RELIANCE Energy
Anil Dhirubhai Ambani Group

# Goa Power Station

## Unit Profile

- Set up thru' International Competitive Bidding held in 1997
- Went into commercial operation in August 1999
- Ensures **reliable**, **efficient**, **environmentally safe** operation
- State of the art Plant Controls for **total automation** for Startup, Shutdown & Protection
- Integrated **Information Management** & **Control System** with self diagnostics
- Plant operated and managed by **experienced professionals** drawn across the power industry with total strength of **42**
- **Most modern Underground Distribution System** spread across Murmogoa Port, Verna, Old Goa, Kundaim and Madkaim Industrial Estates
- About **15 MW** power is delivered to Govt. of Goa grid
- Balance supplied to nearly **100** industrial consumers - **quality power** through dedicated **Underground Distribution System**

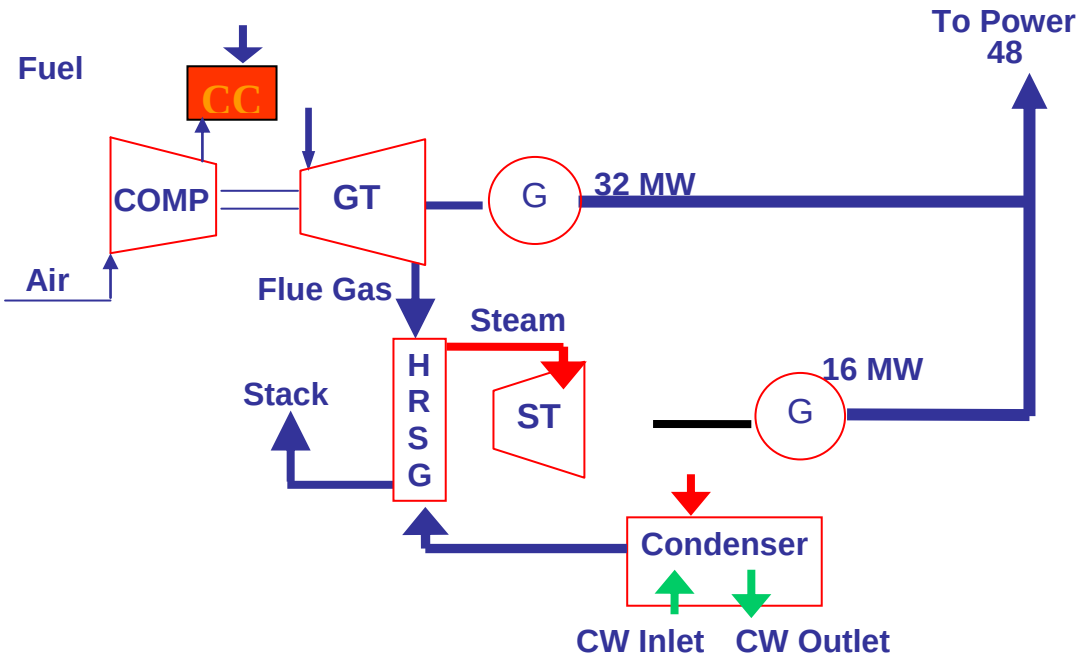
**Goa Power Station of Reliance Infrastructure Ltd (Formerly Reliance Energy Limited)** is a 48 MW, Naphtha based, Combined Cycle Power Plant, went into commercial operation from 14th August, 1999.

The power plant is equipped with state of the art Gas Turbine (32 MW), Steam Turbine (16 MW) both with Mark V control system and Heat Recovery Steam Generators. Majority of the equipment and control systems are sourced from renowned technology providers across the world including General Electric and Siemens and manufacturers like BHEL and Foxboro. It is a fully automated plant with integrated nature of operation and maintenance philosophy.

Over a period of last 7 years of successful operation Goa Power Station has grown from a generating company to a full fledged distribution and utility enterprise. Over the last five years it has developed additional customer base in Goa and today almost 60% of the generation goes directly to major industrial consumers. It has also set up reliable underground cable distribution network system and sub stations in Verna, Kundaim and Madkaim Industrial Estate to supply quality and reliable power to industries. Consumers include major Indian and multinational companies like, Coca Cola, Finolex, D-Link, Abbot Laboratories, Cipla, Birla Optics, Colorcon, Universal Cables, Dr. Reddy's Laboratories, Lupin Pharma, Pentair, Betts India, Microlabs, Syngenta, Novartis, Procter & Gamble, Hindustan Lever, Ciba Specialties Chemicals, Aventis, Wyeth Lederle, Essel Propack, Ratiopharm, etc., who are all availing the benefits of quality and reliable power supply from the Goa Power Station. In the process it has been acknowledged as the preferred electricity supplier and technological solution provider in Goa.

Today Goa Power Station currently has industrial consumer base of about 90, besides supplying power to GoG.

## Plant Schematic – Process Flow




## Energy Consumption:

| DESCRIPTION | UNIT | 2005-06 | 2006-07 | 2007-08 |
|---|---|---|---|---|
| | | | | |
| Total Unit Generated | Lakhs kWh / Year | 3505 | 3546 | 3268 |
| Total Energy Consumption | Lakhs kWh / Year | 101 | 96.1 | 92.7 |
| Specific Energy Consumption | | | | |
| Aux Power Consumption | kWh/kWh | 0.024 | 0.023 | 0.0221 |
| Heat Rate (Gross) | kCal/kWh | 2022 | 2017 | 2065 |
| Total Fuel Used | MT/Year | 68463.883 | 68537.344 | 64714.272 |
| | | | | |

| SPECIFIC ENERGY CONSUMPTION | UNIT | 2005-06 | 2006-07 | 2007-08 |
|---|---|---|---|---|
| | | | | |
| % Reduction over previous year | | | | |
| Aux Power Consumption | Lakhs kWh / Year | 101 | 96.1 | 92.7 |
| Aux Power Consumption | % | - | 4.85 | 3.5 |
| Heat Rate (Gross) | % | - | 0.24 | -2.38 |

| | | | | |
|---|---|---|---|---|
| | | | | |

## Energy Conservation Commitment

The plant has taken up several targets towards saving of resources and improving environmental performance.

Reliance Infrastructure Ltd ( RInfra ) at Goa has been an active contributor to the field of Conservation of other resources (Water, process chemicals etc.). It has been successfully operating a Combined Cycle Power Plant & converting maximum fuel energy to electricity by deploying a boiler in the exhaust of Gas Turbine. This boiler generates steam which is feed to the Steam Turbine for further generation of power, thus maximizing Plant efficiency.

Along with energy conservation RInfra Goa has been responsible and a socially aware organization and has been very active in reducing water consumption by adopting many in house developed Programmes.

The “Energy Conservation Cell” in RInfra is responsible for implementation of Energy Conservation Projects and to follow all guidelines set by the Bureau of Energy Efficiency.

The function of the energy conservation cell:

a. Energy monitoring and control to reduce energy cost
b. To identifying Energy saving Opportunities/ New technologies for Energy savings and to decide on its technical / financial feasibility for project implementation.
c. Formation of sub committees for Implementation of various Energy Management Programmes (EMPs) within organization.
d. Conduct training Programmes and workshop at various levels within the organization for Energy Conservation Awareness.
e. Budget Approval.

An "Energy Conservation Cell" has been constituted which is responsible for implementation of Energy Conservation Projects and to achieve minimization of energy consumption as per the guidelines set by the Bureau of Energy Efficiency.

## a. FUNCTION OF ENERGY CONSERVATION CELL

f. Energy monitoring and control to reduce energy cost
g. To identifying Energy saving Opportunities/ New technologies for Energy savings and to decide on its technical / financial feasibility for project implementation.
h. Formation of sub committees for Implementation of various Energy Management Programmes (EMPs) within organization.
i. Conduct training Programmes and workshop at various levels within the organization for Energy Conservation Awareness.
j. Budget Approval.

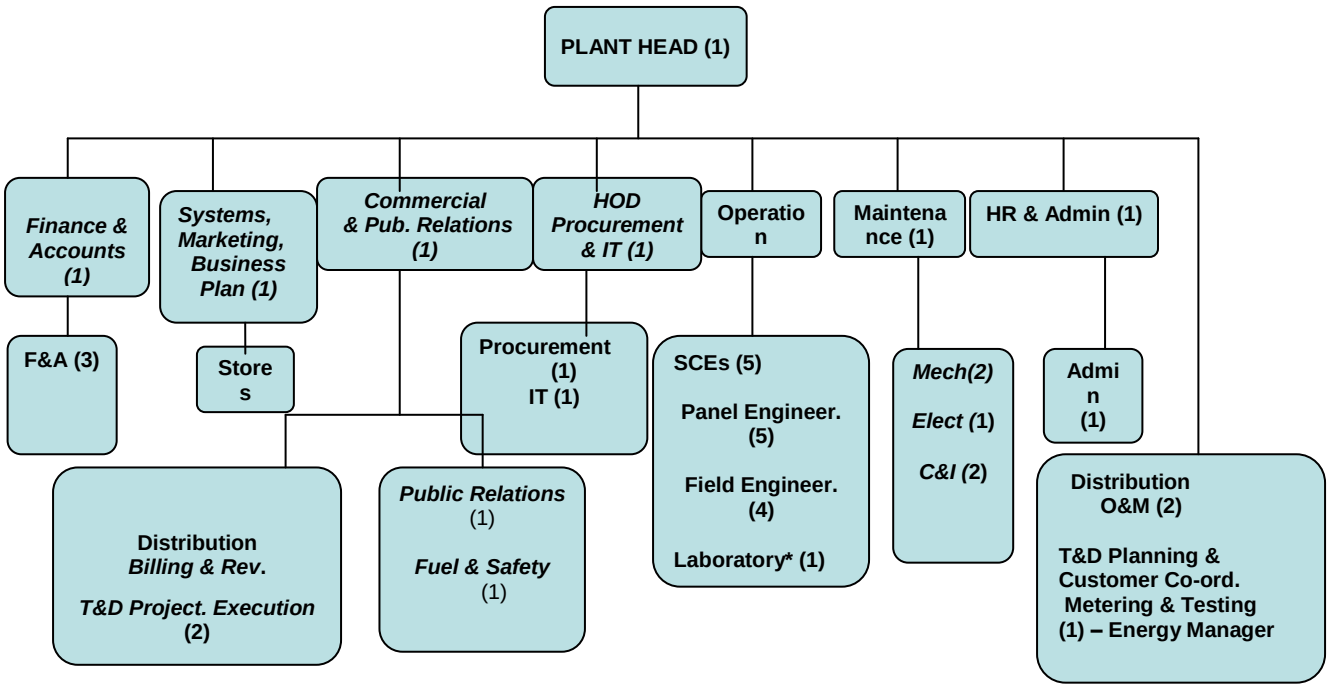
## b. ACHIEVEMENTS OF ENERGY CONSERVATION CELL :

The Achievements include:

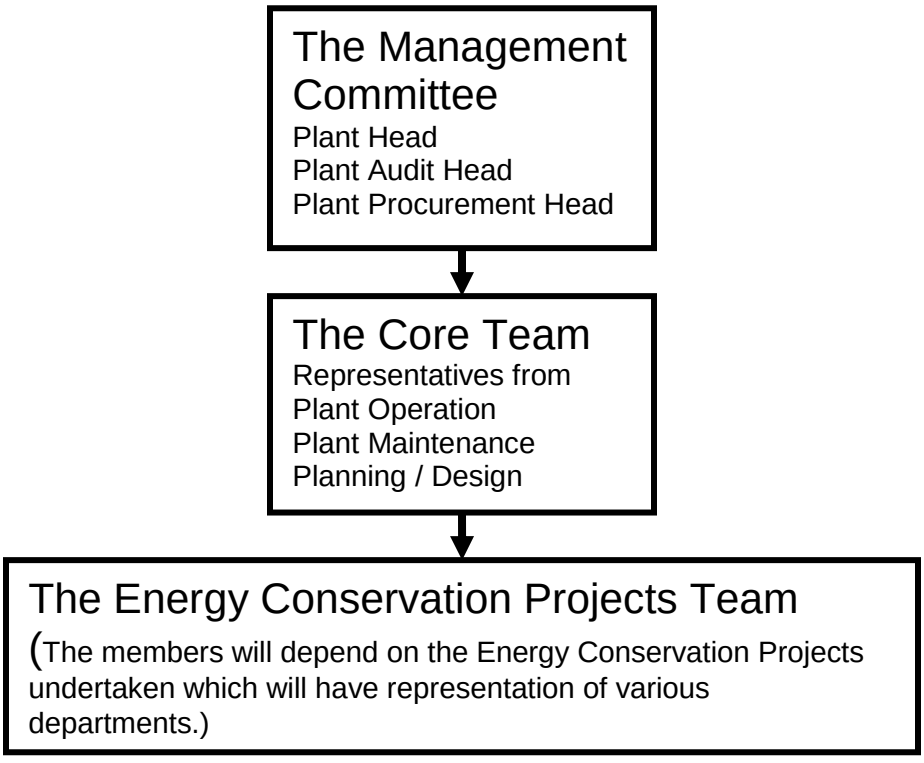
- **Management Programmes (EMPs)** were formulated, studied, successfully completed and implemented & few are under progress to improve the performance on continual basis.
  The Programmes (MPs) taken up till now includes the following:

  - ❖ Study of optimization/reduction of resources ( e.g. Naphtha, water, auxiliary power consumption, & Lubricating oil),
  - ❖ Installation of Variable frequency Drives (VFDs) on Plant process pumps
  - ❖ Adoption of improved technology ($ClO_2$ generation by 3 pump method etc.) to minimize water and chemical consumption
  - ❖ Equal Loading of all Auxiliaries Transformer for reduction in Transformer losses
  - ❖ Delta to star conversion of motor running below 50% rated power
  - ❖ Installation of fine control thermostat for the office Air Conditioners
  - ❖ Installation of CFL lamps in
    a) switchgear room b) STG building c) DM lab d) Pump house
  - ❖ Replacement of filament type indication lamps to LED type

## Organizational Set up



## Organization Structure of Energy Management.



## ENERGY CONSERVATION ACHIEVEMENTS

## 2005- 2006

### 1. Energy saving from Air-conditioning Compressors by Partitioning of non – utilized control Room space and Window filming of Control Room Window panes.

The Power Plant has a Control Room for all its plant related operations. Originally the control room was designed for future expansions & other uses; hence the area for air conditioning was large.

The architecture of the control room was modified by providing adequate partition walls & area of air conditioning was reduced. This activity was also supported by providing anti sun films on windows of the control room. Both these activities reduced the energy load required for air conditioning.

**Energy saving achieved on AC Compressor Load is 5 %.**

| | |
|---|---|
| **Daily Energy Saving:** | **38.4 KWh** |
| **Yearly Saving:** | **Rs. 70,000** |
| **Investment:** | **Rs. 80,000** |
| **Payback:** | **14 Months** |

## 2. Commissioning of Plate Heat Exchanger for cooling Gas Turbine atomizing Air Cooling Water keeping FRP Tower as standby.

Commissioning of Plate Heat Exchanger for cooling Gas Turbine atomizing air cooling water has resulted in the following:

- ❖ Improvement in reliability of Atomizing Air Cooling water system
- ❖ Energy saving due to stoppage of FRP Tower Fan Motor (1KW)
- ❖ Reduction in DM Water consumption by **3650** CuMts /Annum
- ❖ Reduction in water treatment chemical cost by 70%

**Annual Saving of Energy, DM Water & Chemical:** **Rs. 2, 55,500.**
**Cost of Plate Heat Exchanger:** **Rs. 75,000**
**Payback:** **3.5 Months**

## 2006 – 2007

### 1. Augmentation of Power Plant Load for Energy saving and better Heat Rate.

**a. Higher Dispatch of Electricity during off Peak Hours through innovative tariffs and discount options –**

The generation of a power to a great extent depends on the demand of power from the customers. Generally the power plant generation is less during the off peak hours (00:00 Hours to 07:00 Hours) and on weekends depending on the energy consumption patterns. RInfra at Goa increased the demand for its power among its customers by devising innovative tariff and discount options & thus generated more power intake during off peak hours. This change in operation resulted to better usage of fuel efficiency i.e. improved the fuel consumption per unit of electricity generated.

The entire study was a success and resulted in continuous supply of air from the Gas Turbine thus saving about 500 Kilowatt of electricity per day. The existing compressed air system is used as a back up & for usage during plant shutdowns, thus maintaining redundancy in the system. Lesser running hours of the Reciprocating compressors reduced the maintenance costs.

**b. Gas Turbine Inlet Air cooling.**

Gas Turbine Output & Efficiency are reduced during periods of high ambient Temperature. Inlet Air Cooling has emerged as the one of the most effective and Reliable Power Augmentation method for Gas Turbines.

The Cooling System uses DM water and atomizes into billions of micro-fine fog droplets (typically < 20 Microns) through the use of high pressure pumps and special nozzles. This micro –fine droplets float in air just like list or clouds of fog in nature. The evaporation of fog into inlet air stream of a Gas Turbine decreases the temperature of Inlet Air and increases its density. Since Gas Turbines are constant volume machines, the dense air results in the following:

- Increase in Turbine Output Power
- Decrease in Heat Rate
- Increased Air mass flow
- Reduction in NOx emissions

Depending upon the type and condition of the Turbine, almost 0.8% (0.25MW) Turbine Output Power gain is achieved for every 1DegC of Cooling

Fogging system supplied by Mee Industries was installed on GT Inlet air duct.

| | |
|---|---|
| **Cost of fogging system:** | **Rs. 88, 00,000** |
| **Annual Gain from Power Augmentation:** | **4.05 MU** |
| **Annual Fuel (Naphtha)** | **Saving: 211 MT** |
| **Net Gain per Annum:** | **Rs. 111, 00,000** |
| **Payback:** | **9.5 Months** |

## 2. Energy savings by modification in HRSG Feed water Pumps system.

The Configuration of the Power Plant at Goa includes a Gas Turbine, a Heat Recovery Boiler & a Steam Turbine. High Pressure Boiler Feed Pumps are used in the Boiler for circulating boiler feed water. This feed water system also includes Low Pressure Pumps as the

boiler generates low & high pressure steam.

Following modifications were planned in Boiler feed water system:

(i) **Blinding of the 8th stage of the HP Boiler feed water pump impeller**: This in turn would reduce the energy required to pump the feed water without any adverse affect on any of the system parameters.

(ii) **Bleed of from 2nd stage of HPBFP Pump for LP feed water requirement:** A tapping from an intermediate stage (2nd stage) of the High pressure pump would supply feed water to the Low Pressure System. This required modification of HPBFP and interconnection piping upto LPBFP header.

The following savings were achieved:

a. **Energy Saving:**
KW reduction from blinding 8th stage Impeller = 30 KW
KW reduction from providing 2nd stage
Bleed – off and stopping LPBFP Pump = 17 KW
Total Energy saving = 1128 Units

b. **Reduction in HPBFP discharge Pressure:** Modification resulted in reduction of HPBFP discharge pressure from 90Kg/cm2 to 80kg/cm2 thereby reducing the stress on HP Economizer tubes.

**Cost of spares & consumables: Rs. 75,000**
**Cost of services: Rs. 1, 55,000**
**Total cost: Rs. 2, 30,000**
**Daily Energy Savings: Rs. 9024 per Day**
**Payback: 26 Days**
**Annual saving: 33,00,000**

### 3. Reduction in auxiliary Power consumption on account of reduced lighting load.

Project was to replace Filament indication lamps with LED type indication Lamps and installation of Electronic Ballast on Fluorescent tubes.

LED type indication lamps consume 0.5 W as compared to filament lamps (supplied by Panel suppliers) which consume 8 W.
The replacement is being carried out in a phased manner

Expected savings is around 650W that accounts to approx Rs 56,000

**Energy saving achieved**
**Daily Energy Saving: 15.6 KWh**
**Yearly Saving: 5694 KWH**
**Investment: 12,279**
**Payback: 2.5 Months**

## 2007-2008

### 1 Energy Conservation for In House Drives by installing VFD (Variable frequency Drive) on Motors

Plant In House drives are used for various support functions of the Power Generating Utility. These functions include pumping of fluids (water), cooling fans, air compressors, etc. An audit was performed for identification for reduction in energy utilized by these drives.

A subsequent study of these options resulted into selection of VFD i.e. Variable Frequency Drive. The VFD was applied to water pumping equipment (Steam Turbine Condensate Extraction Pump & Cooling Tower Make Up Pump) & cooling fan drive (Cooling Tower Fan).

| | |
|---|---|
| **Energy Savings achieved:** | **576 KWh per day** |
| **Annual Savings achieved:** | **Rs. 14,50,000** |
| **Investment:** | **Rs. 3,20,000** |

**Payback:** **2.6 Months**

## 2 Installation of High Voltage Series reactor on Power evacuation feeders( Govt. Of Goa ).

Increased Reliability of Power supply to Consumers by minimizing Voltage dips.
Installation of High Voltage Series Reactor (HVSR) at Goa Power Station

**ACTION TAKEN:** The HVSR is installed with a purpose to minimize the magnitude of voltage dips faced by RInfra Consumers, for any faults occurring in the GOG grid system. The reduction of voltage will be limited to 70% even for major faults in the grid. The HVSR was installed with an Outdoor structure for Isolation and metering system for GOG tariff metering.

The highlights of the project include:

- HVSR was type tested at Central Power Research Institute (CPRI), Hyderabad for High voltage lightening impulse tests.
- The metering instruments were tested at Electrical Research and Development Association (ERDA), Vadodara.
- Detailed fault analysis study on ETAP, an Electrical Power analyzing Software, for the sizing of the HVSR
- Optimizing the reactor sizing by improvement of grid voltage.
- Project completed and charged in record time of 40 days.

3 phase Series Reactors

Mini switch-yard for HVSR

**ACHIEVEMENT:**
**The major benefits of this project include:**

- **Improved quality of supply to RInfra Consumers.**
- **No voltage dips for consumers, resulting in no process interruptions.**
- **Benefit to the consumers in terms of enhanced man-hours & improved productivity.**
- **Benefit to RInfra in terms of no loss of consumer load on voltage dips and loss of generation due to tripping of STG.**

- **Enhanced Switchgear and cable life due to low value of fault currents.**
- **Improved stability for RInfra generation.**
- **Improved metering accuracy due to the new metering system of 0.2 accuracy class.**

## 3 Six Sigma project for study on improvement in combined cycle heat rate by reduction in compressor fouling.

Suggestions of the project like tandem operation of online water wash with offline water wash of GT compressor has been implemented to minimize fouling of Gas Turbine Compressor and improve heat rate. Online water wash has been scheduled for daily operation with two detergent wash per week. Offline water wash has been recommended after every three months of GT operation. Compressor fouling samples have been taken and sent to Lab for analysis as a confirmatory test for the kind of particles that get carried along with the air and deposit on compressor blades.
Based on this report procurement of high efficiency synthetic filter media based on Nano fiber technology has been done.
Installation of this filters are planned in the month of Oct 2008

**Expected reduction in inlet air DP = 50 mmWC**

## 4.TARGET: Improvement in Plant Efficiency and Output by cleaning fire side deposits in HRSG by Dry Ice blasting of HRSG flue gas side deposit.

**ACTION TAKEN:**
After working with various options of cleaning the HRSG module on line as well as off line, we zeroed in on the method of **Dry Ice Blasting** for the following reasons:

a. It is a proven cleaning methodology having been successfully tried in Europe and North American countries.

b. Unlike other modes of off-line cleaning, Dry – ice cleaning doesn't leave large amount of residual wastes.

c. This method doesn't adversely affect the HRSG Tube metallurgy.
M/s CMW $CO_2$ Technologies, Mumbai was contacted for the above activity since they had carried out demonstration of Dry Ice cleaning at NTPC, Dadri.

Dry ice blasting uses non-toxic, non-hazardous, high-density dry ice pellets in high-velocity airflow to blast away unwanted surface materials. On impact, the dry ice instantly sublimate without generating any secondary waste, so dry ice blasting is a cleaner way to clean. Dry ice blasting also meets EPA, USDA, and FDA guidelines.

**Advantages of DIB**

**a) Less clean-up waste –** No secondary waste

**b) Extend equipment life** by reducing equipment and component wear

**c) Clean in place:** Saves time, cost, and labor by cleaning equipment in place.

**d) Clean more thoroughly with dry ice blasting** – Dry Ice can reach places that other methods cannot, reaching nooks and crannies those are difficult to reach with brushes or chemicals.

**e) Reduce or eliminate damage to equipment :** Dry ice blast cleaning is non-abrasive because as the dry ice strike the surface to be cleaned, they immediately become soft and sublimate (evaporate), after loosening the contaminant from the part to be cleaned.

**f) Save space - No need for a dedicated cleaning area :** Dry ice blasting units are portable, so they go to where the equipment to be cleaned is located, instead of bringing the equipment to the cleaning area.

**g) A safe cleaning environment**

Dry ice is non-toxic unlike many solvents used in the cleaning industry such as TCA

**h) Dry cleaning**

Dry ice blasting cleans thoroughly and leaves the equipment dry. It works without chemical solvents, without lubricants and without water. So it's the perfect cleaning solution for electrical equipment or other water-sensitive applications.

**i) Non-polluting and environmentally friendly**

As a cleaning agent, dry ice simply disappears after it's used in dry ice blast cleaning. Dry ice doesn't become a toxic waste or a disposal problem like many popular cleaning solvents.

**ACHIEVEMENT:**
**Overall reduction in DP at Gas Turbine exhaust = + 100 mmWC.**
**Improvement in combined cycle output = + 4.5 MW**
**Improvement in Gross Station Heat Rate = 60 Kcal/Kwh.**

### 5. Reduction of Auxiliary Power consumption on account of reduction in lighting load by replacement of existing tube lights with energy efficient TL 5 tube lights.

TL5 lamps consume power up to 28W. This gives a power saving of 12 W per lamp.

Also, the light output of TL5 is higher than the conventional 40W T8 lamps which reduce the total number of lamp requirement.

**ACHIEVEMENT: Total power savings of 1.9KW and cost saving of Rs1,74,000 achieved.**

### 6. Adoption of Technology for Resource saving (Lube Oil).
### PROJECT: Monitoring of Moisture content of Turbine lubricating Oils

**ACTION TAKEN:** Procurement and installation of Low Vacuum Dehydration Unit-LVDH50

A Low vacuum Dehydration Unit has been installed to monitor and control moisture content of lubricating oils for GTG (Servoprime 32T) & STG ( Servoprime 46 )

Both GTG and STG have been supplied by OEM with Oil centrifuges to remove suspended particles, magnetic / nonmagnetic, organic/inorganic, resinous matter etc. On some occasions it was found that despite operating Centrifuge continuously, the moisture was still not removed up to normal limit (< 100 ppm). Hence, a Low Vacuum Dehydration Unit has been procured which has substantially reduced lube oil top – up rate.

**ACHIEVEMENT:**

- **Reduction in Lube oil rejection.**
- **Annual Saving of Lubricating Oil : 200 Ltrs equivalent to Rs 16,000**

## 7. Reduction in Fuel handling loss.

Reducing leakage during Naphtha Un-loading from couplings

**ACTION TAKEN:** Customized coupling for Un-loading of Naphtha Tankers provided for each Naphtha Tanker and Unloading point.

**ACHIEVEMENT:**
**Leakage from unloading hose coupling completely stopped.**
**Annual saving of Naphtha = Rs. 2,25,000**

## 8. Reduction in Aux power consumption by installing energy efficient blades on Cooling Tower fans

Replacement Plan of existing cooling tower fan blades has been initiated and purchase order issued with guaranteed savings of 15 to 20 % on existing power consumption.
**ACHIEVEMENT : Will result in savings of approximately Rs. 15 Lacs per annum.**
**Cost of fans = 3.75 Lacs**
**Payback = 3 Months**

### 9. Reduction of energy consumed in effluent treatment process and in discharging the same.

**ACTION TAKEN:**

Installation of VFD for ETP pump motor which will help reduce the power consumption during the ETP water discharge.

**ACHIEVEMENT: Reduction in power consumed during discharge of ETP water for gardening.**

**Reduction in Power consumption = 8.6 KW**

- **Annual Saving = Rs. 50,000**

### 10. Installation of motion sensors

All non critical areas in the plant were identified where there is less access of people. These areas were identified for installation of motion sensors to automatically switching OFF the lights when not in use.

In the 1st phase motion sensors was installed in Cable Cellar room

**ACHIEVEMENT: Reduction in power consumed.**

**Reduction in Power consumption = 0.5 KW**

- **Annual Saving = Rs. 43,800**

## Energy Conservation plans and Targets – 2008-2009

1. **Enhancement of Plant Output and improvement in Efficiency by replacement of Steam Ejectors with Motorised Vacuum Pump**
   Steam Turbine has been supplied with conventional Steam ejectors for maintaining Vacuum in Condensor. Detailed engineering has been carried out for replacement of Ejectors with Motorised Vacuum Pump. There is a scope for enhancement of Plant Output and improvement in Heat Rate (efficiency)

   **EXPECTED BENEFIT:**
   **Estimated cost of vacuum pump = Rs. 40,00,000**
   **Additional gain from Steam Turbine = 103 KW**
   **Additional units generation/year = 886329 KWh**
   **Payback period = 5.4 Months**

2. **Installation of energy efficient blades for cooling tower fan.**

Installation of New aerodynamic design FRP-E composite blades are being planned to replace the existing FRP conventional design blades.

**EXPECTED BENEFIT:**
**Estimated cost = Rs. 3,20,000**
**Reduction in power: 15 KW**
**Expected annual saving: Rs 12,60,000**

**3. Dry Ice blasting – 2nd Phase**

Based on the success of the 1st stage Dry Ice blasting, 2nd phase of the Dry Ice blasting is planned to clean the HRSG flue gas side deposits.

**EXPECTED BENEFIT:**
**Estimated cost = Rs. 6,00,000**
**Reduction in HRSG DP: 50mm WC**
**Expected annual saving: Rs 15,00,000**

**4. Installation of TL5 lamps – 2nd phase**

To further reduce the plant lighting load additional area has been identified for installation of energy efficient TL5 lamps.

**EXPECTED BENEFIT:**
**Estimated cost = Rs. 13,500**
**Expected annual saving : Rs 40,000**

**5. Optimizing of Auxiliary transformer tap position – Reduction of transformer losses by adjusting the tap position at the optimum level**

Energy audit was carried out by CII and based on their recommendations auxiliary transformer tap position needs to be changed to optimize the 6.6KV voltage.
This will reduce the power consumption of HT motors through reduction in voltage dependant losses

**EXPECTED BENEFIT:**
**Estimated cost = 0**
**Reduction in power consumption : 0.5 %**
**Expected annual saving : Rs 2,26,000**

**6. Replacement of Cooling Water Pump with optimum sized Pump**

Energy audit of Plant's pumping system was carried out in consultation with Kirloskar corrocoat pvt. ltd.

It was found that there is a scope of savings of approximately 23 KW by replacing the present pump which is consuming 282 KW at efficiency of 68% with a optimum sized pump operating at efficiency of 83%.

Existing drive (motor) shall be retained and only the pump needs to be replaced.

**Reduction in Aux Power = 23 KW**
**EXPECTED BENEFIT:**
**Estimated cost = 25,00,000**
**Reduction in power consumption: 23KW**
**Expected annual saving: Rs 19,00,000**
**Payback period: 16 Months**

**7. Reduction of Auxiliary Power consumption on account of street lighting load by using energy – efficient lamps. Replacement of HPMV lamps with metal halide lamps.**

Based on the trial on sample metal Halide Lamp, it has been observed that metal Halide lamps has a considerable potential in power saving.
Existing 250 W Mercury vapor lamps is planned to be replaced with a 125W metal halide lamps and similarly 125W Mercury vapor lamps lamps will be replaced with a 70W metal halide lamps in stages. This replacement can be done without affecting the light output.

**EXPECTED BENEFIT:**
**Expected power saving of 3.15KW**
**Expected annual saving: Rs 1,38,000**

**8. Installation of multi stage trim valve on HP Boiler feed pump recirculation line**

An exercise carried out on HPBFP recirculation line for identifying passing through the ARV valve and it was observed that ther can be a considerable power saving by providing Trim Valve on the recirculation line

**EXPECTED BENEFIT:**
**Expected power saving of 18KW**
**Expected Cost: Rs 2,50,000**
**Annual Savings: Rs 15,00,000**
**Payback period : 2 Months**

## Environment and Safety

- **ZERO ACCIDENT RECORD** since project commissioning in 1999.
  RInfra Goa Power Station won the following awards:

RInfra Goa Power Station won the following awards :

- **Greentech Foundation GOLD AWARD** in Gas Power Sector for outstanding achievement in **Environment Management** for 2007-08.
- **Greentech Foundation SILVER AWARD** in Gas Power Sector for outstanding achievement in **Environment Management** for 2006 -07.
- **Greentech Foundation GOLD AWARD** in Gas Power Sector for outstanding achievement in **Safety Management** for 2006-07.
- **Greentech Foundation GOLD AWARD** in Gas Power Sector for outstanding achievement in **Safety Management** for 2005-06.
- RInfra, Goa Plant was given a special recognition in RInfra's **"Simply the Best"** and **"Beat the best" awards**. The award is a result of dedicated work of generation and distribution excellence on reduction of distribution losses for the year 2007-08

- **FIRST prize in STATE SAFETY AWARDS:** Inspectorate of Factories and Boilers in Goa with Green Triangle Society (NGO) has for the first time started a State Safety Award for the best performing Industry in different categories. RInfra, Goa was adjudged FIRST and received State Safety Award. The criteria of above selection included accident records and frequency, legal compliances, environmental and occupational health parameters.
- OHSAS 18001under implementation.
- Special **software developed In-house** for tracking of legal compliance on or before scheduled date.
- **Emergency Management System** is in place with **mock drills**.
- **Unsafe Observation Module:** Keeping in view our goal to run the plant at par with world class Safety standard. Apart from site preparedness, a module for recording and monitoring Unsafe Observation was developed and implemented by in house IT Team. An Employee who observes any Unsafe working practice in the Plant logs the same in the module and same is looked in details by the Safety in charge for making place of work much safer. Regular meetings are held by the Safety committee to monitor and discuss on the action to be initiated.
- **Standard / Safe operating Procedures** are developed and made available on plant intranet for reference by all Plant O&M Personnel.
- **Maintenance Procedure and Guidelines** (**Standard Operating Guideline)** are provided in the ERP System which is Scheduled to generate Work Orders & Permit Request as per the Equipment Data provided in the System. Presently there are about 100 SOGs available.

## Environment Management:

- **EMS Certified as per ISO14001:2004**
  EMS system up-gradation from ISO 14001:1996 to ISO 14001:2004 successfully carried out in April 2006.
- **Special in-house software** developed for online monitoring of Plant performance and environmental parameters (Aux power consumption, Fuel consumption etc.)
- In total, 39 **Environment Management Programmes (EMPs)** were formulated, studied, successfully completed and implemented & few are under progress to improve the environmental performance on continual basis.
- **Environmental Targets** for resource optimization being set regularly monitored and achieved.
- Through a structured landscaping programme over 9200 trees were planted with in plant premises since 1999.
- Survival rate accounting being carried out for tree plantation on annual basis.
- **E- Magazine -Green Power is** an E-magazine developed in house and acts as a single point platform for all issues related to Environment and ISO 14001. Employees are encouraged to regularly send articles relating to Environment which are hosted in Green Power there by increasing their involvement.
- **Measures for abatement / mitigation of pollution by**

❖ Effluent Treatment Plan
❖ On – Line Monitoring of Effluent Water and use for Gardening
❖ On – Line Stack Monitoring
❖ Monitoring of Ambient air quality
❖ Monitoring of Ambient Noise quality:
❖ Operation of Oil water separator:
❖ Segregation and disposal of wastes