ZINC SMELTER VISAKHAPATNAM - HINDUSTAN ZINC LIMITED
Zinc Smelter, Visakhapatnam (Andhra Pradesh)

Unit Profile

Zinc Smelter Visakhapatnam, a unit of Hindustan Zinc Limited, is engaged in manufacturing of Zinc, Cadmium and Sulphuric Acid. In order to bridge the gap between country's demand and production, unit was commissioned in 1977 with installed capacities of 30,000 MTPA Zinc, 115 MTPA Cadmium and 60,000 MTPA. Performance improvement projects and debottlenecking exercises were undertaken in phases to enhance the production capacity. The present capacities of the unit are 56,000 MTPA Zinc, 138 MTPA Cadmium and 91000 MTPA Sulphuric Acid.

Zinc metal is extracted through hydro-metallurgical route using Roast-Leach-Electro-winning process. Sulphuric Acid and Cadmium metals are produced as by-products. Raw materials required for the plant is sourced from the captive mines located at Rajasthan.

Due to hydro-metallurgical route, manufacturing of zinc is power intensive. Keeping this in view, Unit has adopted state-of-the-art technology to conserve the power.

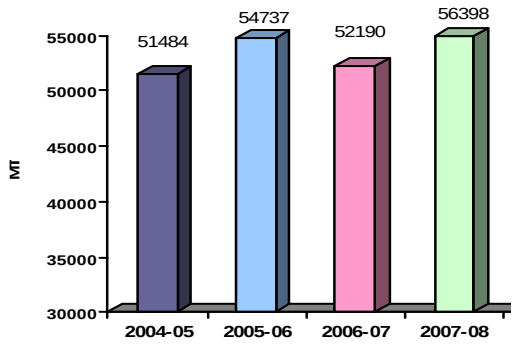
The plant operates round the clock in three shifts of 8 hours duration each. Unit is managed by a team of dedicated professionals, committed to the management of Safety, Health, Environment, and Quality (SHEQ). Unit has implemented Best^4 Management Systems (ISO-9001, ISO-14001, OHSAS-18001 and SA-8000) and certified to Best^4 Management System certification. Unit is the recipient of **National Energy Management Award 2008** from the **Confederation of Indian Industry**, New Delhi. and **"Excellence in All Round Performance Award"** from the Federation of Andhra Pradesh Chamber of Commerce & Industry.

Energy Consumption

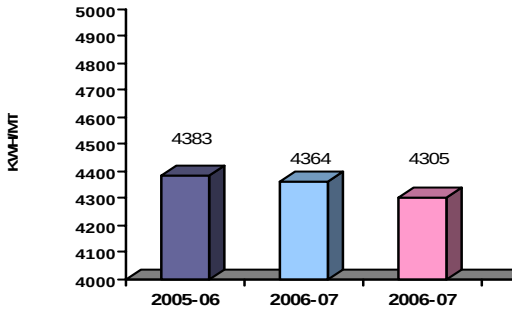
By implementing various energy saving projects there has been consistent decrease in the specific Electrical and Thermal Energy Consumption.

Description	Unit	2005-06	2006-07	2007-08
Zinc Metal Production	MT	54737	52190	56398
Total electrical energy consumption	Lakhs KWH	2398.19	2278.32	2428.74
Specific energy consumption - Electrical	KWH/MT	4380	4364	4305
Total Thermal (Fuel) Consumption	MKCals	15860	8454	10177
Specific energy consumption – Thermal (Fuel)	MKCals/MT	0.29	0.16	0.18
Energy cost as % of manufacturing cost	%	48 %	44 %	41%

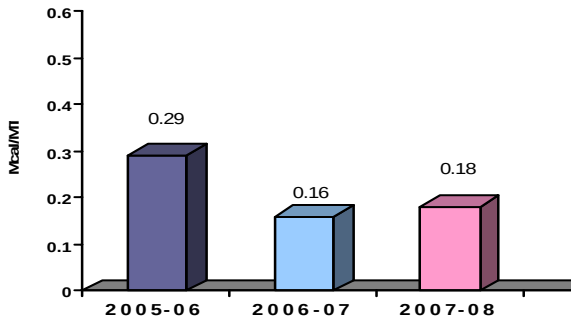
Zinc Ingot Production Trend



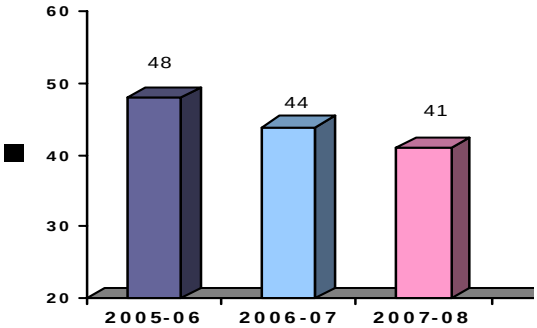
Power Consumption Trend



Thermal energy consumption Trend



Energy cost as % of Manufacturing Cost

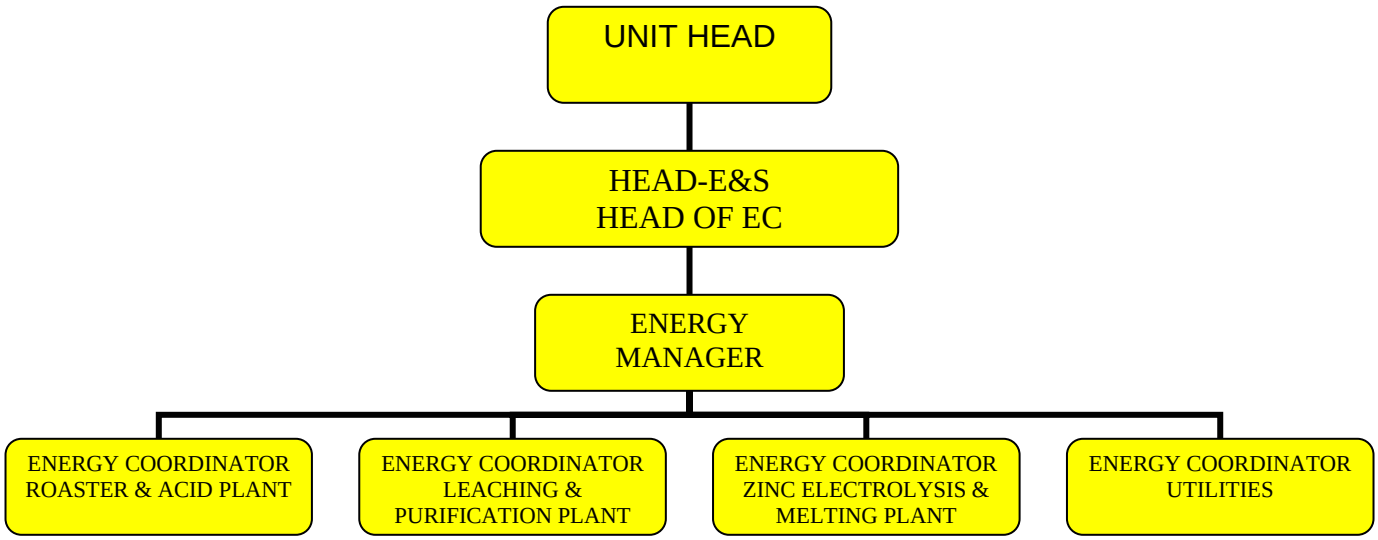


Energy Conservation Commitment, Set up & Policy

Zinc Smelter Visakhapatnam (ZSV) considers Energy Saving as a **key value driver** and hence emphasis is given at all levels to conserve the energy for enhancing the productivity. 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 saving efforts, company has launched the **Six Sigma approach** and good number of projects have been undertaken through this approach in order to save the specific energy consumption. Company has also formulated Energy Management Policy and same has been displayed at all locations.

Energy Conservation Cell has been constituted and Manager (Electrical) has been made Energy Manager to make a focused approach towards energy conservation.

Energy Conservation Cell Structure



Hindustan Zinc Limited

Zinc Smelter Visakhapatnam

ENERGY MANAGEMENT POLICY

We, at Zinc Smelter Visakhapatnam, are committed to optimally utilize the various forms of energy in all our activities and products so as to become the lowest specific energy consumer in the industry segment and to make it environmentally sustainable for future generations.

To accomplish this, we will :

- *Comply with energy conservation Act-2001 and other statutory requirements.*
- *Involve & train all the employees to make energy conservation a way of life in and outside the plant.*
- *Conduct regular internal and external audits to identify areas for improvements.*
- *Replace energy inefficient equipment with energy efficient equipment .*
- *Adopt energy efficient operations and energy efficient technologies/equipment.*
- *Recognize energy conservation initiatives by our employees.*
- *Reduce the cost continuously by adopting energy management system & six sigma approach.*

Date: 24th May, 2006
Place : Visakhapatnam

Unit Head

Energy Conservation Achievements

During the period **2005-2008,** ZSV has implemented number of initiatives through internal & external audits, adopting six sigma tools, brainstorming sessions involving all employees, regular monitoring. This has resulted in savings of **Rs 993 Lacs** during last 3 years with most of the projects having recurring benefits.

Energy Conservation Measures Undertaken During 2007-08

1. Reduction in power consumption in Forced and Induced draught Fans :

Four nos forced draught Spent Electrolyte Cooling Tower fans in Zinc Electrolysis Plant have been converted to hollow FRP blades (Aerodynamic efficient.) of Parag Make from Solid FRP blades and decreased the rating wherever required. In addition, installed Polyester FLAT Belt Drive in One Electrolytic Fan supplied by ELGI Ultra tech.

Benefits Achieved :

- Load Before : 54 kW
- Load after :31 kW
- Total Annual saving :1.93 lacs kWh and Rs.5.80 lacs
- Investment: Rs. 2.10 lacs

Two Nos Induced draught fans in Hamon Thermo pack cooling tower have been replaced with Aero Tech Engineers make hollow FRP Blade from solid FRP blade

Benefits Achieved

- Load Before : 52 kW
- Load after :33 kW
- Total Annual saving :1.60 lacs kWh and Rs.4.80 lacs
- 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

2. ***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

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.

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

S No	Identified factor	Countermeasure	R/Hrs			Savings in kWh per day
			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

S No	Identified factor	Countermeasure	R/Hrs			Savings in kWh per day
			Pre's	Exp'd	Red'n	
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
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
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

Benefits Achieved :

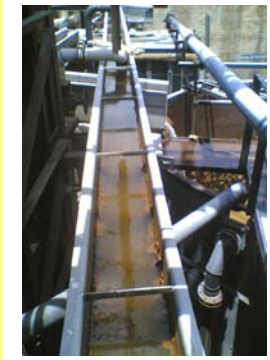
By implementing the aforesaid measures, specific power consumption in Leaching & Purification process was reduced from 162.32 KWH/MT to 147.80 KWH/MT. This resulted in savings as given below:

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

3. ***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 taken** :

- 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.
- Trimming the impellers of second pump (18.5kW) was done from 300mm to 270mm.



Benefits Achieved

- 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
- Investment: Rs. 0.55 lacs

4. ***Optimization of Zinc Electrolysis spent circulation pump running hours:***

Two pumps (96C & 96A) of a Circulation tank used to run continuously and problems identified were starvation of one pump and less through put from both pumps**.**
Actions taken :

- 96C pump (37kW) suction and delivery lines MOC changed from 6"HDPE to 6"FRP lines resulting in more **through put** and resulting in reduction in running hours of 96A pump motor 37kW (from 17 hrs to 10 hrs).
- Installed ultrasonic level controller, with auto Control operation to 96A pump motor (60HP) to avoid the running of pump in starvation

U/S Level Controller

Benefits Achieved

- 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

5. Optimization of Running Hours of Spent Pumps

The MOC of pipes changed 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 required now and 49/49 A pump isolated from service

Benefits Achieved

- 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

6. 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.

Benefits Achieved

- 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
- Investment: NIL

7. Optimization of distribution LT Operating voltage

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.

Benefits Achieved

- Load Before : 315 KW
- Load after : 290 KW
- Power Saving : 25 kW.
- Total Annual saving : 2.10 lacs kWh and Rs.6.30 lacs
- Investment: NIL

8. Right Sizing of Pump Impellers

The project comprises of following initiatives:

- Trimming of Impellers based on 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

- 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
- InLeaching &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

Benefits Achieved

- Power Saving: = 50.62 kW
- Total Annual saving : 4.25 lacs kWh and Rs.12.75 lacs
- Investment: Rs. Nil

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

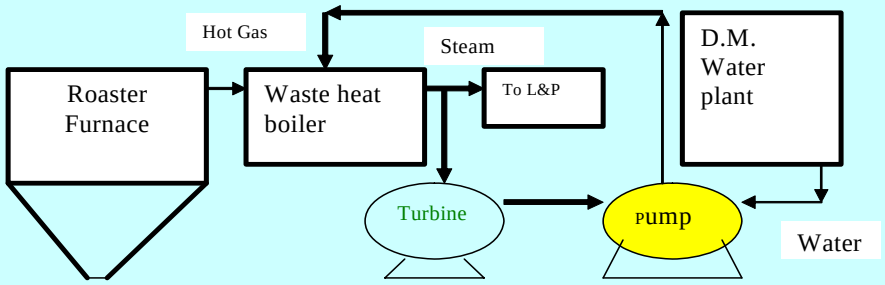
In Zinc Electrolysis cell House all 46 cascade are connected by bus bar link. Milli volt drops of these Bus bar joints were observed on higher side i.e. varies from 40 mV to 159 mV. The temp at these joints was also on higher side indicating higher loss in it. The joints having above 50 mV were opened 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.

Benefits Achieved

- Power loss before : DC15 kA x 3520 mV=52.8 kW
- Power loss after : DC 15 kA x 2250 mV = 33.75 kW
- Power Saving : 19.05 kW.
- Total Annual saving : 1.60 lacs kWh and Rs.4.80 lacs
- Investment: NIL

10. ***Running of turbo circulation pump in Waste Heat Boiler with steam***

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



Benefits Achieved

- Power Saving : 4.87 Lacs kWh
- Cost saving : Rs. 14.61 Lacs per annum
- Investment: NIL

Energy Conservation Plans & Targets

Sl No.	Energy Center	Title of the project/ Energy conservation measure	Potential Savings Lacs kWh	Potential Savings in Rs. Lacs	Estimated Investment in Rs Lacs	Time frame
1	Central services	Replacement of solid blade fans of Gas cleaning plant Cooling Tower with hollow blade fans.	0.58	1.73	0.65	Jun-08
2	Central services	Study for Demand side controller and further reduction in Compressed Air.	0.57	1.70	2.50	May-09
3	Central services	Separation of Clarifier water lines into low and high pressure lines.	0.36	1.07	Nil	May-09
4	Central services	Install VFD to Atlas Copco Compressor in Roaster Area.	0.33	0.99	0.75	Jun-09
5	Central services	Taking lower size pumps with cooling fans in place of one big pump in winter.	2.20	6.60	Nil	Jun-08
7	Central services	Optimise the Operation of Boiler Feed Water Pump (BFP).	0.60	1.79	3.00	Jun-09
8	Central services	Optimise the Operation of Hammer Mill Loading in Stocking Area.	0.21	0.64	Nil	Oct-09
9	ZnO plant	Install a Separate Blower for Conveying System in Zinc Oxide Plant.	3.14	9.43	1.50	Aug-09
10	Central services	CFL lamps for office and colony lighting.	0.09	0.27	0.20	Sep-09
11	ZEM	Standardization of Cell House Lighting.	0.13	0.39	0.60	Oct-08
12	ZEM	Delta to Star starters for cooler fans.	0.41	1.24	Nil	Nov-09
13	Central services	Installation of Energy Savers.	0.24	0.71	0.70	Dec-08
14	Cadmium plant	Cadmium plant system voltage optimization.	0.82	2.47	Nil	Dec-08
15	Central services	Jarosite pump controls at ETP	0.01	0.03	Nil	Jun-08
16	Central services	Changing of 5 Ton capacity AC to 2 nos 1.5 Ton AC in LAB.	0.26	0.77	0.50	Jun-08
17	Central services	Optimisation of compressor House cooling water pump.	0.41	1.24	Nil	Dec-08
18	Central services	Optimisation of ETP FD pump capacity.	0.13	0.39	Nil	Jun-08
19	Central services	Reaction tank agitator stopping at ETP.	0.91	2.72	Nil	May-08
20	Central services	Optimisation of Running of HOT calcine pump of Cooling tower.	0.73	2.18	Nil	Apr-08
21	Central services	RAX, cooling system modified	0.18	0.55	0.20	Jun-08
22	Central services	Replacement of old Induction motors with Energy efficient motors.	2.24	6.72	7.46	Dec-08
23	ZEM	Shifting of one AC inside Rectifier room - Stopping all out side Acs.	0.82	2.47	0.40	Jun-08
24	ZEM	Shifting of Rectifier water recirculation pumps inside Pump House to avoid negative suction	0.52	1.55	0.80	Dec-08
25	ZEM	Replacement of cell house fans by Parag	0.77	2.30	1.50	Jan-09

		Fan hollow blade.				
26	ZEM	MOC of 2 spent circulation pumps 8" HDPE pipe line to be changed.	0.32	0.96	0.60	Dec-08
27	L&P	Install VFD For First Stage And Second Stage Press Filter Feed Pumps (16 or 20) 22 kW.	0.42	1.26	1.00	Dec-08
28	L&P	Install VFD for Dorr-7 U/F Pump-1 15kw.	0.13	0.39	0.75	Jun-08
29	L&P	Installation of level controller on 66C pump tank.	0.32	0.96	0.65	Dec-08
30	Electrical	Power reduction of total smelter by six sigma methodology.	19.60	58.80	10.00	Mar-09
		Total	**37.44**	**112.32**	**33.76**	

By adopting the above energy conservation measures, ZSV will be able to achieve the set target of 4100 KWH/MT of Zinc metal produced by the end of 2010. Financial savings projected is Rs. 112 lacs. In addition, reduction energy consumption through Kaizens, Suggestion Scheme and Quality Circles are planned during 2008-2010.

Environment & Safety

Safety & Occupational Health

ZSV has a commitment to provide a safe and healthy workplace for its employees and contractors. We believe that we can minimize risks and train our employees and contractors to recognise this and act accordingly. Our safety and health initiatives focus on the following elements:

- Leadership – ensuring that senior management and operational heads provide leadership in, and are committed to, health and safety;
- Management systems – ZSV has adopted OHSAS18001 certified management systems. Safety committees operate at various levels to ensure that employees are involved in decisions affecting their health and safety;
- Training – safety flows from safe behaviours and attitudes. Regular training is provided to all employees and contractors to increase their awareness and to improve their behaviours and attitudes towards safe working practices; and
- Risk management – risk assessments are carried out, particularly for hazardous operations, and significant risks are minimised by the application of engineering measures and the adoption of new technology and safe working practices.
- Safety steward system - ZSV has implemented Safety steward system on an experimental basis to improve standards. This has yielded excellent results and, importantly, is motivating individuals and teams to integrate HSE actions into their routine activities and thinking.
- Audits - Many internal and external audits were undertaken through specialists, as well as relevant agencies, to look at the operations and identify risks and hazards, whilst also recommending preventive measures.
- Safety promotion – every year we celebrate safety week and various competitions are conducted such as Safety Slogan/ Poster/ Suggestion/ Playlet/Essay. In addition, we recognize best safety conscious employees and best housekeeping plants.
- Occupational Health –We have got full-fledged Occupational Health Centre which conducts regular occupational health surveillance of all employees and contractors. This

includes specific examinations such as audiometry, lung-function test, blood cadmium, vision tests, chest x-rays and pulmonary function tests.

Our commitments and initiatives have enabled us to bag the prestigious **Greentech Safety Platinum Award 2006** instituted by Greentech Foundation, New Delhi.

Environment

ZSV is fully conscious of its responsibility towards environment protection and sustainable development. Top Management has demonstrated its commitments through formulation & implementation of **Environment Policy** with the objective to achieve sustainable development through compliance of legal & other requirements, continual improvement in environmental performance through reduction in pollution, recycling/re-use of wastes, conservation of resources and adoption of eco-friendly technology.

Company has implemented ISO 14001 Environmental Management system & improved the environmental performance by identification of significant aspects and taking measures (environment management programmes / standard operating procedures) to prevent/ reduce the effects of significant aspects.

All pollution control measures were incorporated in the design stages itself with respect to all environmental attributes. However, additional facilities have been created in the vital areas to prevent pollution. These include onsite **Secure Land Fill** for effective management of solid wastes, **Tail Gas Treatment Plant** for reduction in SO2 emission from 500 ppm to less than 250 ppm, **Effluent Treatment Plant** for proper treatment of effluents, **Residue Treatment Plant** for recovery of metals from the residues, **Mercury removal plant** to recover mercury from the gases, etc.

Besides the facilities available for environmental protection, ZSV has been following environment friendly practices such as regular monitoring of air quality (ambient & workzone), water (effluent, groundwater), soil, developing greenbelt through plantation of 5000 saplings every year, improving the housekeeping, organizing a number of training & awareness programme on environment among the surrounding villagers, children, employees and their family members, customers and suppliers.

Various requirements relating to EHS legislations were duly complied by the company. In addition, company also complied voluntary requirements relating to Corporate Responsibility for Environment Protection applicable for zinc industries.

Company has been rewarded by various bodies for the environmental improvement initiatives. These include :

i) **Best Solid Waste Management Award from State Pollution Control Board.**
ii) **Greentech Environment Excellcelnce Gold Award in Metal Sector for 2006 from Greentech Foundation, New Delhi.**
iii) **Golden Peacock Environment Management Award from the World Environment Foundation, UK.**
iv) **CII – Leadership & Excellence Award in Environment, Health & Safety : 2007**