

ESSAR POWER LIMITED

515 MW , HAZIRA



Unit Profile

Gas Turbine: 3 No. GE make Frame 9E machine of 110 MW each.

HRSG : 3 No. of Hanjung (Korea) make Dual Pressure HRSG.

Steam Turbine: 1 No. 185 MW GE make steam turbine.

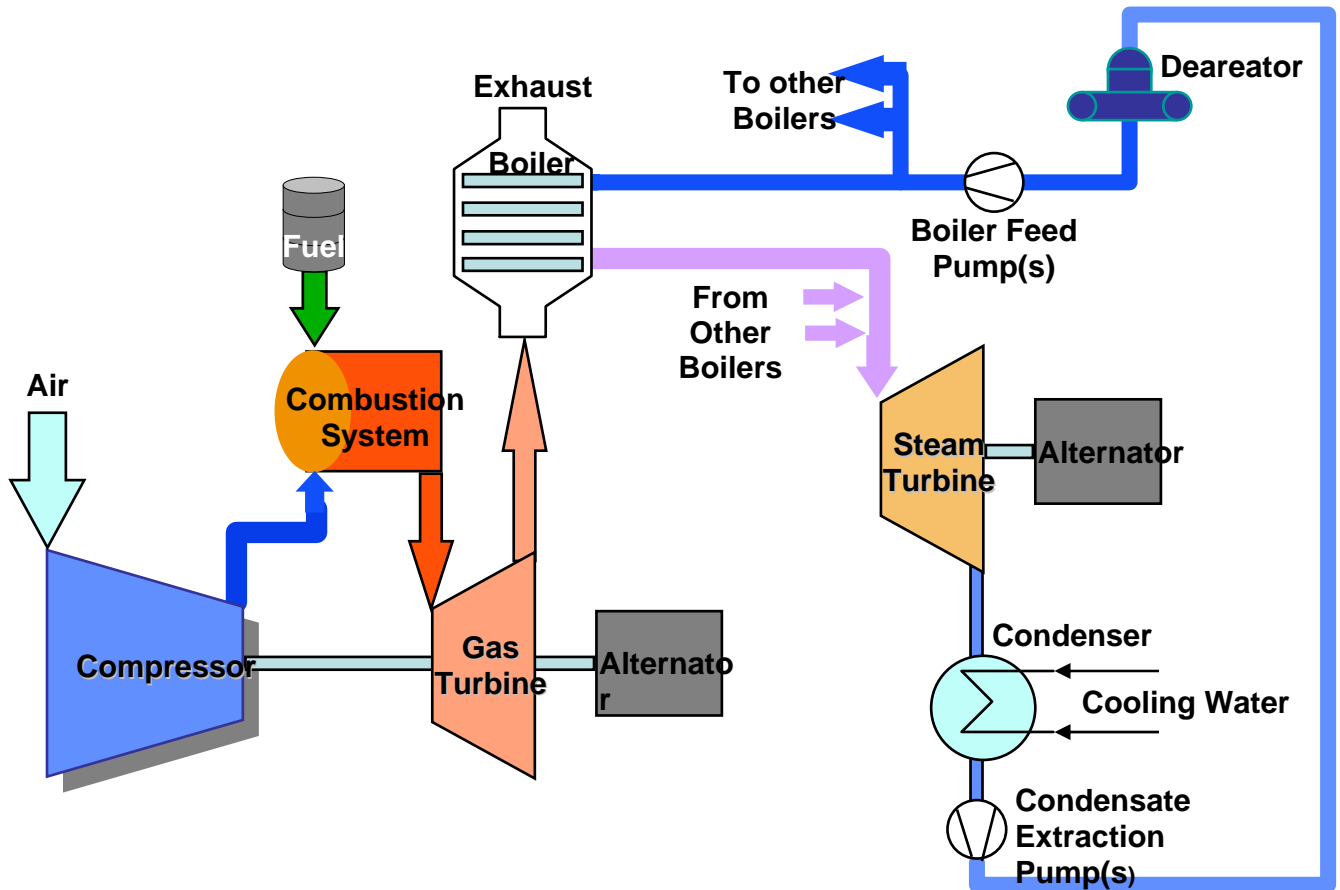
Essar Power 515 MW Combined Cycle Plant , Hazira Surat.

Unit Profile :

Essar Power Limited is a 515 MW Combined Cycle Power Plant. The Plant has Three Gas Turbines , each rated 110 MW, GE Make along with, three Heat Recovery Steam Generators (HRSG) of Hunjung Korea Make and a 185 MW rated GE Make Condensing Steam Turbine.

The Gas Turbine has Dual Fuel Firing Capability. Both Gas and Naphtha can be fired depending on the availability of the Fuel. Total 330 MW of Power is generated from the Gas turbine and the balance 185 MW are generated by Steam Turbine. The Exit Flue gases of the Gas Turbine at 560 Deg C goes to individual Heat Recovery Steam

Generators (HRSG) . At HRSG, Steam is generated at two levels, HP Steam at 76 bar and 525 Deg C Temp with a flow of 175 TPH (Tons Per Hour) and LP Steam is generated at 6 bar pressure with a temp. of 220 Deg C and 32 TPH flow.



Unique Features of Essar Power:

- First IPP Post Liberalization.
- One of the Biggest Private Capacity in One location.
- Best Safety Practices- Sword of Honor/OHSAS 18001.
- Most Environment Friendly with CDM.
- Unique Islanding Systems for Grid Support.
- Multi fuel with online change over systems.
- In-house O&M.
- Lowest Man MW Ratio.
- High availability and PLF among Similar plants Globally.
- Energy Efficient with low Aux consumption and low Heat Rate.
- High level of Plant and Business process automation.

Achievements at Essar Power Ltd :

- ✓ Thermal barrier Coating and installation of Life Extension Kits in GT. (Honey Comb Shrouds & Cutter tooth buckets).
- ✓ 35 Modifications in Plant Last year augmenting Plant Availability to 97%.
- ✓ Preventive and Predictive Maintenance of Critical Equipments like Flow Divider and Warren Pump.
- ✓ In House Combustion Inspection of Gas Turbine.
- ✓ Six-Sigma Approach resulted in 75 ideas being implemented.
- ✓ Benchmarking of Plant Performance with similar Plants.
- ✓ Last Year 10 Energy Conservation Schemes implemented.
- ✓ Technical Audit (Over 200 Modifications in the Plant)
- ✓ Units successfully islanded during the flooding of Surat for six days ensuring Power supply to ESTL and colony thereby ensuring partial production capacities
- ✓ During Hot Gas path inspection of GT # 3 the replacement of old parts resulted in capacity regain to the tune of 8 MW and plant Heat Rate by 1 %
- ✓ The Company has provided prompt Flood relief to the people of Surat & nearby GETco Substations during heavy Floods in August 2006. The Company continues to encourage participation of local labour in and around Hazira, by providing business and job opportunities through various job contracts.
- ✓ Conventional HPSV, HPMV & Copper ballast Lights replaced by Energy efficient lights in the Water treatment area, Service buildings, Stores and various MCCs .

Highlights of Operation :

- ✓ Maximum Station Load Achieved – 554 MW
- ✓ Maximum Station Monthly PLF- 91 % (Dec- '97)
- ✓ Lowest Manpower to MW Ratio - 0.15
- ✓ Mee- Fog Installed augmenting Station Capability by 10%.
- ✓ In House repair of Control System Cards of GE and Siemens.
- ✓ Steam Turbine MI in 22 Days & GT-3 MI in 21 Days.
- ✓ Plant is being operated at maximum possible load to achieve best possible heat rate as per the demand of GUVNL & ESTL.
- ✓ Excellent track record of Survival during Grid Disturbances. On 30 th July 2002, helped Power restoration of South Gujarat during grid failure.

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Safety & Environment :

Plant was Accredited with OHSAS 18001 certification through in-house safety system implementation, and maintenance of High safety standards. Accreditation done by British Standards.

Details of Certifications received by Essar Power :

- OHSAS 18001 certification received in February 2007 from M/s BSI.
- Applied for ISO 14001 certification in the current year.
- Recipient of the British Safety Council's (UK) National Safety Award for three years in a row from 1998 to 2000.
- Recipient of “ Sword Of honor” award and Five Star rating by British Safety council for Excellence in Safety in 1999.
- The only power plant in India to receive the ISRS level-3 safety rating.

- Achieved Safety Awards from Gujarat State Award Certificate of Appreciation in the year 1999 & 2000 .
- Received the “Shrestha Suraksha Purashkar “ by National Safety Council in 2003
- World-class plant design and construction; equipment from General Electric, Siemens and Honeywell.
- Highly automated, with India’s lowest manpower to megawatt ratio.
- TAC approved Fire Fighting system.

ISO 14001 Initiatives at Essar Power :

- **Green Belt Development all around plant is developed.**
- **On- Line Effluent Monitoring System installed.**
- **On- Line Emission Monitoring System installed**
- **Separation of waste generated in various departments has been done by providing separate bins for safe disposal of different type of waste.**
- **Identification and use of reusable papers from office wastes .**
- **Optimization of Usage of DM Water& Cooling Water by :**

The Ongoing Environment Preservation Drives:

Project Zero : Aim for High	Project Go- Green
<ul style="list-style-type: none"> ▪ Zero Discharge. ▪ Zero Spill. ▪ Zero Ozone Depletion Gases ▪ Zero Asbestos. ▪ Zero Plastics 	<ul style="list-style-type: none"> ▪ Green Frontage under Nirmal Gujarat. ▪ 10000 more trees before this monsoon. ▪ Tree count with species and identification. Ownership of Trees by employees.
Project -Recycling	Major Projects Implemented
	<ul style="list-style-type: none"> ▪ Use of Clo2 instead of

<ul style="list-style-type: none"> ▪ Water. ▪ Waste. ▪ Paper 	<ul style="list-style-type: none"> ▪ Chlorine for Cooling water ▪ Switch over from Naphtha to NG to reduce CO2 emissions ▪ Environment friendly gas R134A being used in AC systems . ▪ Reduction in water consumption through re-utilization & Recovery .
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Reduction in water consumption through re-utilization & Recovery :

There has been a continuous effort to reduce water consumption and find new ways of water re-utilization . Some of the innovations ideas implemented at Essar Power are :

- Salt recovery scheme is being implemented to recover salt from regeneration waste of softening plant
Annual savings – 350 T of salt and 33000 cu. M of water
- Circulating cycle (COC) improved from 3.5 (design) to 8 , by chemical treatment resulting in 27% saving in water consumption.
- PSF Backwash water requirement per day 210 cu. M. 80% Back wash water recovered and used as raw water
Annual savings of 61000 cu. mtr
- Blow down utilization for Horticulture water usage.





The ETP blowdown is now being used for horticulture in the Essar Township, through recirculation to a pond at Esar Township by a diesel pump, thus reducing the water consumption

Comparison of parameters vis-à-vis Coal Based Power Plants

Parameters	Indian Coal Based Units	EPOL Gas Based Unit.	Savings based on past 9 years Combined Cycle plant running
Raw Water Consumption nm ³ / MU	1994.0	1433.0	137,52,446 Sm ³
Aux Consumption Kwh / 1000 units.	120	16.9	25,96,831 Kwh
CO ₂ (t / MU of Gen.)	1144	486	168,51,228 ton of Co ₂
Land requirement for 500 MW plant	600 Acres	26 Acres	574 Acres

* Source : Calculated based on data given in " Manual on Best Practices in Indian Thermal Power Plant - CII"

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Savings done by selecting Gas based plant vis-à-vis coal based plant : in terms of natural resources, in the last 9 years are :

- Savings in water consumption by : 137,52,446 m³
- Savings in Auxiliary Consumption of power by : 25,96,831 Kwh
- Reduction in CO₂ emissions by : 168,51,228 ton of Co₂
- Savings in land utilization by : 574 Acres

Energy Management System :

At Essar Power Ltd. We are committed to minimize consumption of the Specific Energy & Waste products .Energy Conservation team consists of four groups comprising of HODs & Engineers of different departments.

Energy Conservation schemes are approved & implemented after being thoroughly discussed in the Energy conservation Meetings held once in two months on regular basis. Sr. Vice President heads the discussion.

Group A: Steam Distribution, HRSG and STG.

Group B: Compressed Air Network / Pumps / Motors.

Group C: Refrigeration & Air conditioning / Electrical load.

Group D: Fuel System / Consumables / GT Aux

Energy Tracking & Performance Monitoring.

1. On- Line Monitoring of Station Performance. Daily Monitoring of Plant Performance related Parameters.
2. Daily Monitoring of Equipment Performance.
3. Daily Monitoring of Consumables and Water Consumption.
4. Periodical GT, Station, Bypass Stack Measurement and Condenser PG Tests.
5. Regular Water wash of GT based on Performance.
6. Study of Desk Engineers' operation to Minimize Aux. Consumption.
7. Optimum Operation Philosophy



ESSAR POWER LIMITED , HAZIRA **ENERGY CONSERVATION POLICY.**

Essar Power is committed to achieve excellence in Energy Conservation by providing & maintaining environment towards Energy conservation & following the best operating practices for achieving it.

In Fulfillment of this commitment, & our goal towards achieving excellence in energy efficiency in all spheres of operation, we will make continuing efforts to:

- **Demonstrate visible commitment towards Energy conservation across all levels of management starting from top.**
- **Increase Energy Efficiency awareness & Competence by Continuous education & training to all employees & contract workers for optimizing energy consumption in all aspects of operation.**
- **Continuous monitoring of Energy consumption pattern on daily basis to reduce the specific energy consumption**
- **Optimise Production in order to achieve maximum efficiency in the Combined Cycle Plant.**
- **Integrate Energy conservation measures in all phases of operation & maintenance.**
- **Foster Continual improvement along with up gradation of technology to achieve higher availability , reliability , Plant Load factor , thermal efficiency & Low auxiliary consumption.**

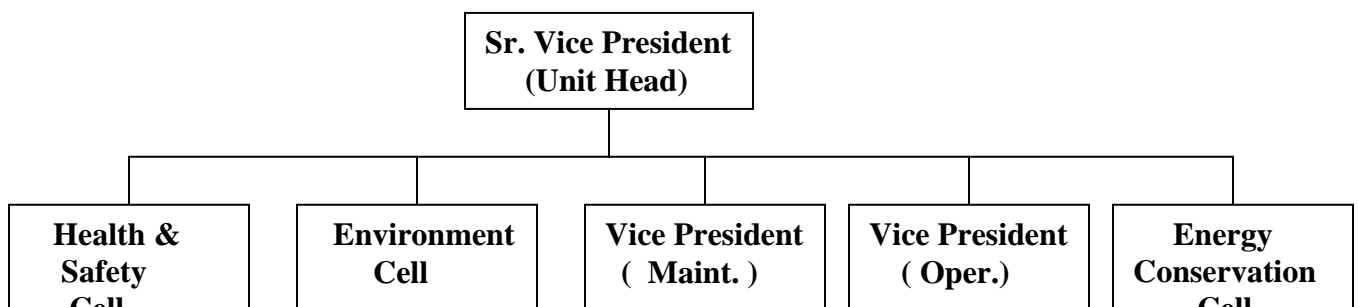
This policy has been communicated to all employees of ESSAR POWER LTD. & shall be made available to the Public & all interested parties . All of us at ESSAR POWER LTD will institutionalize Culture of Energy awareness & work together to achieve excellence in Energy management at Essar Power forever.

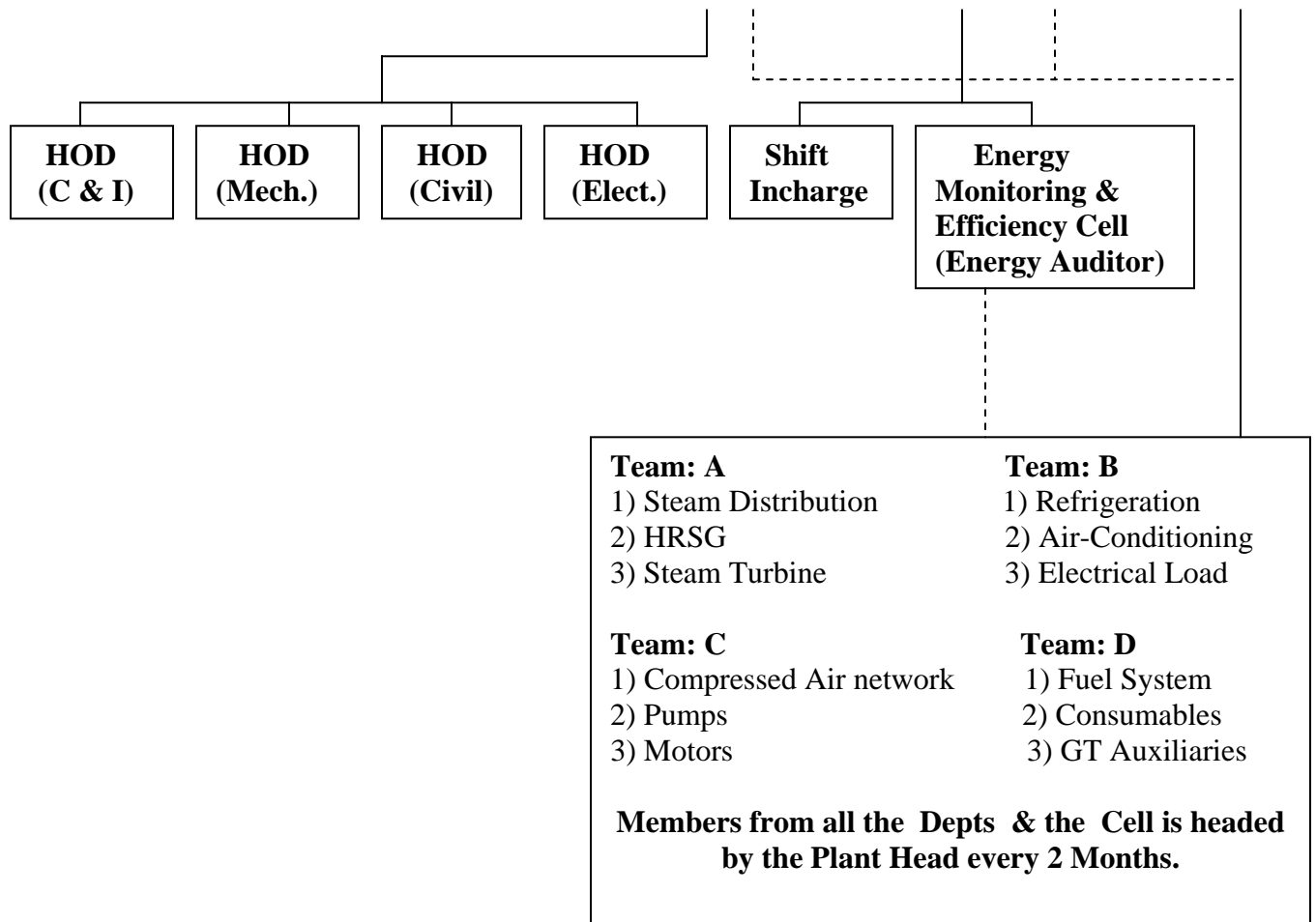
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Date : 22.07.2005

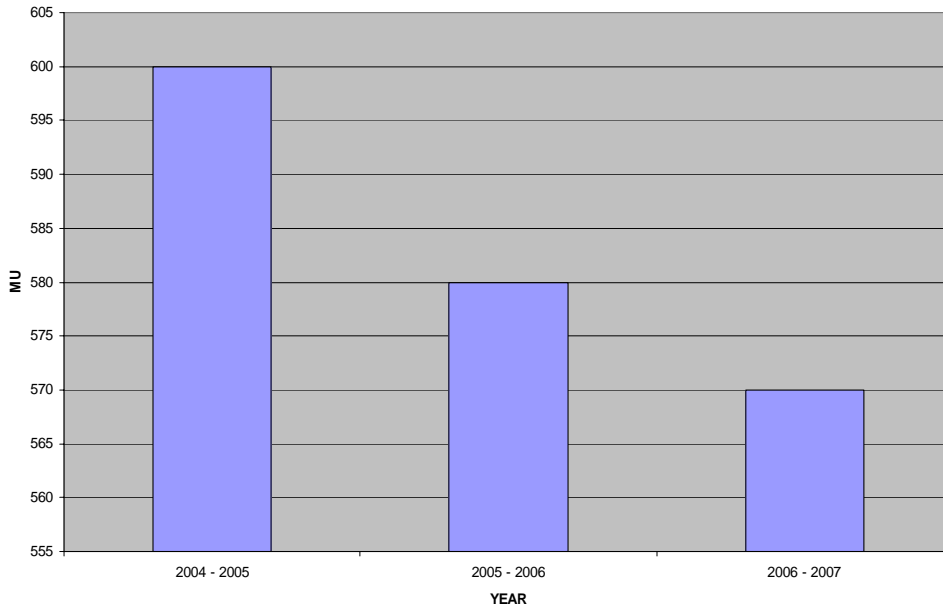
**T.S. Bhatt
Sr. Vice President.**

ORGANISATION STRUCTURE :

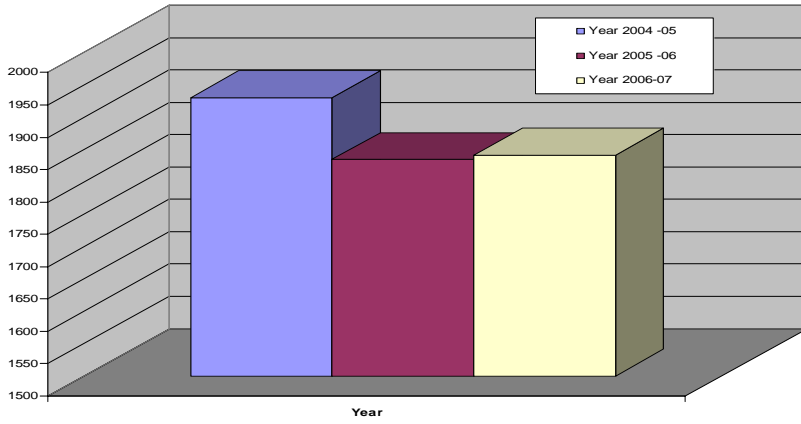




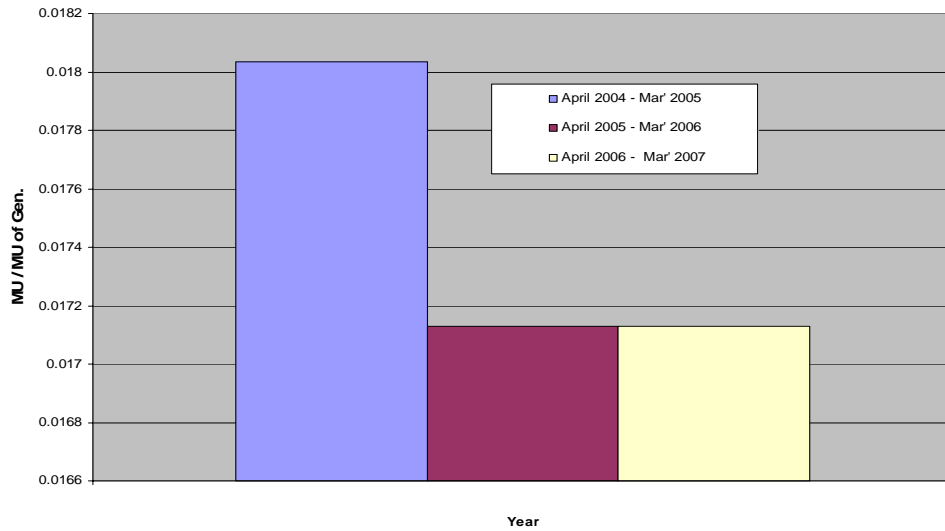
Total Auxillary Consumption in MU

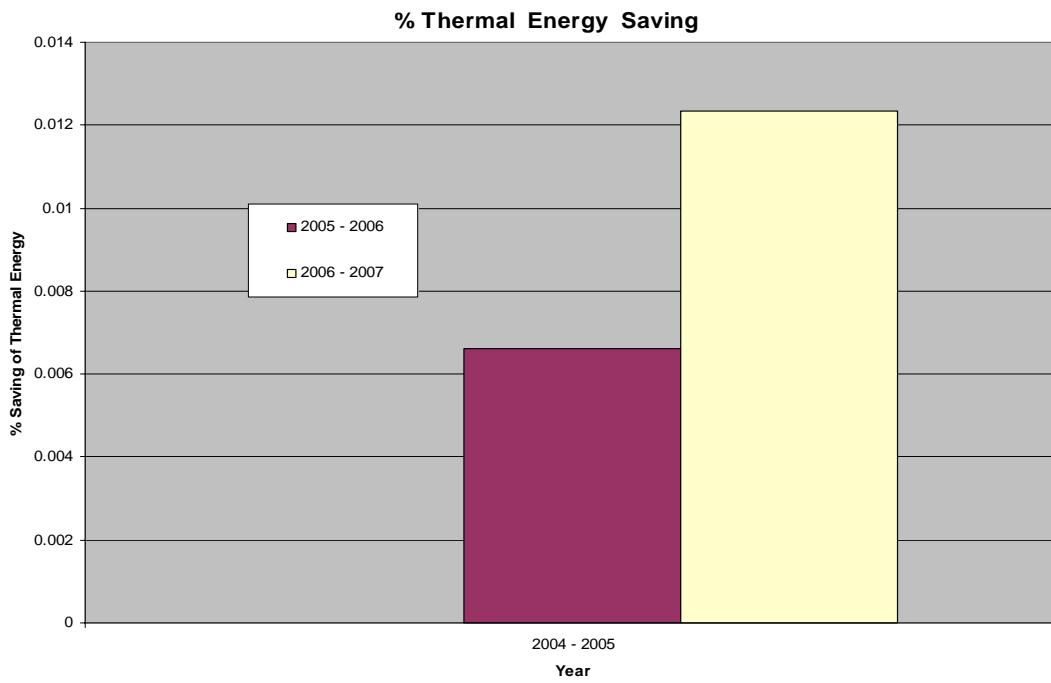
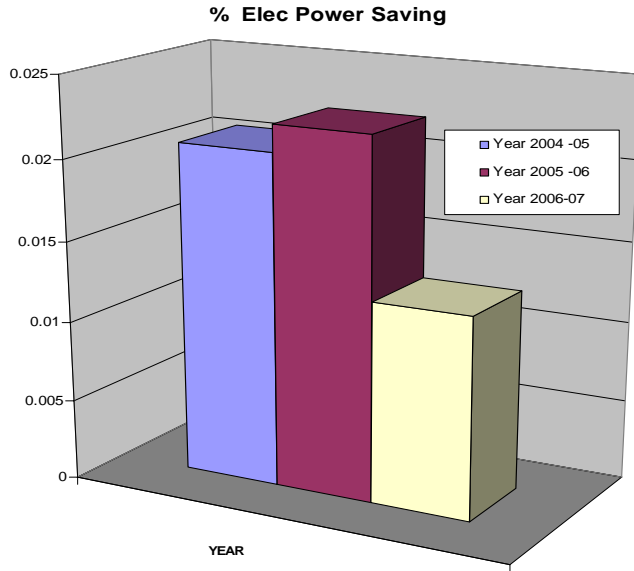


Specific Thermal Energy Cons. / unit of Gen.



Specific Energy Consumption / Kwh of Gen.





Brief details of Major Energy Conservation Schemes are :

YEAR 2004 -05

1. LPBFP Stage removal.



Background : LPBFP Discharge Pressure is 20 bar, which is higher compared to operating Pressure of 6 Bar in the Boiler drum. Normally two LPBFPs are running.

Modification : 1 stage was removed. Discharge Pressure reduced to 10 bar. Investment was 3.5 Lakhs.
For all three LPBFPs.

Savings : 20 KWH savings for each running LPBFP.

2. Installation of Variable drive in Raw Water Pump.1



Background : Raw water requirement was 700 M3 / hr. Pump was rated for 1200 M3 / hr.

Modification : Variable drive was installed in Raw Water Pump, as flow reduces during part Load operation & to Minimize power consumption. Investment was 2 Lakhs.

Savings : 35 KWH savings .

3. Delta to star conversion of slightly loaded drives

Background:

Some of the drives were not required to operate at full load due to process requirements runs at less efficiency at low loads than rated.

Modification:

Such drive's connection is changed from Delta to Star, thereby allowing the motor to run on full load at maximum efficiency, drawing less power.

Net saving of 30KWH

4.Replacement of conventional lights into energy efficient lights



Background:

Earlier conventional type electronic ballast lights was used in various buildings.

Modification:

Such lights were replaced with energy efficient fluorescent tubes in control building offices, Stores building, various buildings.

Net saving of 40kwh

Year 2005-06

5. Stoppage of additional Running BFP during 2 GT Operation.



Background: Stoppage of major aux drives like HP BFP on STG part load operation depending upon No. of GT in operation.

Modification: Two HPBFPs were running as the Total flow requirement is 380-390 TPH with STG Load of 110 MW(2 GT oper.). HPBFP Head v/s Flow curves were studied and it was observed that with 2 GT in operation , Single HPBFP can be run (Flow – 372 M3/Hr. Head- 1250 M) with lesser discharge pr. of 110 kg/cm2. Investment was Nil.

Net Savings of 1000 KWH

6. Stopping of 20 hp service water pump

Background : 20 hp (@ 15kwh) was used for catering the service water requirements like gardening , lavatories

Modification : Service water requirements of @ 20 m3/hr was now catered by taking tapping from clarified water pump discharge header (flow 520 m3 /hr) which runs continuously for running softening plant. Investment was nil

Net Saving of 15 KWH

7.Using chlorine dioxide instead of Chlorine Toner



Background:

Earlier Chlorine dozing was there in steam turbine cooling water. It was unsafe to handle a chlorine toner for dozing. It also requires booster water pumps for chlorine ejectors.

Modification:

Chlorine dioxide is more effective biocide as a substitute for chlorine. Also it's operation is more safe than handling the chlorine toner. This system makes the use of Sodium Chlorite and liquid chlorine cylinder of 40 kg capacity requiring small capacity booster water pumps

Net saving of 6 kwh

8. Impeller trimming of various drives



Background:

Earlier the pressure developed by HSD (Diesel) forwarding pumps and meefog (GT air inlet cooing) water forwarding pumps was higher than that of maximum required.

Modification

Maximum required pressure by these pumps was worked out and impeller was trimmed . The power consumption by both (HSD & meefog) the pumps was reduced by @ 20 %

Net saving of 15 kwh

9 Replacement of motor driven Roof extraction fans



Background:

Roof extraction fans were required to maintain the steady draft of air flow in various sections of plant and to extract any hazardous gases if present. These were installed on roofs of DM plant, cooling water pump house, softening plant, Steam Turbine auxiliary building.

Modification:

These roof extraction fans were successfully replaced with Wind spin Turbines, that does not require any external power to drive.

Net Saving of 27 kwh**Energy Conservation Projects in pipeline (planned for the year 2007-08)****Boilers / Steam distribution system**

- Thermal survey of to be carried out for GTG# 1& 3 exhaust plenum.
- Additional HRSG CPH in HRSG-2 to reduce boiler outlet temperature which is presently being measured at around 135 deg C .
- Study to be done to use water from Gland steam condensate drain. In view of high dissolved oxygen level in drain water , the water can not be pumped to CST tank . The water can be used in degasser tank.
- Installation of Radiator type Heat exchanger in place of Present Heat Exchanger (shell & tube type) in Vacuum Pump Seal water system is being planned.
- HRSG bottom insulation thermal survey planned.

Compressed air network / Pumps / Electric motors.

- Instrument Air pressure reduction from 7.8 to 7 bar, which shall result into 10 KWH savings
- **Variable Speed Drive for Condensate Extraction Pumps to be installed**
- **Planned to install sacrificial seal rings for STG Cooling water pumps to improve pump Sealing and to reduce internal pump losses.**

Refrigeration and air-conditioning / Electrical Load management / Lighting

- Electrical system power factor improvement by installing dry type of capacitor at Various MCC and ACDBs.
(Pilot project at WT MCC executed and PF improved from 0.82 to unity)
- Replacement of remaining Roof Extractor fans with wind driven “Wind spin” turbine Ventilator

Lighting Improvements:

- Replacement of existing street / Outdoor lighting lamp with Acon T5 Fixture

Additional areas of Gas Turbine / Fuel and lube oil, consumables.

- The chloride level limit to be reviewed and to be revised to save water: Chloride level limit has been raised to 350 ppm from a limit of 300 ppm to save water.
- Tapping has been done to utilize IDCT blow down water to nearby Steel plant