving Voltages

- At HZL Electrical supply received at 132 kV & it is step down to 33 kV & 6.6 kV. It was observed that the voltage level of the system varies from 6.5kV to 6.78kV which was resulting in undue tripping & more power loss.
- Maintaining the operation HT voltage in the bandwidth of 6.55 kV to 6.65 kV thereby avoiding the under or over voltages of the motors.
- Power of 4 Nos HT motors Before: 19680 kWh / day
- Power of HT motors After: 19416 kWh / day
- Power Saving : 11 kW.
- Total Annual saving : 0.92 lacs kWh and Rs.2.77 lacs @ Rs.3 / kWh
 - Investment: NIL

10. Optimisation of distribution LT Operating voltage

Equipment :. Zinc Oxide plant Transformers.

- It was observed that Present operating three phase voltage level & lighting voltage level of Zinc Oxide plant transformer is on higher side i.e.436-437 V.
 - The voltage of both Transformer reduced to 413 V. by reducing the existing Tap position.
 - Load Before : 315 KW
 - Load after : 290 KW
 - Power Saving : 25 kW.
 - Total Annual saving : 2.10 lacs kWh and Rs.6.30 lacs @ Rs.3 / kWh
- Investment: NIL

11. Right Sizing of Pump Impellers:

- The project comprises three initiatives Trimming of Impellers based on optimizing Careful study of pump Characteristic Curves & Process Requirements
- Trimming of Impellers to 5–9 % reduction in Diameter
- Process water pump-7 (70M H, Q :750 cum/hr,167kW) in Roaster & Acid Plant cooling tower ,Model :SCT Kirloskar 48/200 Pump Impeller Trimmed to 380 mm from 390 mm

Load Before :141kW Load After :100 kW

11. Right Sizing of Pump Impellers:

- In 65 B pump (50M H, Q150 cum/hr,37kW) of Zinc Electrolysis Plant the Impeller Changed from 6x4-16 to 6X4-14
- Load Before :32.4 kW Load After :24.7 kW
- In In Leaching & Purification section ,Dorr thickener -8 O/F pump (H:20M,11kW,Q :50cum/hr) The Impeller trimmed from 300 to -270 mm
- Load Before :7.46 kW Load After :5.94 kW
- Power Saving: $41+7.7+1.92 = 50.62$ kW
- Total Annual saving : 4.25 lacs kWh and Rs.12.75 lacs @ Rs.3 / kWh
- Investment: Rs. Nil

12. Installation of Energy Efficient Vertical Pump for Acid plant

Installation of Energy Efficient Vertical Pump for Acid plant :

- Two Vertical pumps of each 75kW capacity are in continuous operating duty for H₂SO₄ Acid Circulation . The Reliability of these pumps is of Inconsistent in Nature with MTBF of 2070 hours, which used to affect the Plant operations
- These are replaced with **CHAS Lewis (USA) 55 kW capacity Energy Efficient Vertical Pumps** .
- This Resulted Failure Free Performance in 720 days of operation**
- Power Saving : 44 kW.
- Total Annual saving :3.60 lacs kWh and Rs.10.80 lacs @ Rs.3 / kWh
- Investment: Rs.28.5 lacs

13. Installation of Automatic Level Controller with Auto Operation In Vertical pit pumps

Installation of Automatic Level Controller with Auto Operation In Vertical pit pumps

- 12 Nos Vertical pumps of Each 11 kW are in Intermittent operating duty at various plants .These pumps are used to be operated manually by Operator and require attention to Stop the pump incase of Less Volumes in Sumps/pits .
- These vertical Pit pumps are Modified to Auto Control operation with Level Controller switches.
- **This Reduced the supervision and Contributed to Savings on Pump Idling operation**
- Power Saving : 168 kWh per day.
- Total Annual saving : 0.59 lacs kWh and Rs.1.76 lacs @ Rs.3 / kWh
- Investment: Rs. 0.60 lacs

14. Reduce the ' Milli-Volt' drop in Cascade Link Bus bar

- In Zinc Electrolysis cell House all 46 cascade are connected by bus bar link. Milli volt drops of these Bus bar joints were observed on higher side i.e. varies from 40 mV to 159 mV. The temp at these joints was also on higher side indicating higher loss in it.
- The joints having above 50 mV were opened and applied copper paste along with replacing of connecting bolts.
- This resulted in reduction of milli volt drops from to the range 30 mV to 60mv range.

14. Reduce the ' Milli-Volt' drop in Cascade Link Bus bar

Reduce the ' Milli-Volt' drop in Cascade Link Bus bar.

- Power loss before : $DC15 \text{ kA} \times 3520 \text{ mV} = 52.8 \text{ kW}$
- Power loss after : $DC 15 \text{ kA} \times 2250 \text{ mV} = 33.75 \text{ kW}$
- Power Saving : 19.05 kW.
- Total Annual saving : 1.60 lacs kWh and Rs.4.80 lacs @ Rs.3 / kWh
- Investment: NIL

15. Increase in Cell House Power Rating.

In the Zinc Manufacturing Process, Zinc is extracted in Cell House through Zinc Electro winning process, which is a power intensive Plant. Efficiency of Cell House is known as 'Rating', which is measured as Zn Cathode Produced in MT per day/ Power consumed in AC MW per day.

Improvement in Zinc Electrolysis Rating of > 7.2 MT / MW achieved from Oct-07 onwards which resulted in reduction of 23 units per MT of Zinc Metal compared to YTD Sep-07.

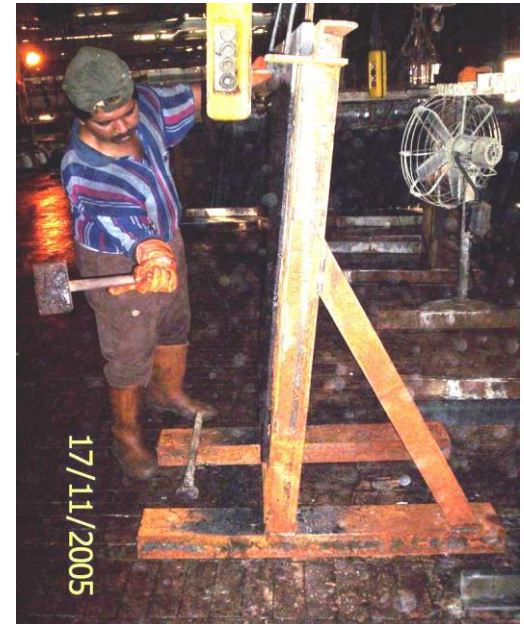
Total Annual saving : 6.21lacs kWh and Rs.18.63 lacs @ Rs.3 / kWh

•Investment: Marginal

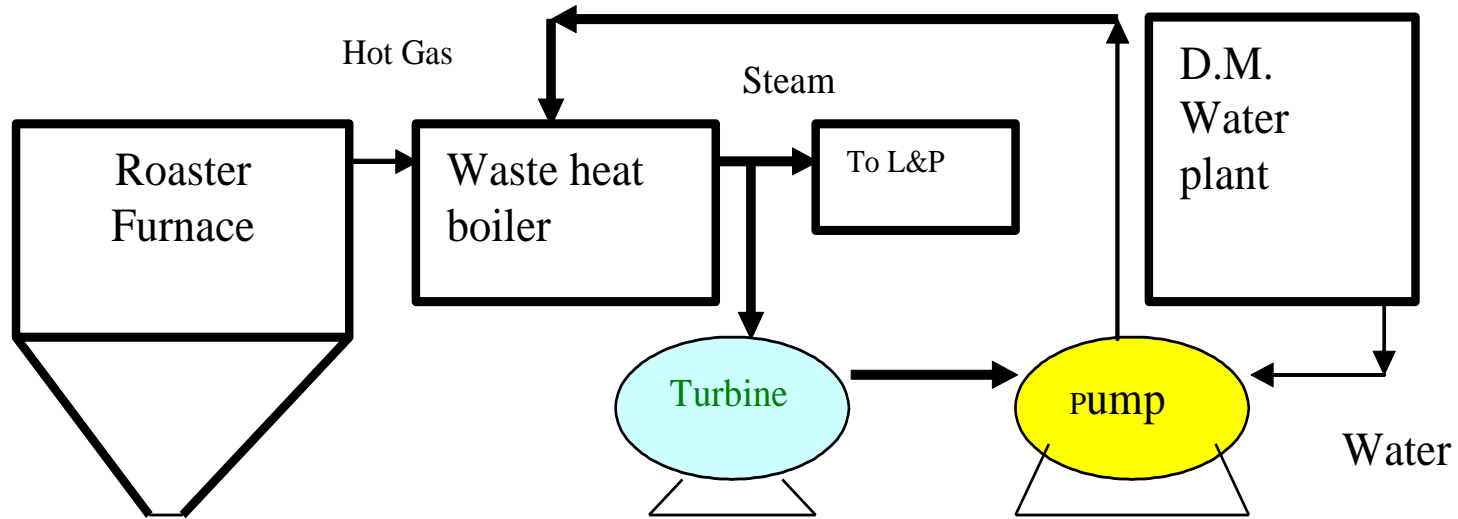
15. Increase in Cell House Power Rating.

The following actions were taken to achieve:

- Maintaining ≤ 0.5 % Sulphide sulphur content in calcine.
- Ensuring continuous availability of calcine to leaching plant.
- Ensuring quality of purified solution.
(Minimising impurities like, Fe^{++} , Cu)
- Focus on anodes straightening.
- Changing of anode spacer position.
- Maintaining anode and cell cleaning cycle.
- Maintaining minimum vacant spaces.
- Continuous monitoring performance of weak strippers



Use of Waste Heat Steam for Energy Reduction



Earlier, one turbine operated pump of **100 HP** capacity being operated with power. It is now operated with the steam generated by recovery of **waste heat** in the Roaster Plant.

The approximate saving of electrical energy is **6.23 lacs units per annum** resulting into financial savings of **15.6 lacs**.

Reduction of Running hours of Auxiliary Boiler:

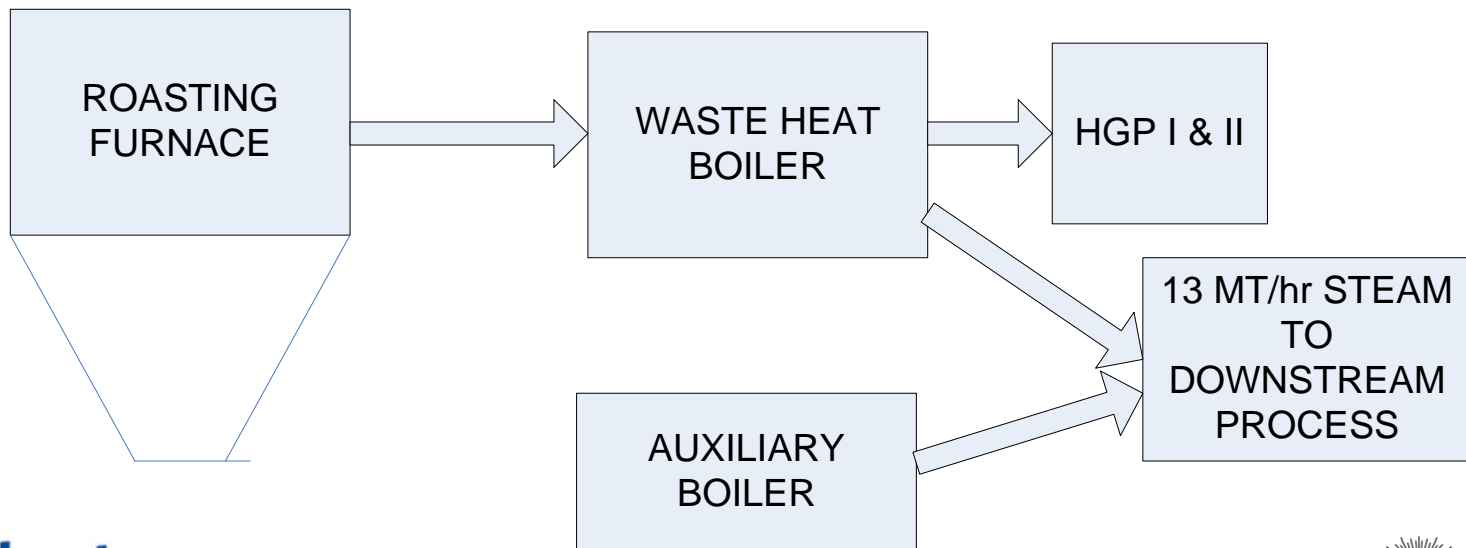
Background of Project:

Down stream Process requirement : 13 MT/ hr.

Waste Heat Boiler : 12 MT/hr.

Auxiliary Boiler : 1 MT/hr.

By increasing Cooling coil area inside the furnace, the throughput of Roaster Furnace increased from 10 MT/Hr to 12 MT/Hr.



Reduction of Running hours of Auxiliary Boiler: :

This has resulted in generation of more steam through Waste Heat Boiler i.e. from 12 MT/hr to 12.9 to 13.0 MT/hr.

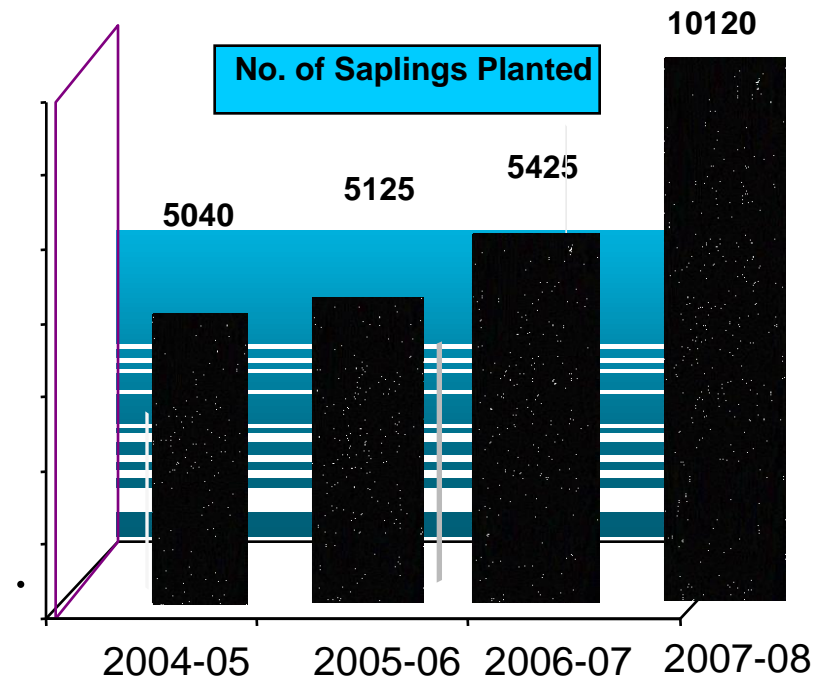
Steam generated through Waste Heat Boiler is now meeting the requirement for the downstream processes.

This has resulted in FO consumption & saving in Energy cost.

Particulars	Unit	2004-05	2007-08
Consumption of FO in Auxillary Boiler	Ltr/MT	42.67	10.22
Zinc metal production	MT		56398
Total consumption of FO @ 2004-05 level	KL		2407
Total consumption of FO @ 2007-08 level	KL		576
Reduction in FO consumption	KL		1830
Reduction in CO2 emission@3.66/KL	Tons of CO2		6698
Rate of FO	Rs./KL		31880
Saving in energy cost	Rs. Lacs		583.44

Investment : Rs.0.50 lacs.

- Greenbelt development with plantation of 5000 saplings per year. Also plantation of **Jatropha** (Bio-diesel plant) started in 2005-06.



•**10120** nos. of Jatropha saplings planted during the year 07-08

- Installed 225 Nos. Turbine Ventilators in Zinc electrolysis Plant.
- The Turbine Ventilators are made of MOC in SS 304 & aluminized fins and installed on FRP Base .
- Runs on Wind Power , No Operating costs ,Continuous operating type Provided the desired air changes to the Installed area.
- Total area covered is 70x50 sq M
- 4 Deg C Temperature drop as Continuous air Exhausts are provided
- Power savings 2-3 kW Sq ft



Team work in Encon,
Monitoring & Reporting
and
Implementation methodology

Team Work in ENCON:

- Individual or Team **suggestion**
- Plant wise **Brainstorming** by plant manager involving of grass root employees & Engineers.
- Monthly Brainstorming during Power review meeting by Unit Management.
- **Quality circle** Projects.
- **Six Sigma** projects (With DMAIC methodology)

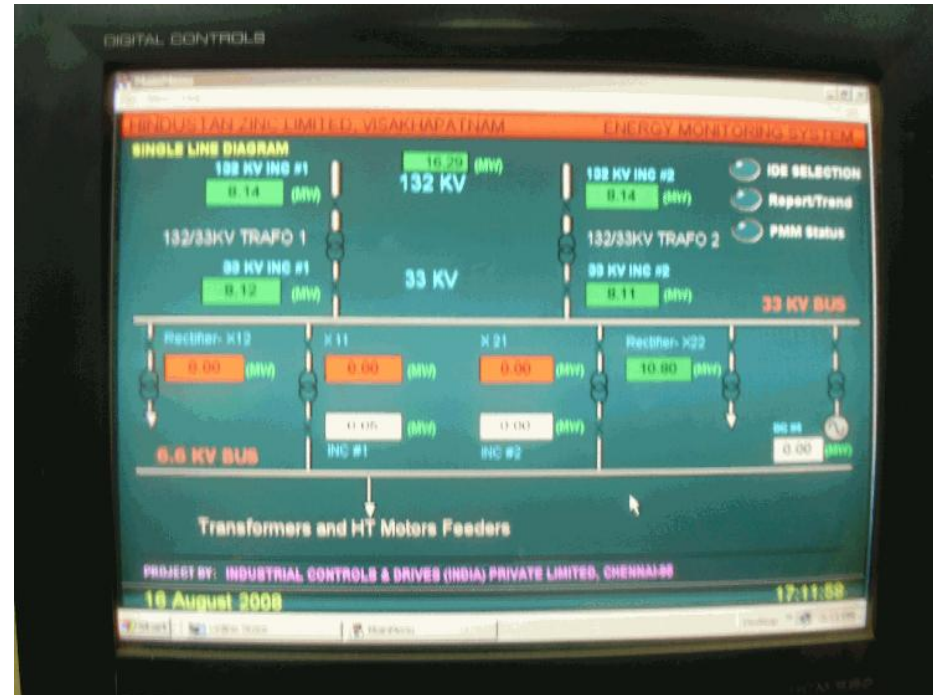
Team Work in ENCON:

Implementation methodology :

- All energy saving **ideas originated** by an individual or team are thoroughly scrutinized by Plant managers & Energy manger to asses the feasibility.
- If the idea is found feasible, **implementation team** will be constituted by the management
- **Necessary resources** are provided for implementation.
- Progress of implementation is closely **monitored** by Energy Manager & SBU Heads .
- Individual or Team are suitably **awarded** on 15th August & 26th Jan by Unit Management.

Energy Monitoring & Review :

- On line Energy Monitoring System has been installed to know the all plants and critical equipment monitoring.



Thank You