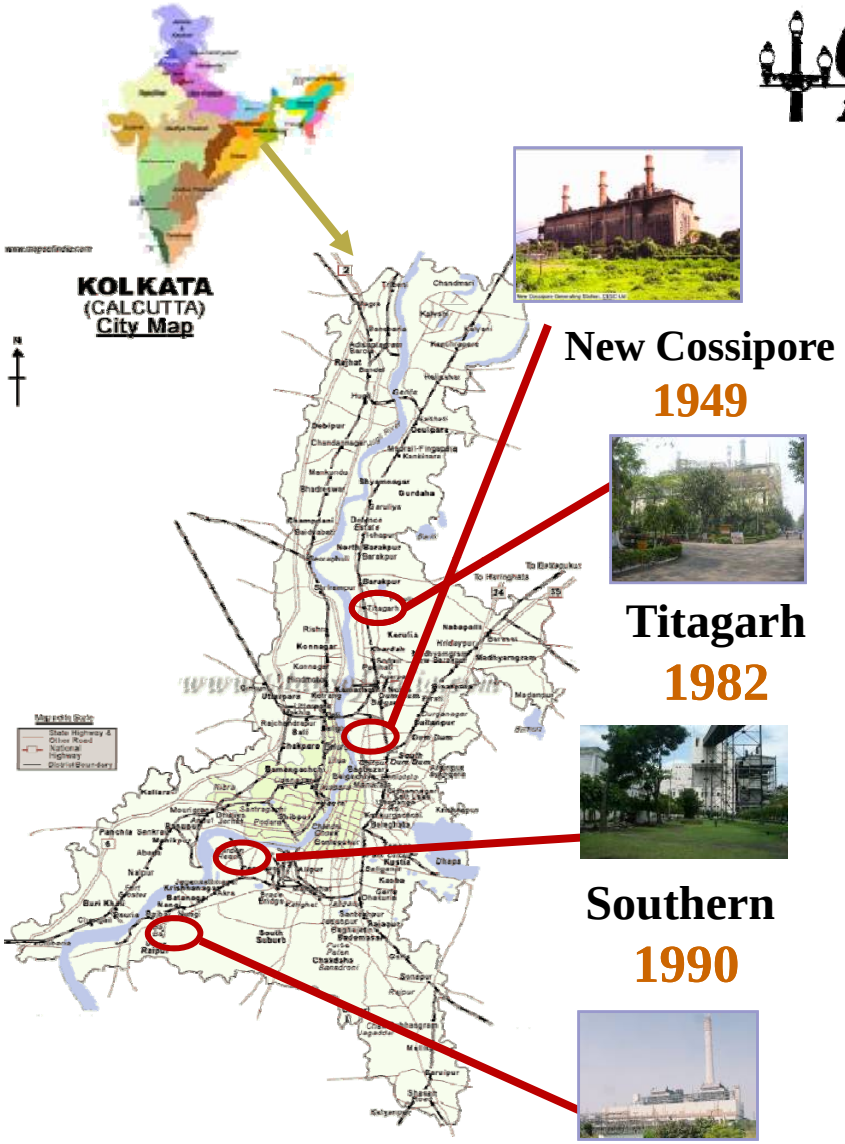
RP - Sanjiv Goenka Group

Saving water and reducing carbon emissions
An experience in power generation

Sanjoy Chakraborti
Executive Director (Generation)
CESC LIMITED

RP - Sanjiv Goenka Group

CESC LIMITED is a century old company and currently is a flagship company of RP-Sanjiv Goenka Group



New Cossipore
1949

Titagarh
1982

Southern
1990

Budge Budge
1997

- 4th largest private sector power utility company in India
- Vertically integrated business model
  Coal Mining → Generation → Distribution → Billing
- 1225 MW Generation, 567 sq.km. area, 2.5 mn consumers
- 80%+ energy requirement from own generation, meeting maximum peak demand of 1900+ MW
- Three CDM projects registered with UNFCCC
- Two projects under construction
- 600 MW thermal project in Chandrapur, Maharashtra
- 600 MW thermal project in Haldia, West Bengal
- Power projects planned in Jharkhand , Orissa & Bihar
- Hydel projects : 3 nos in Arunachal Pradesh
- Wind project : Rajasthan
- Solar project : Bhuj, Gujrat

Our Vision

CESC's business objective is to produce maximum uninterrupted cost effective power in environmental friendly way

CESC's vision emphasized on sustainable growth

Since all the power plants of CESC is city based, the company has taken various proactive measurers in various areas of environment management like emission management, water management, solid waste management etc.

Another key objective of CESC is to conserve energy at the maximum possible way through "Energy efficiency and conservation " efforts

Saving Water & Reducing Carbon Emission

In this presentation there are two parts of experience sharing

1. **Reducing Carbon Emission**

2. **Saving Water**

Saving Water & Reducing Carbon Emission

In simple terms

1 Reducing Carbon Emission

Can be achieved by efficiency improvement

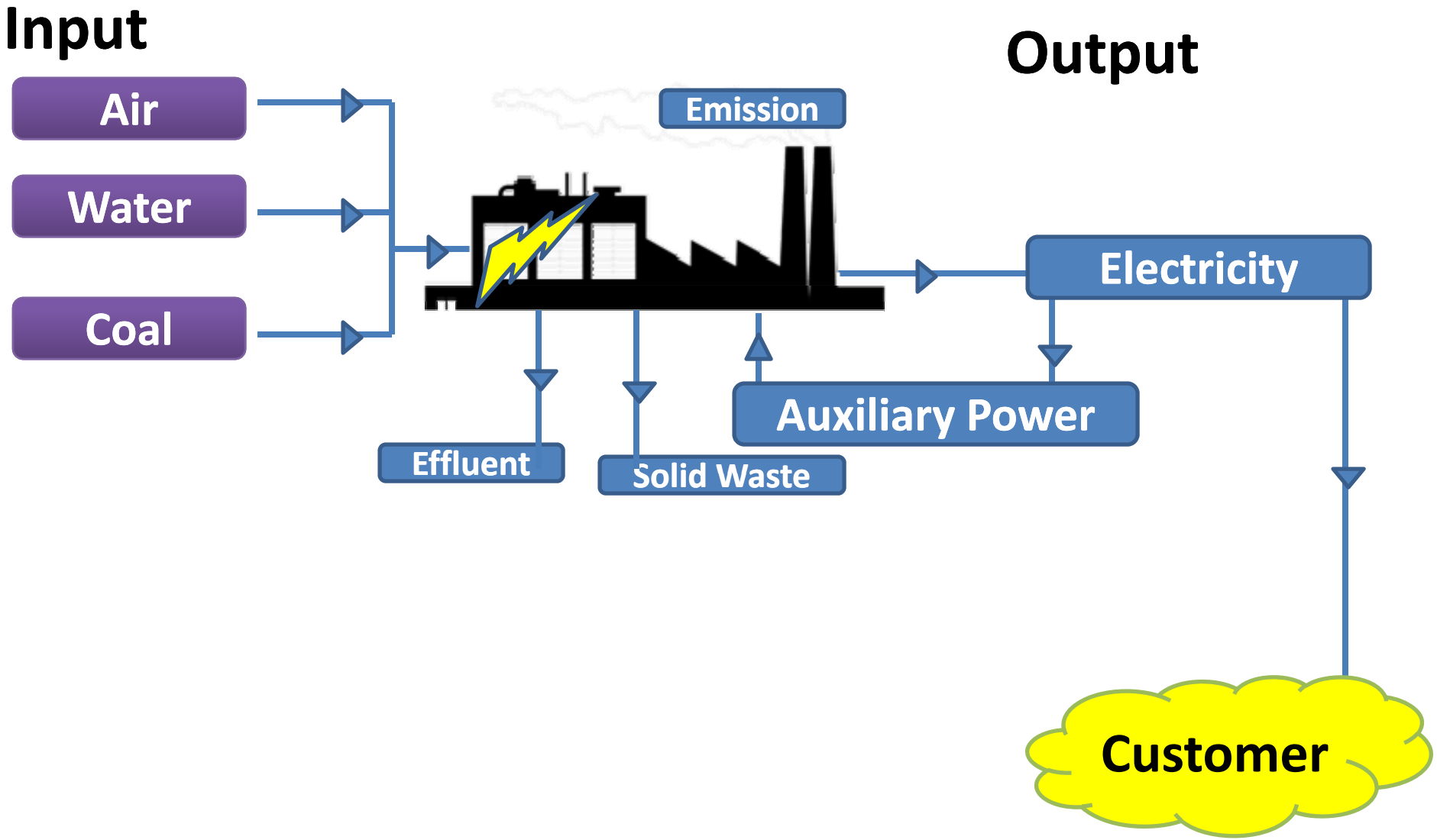
i.e. by producing same amount of power by less fuel

2 Saving Water

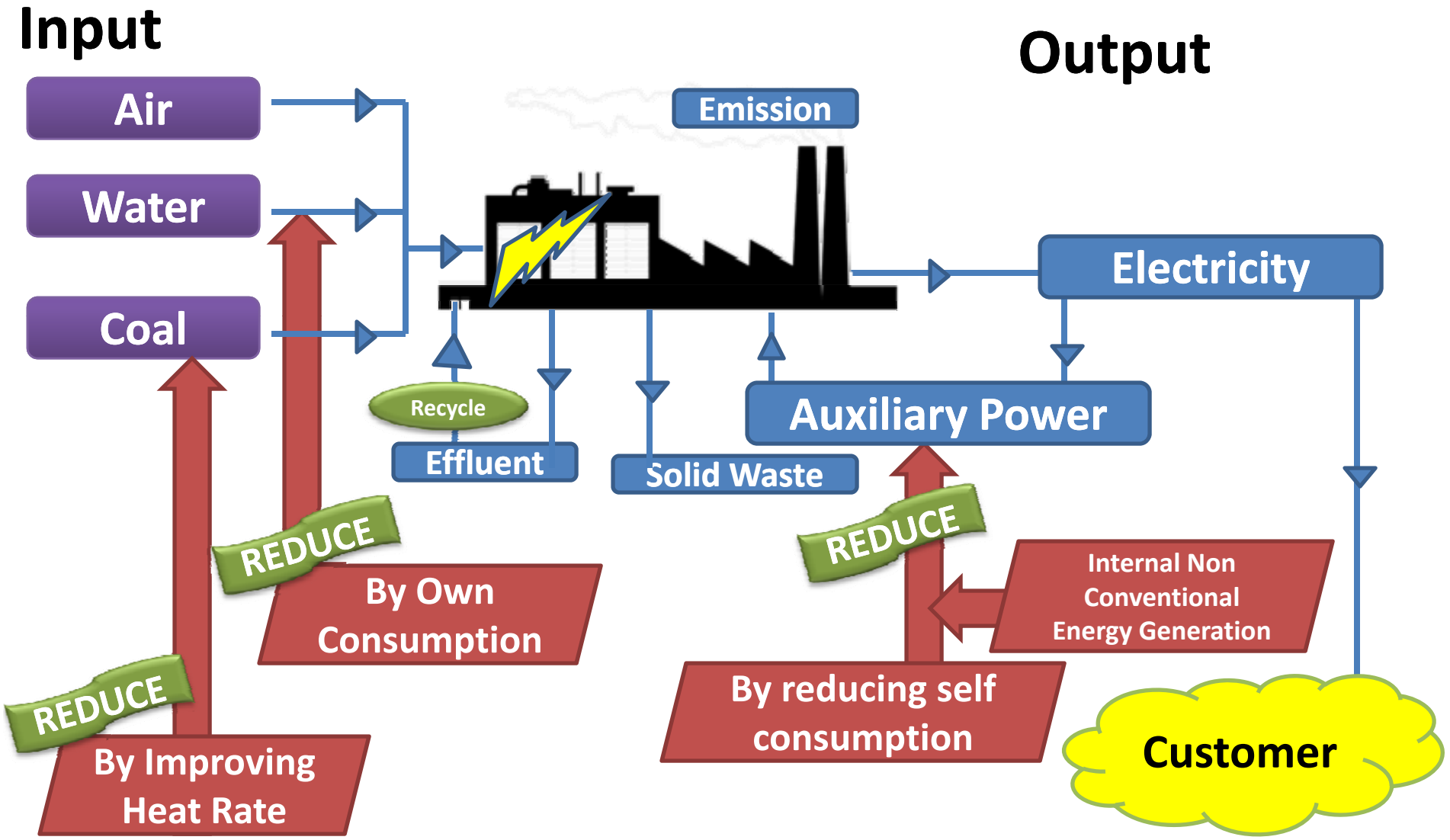
Can be achieved by controlling water consumption

i.e. Reduce process consumption and maximize reuse of effluents for internal purpose

Saving Water & Reducing Carbon Emission

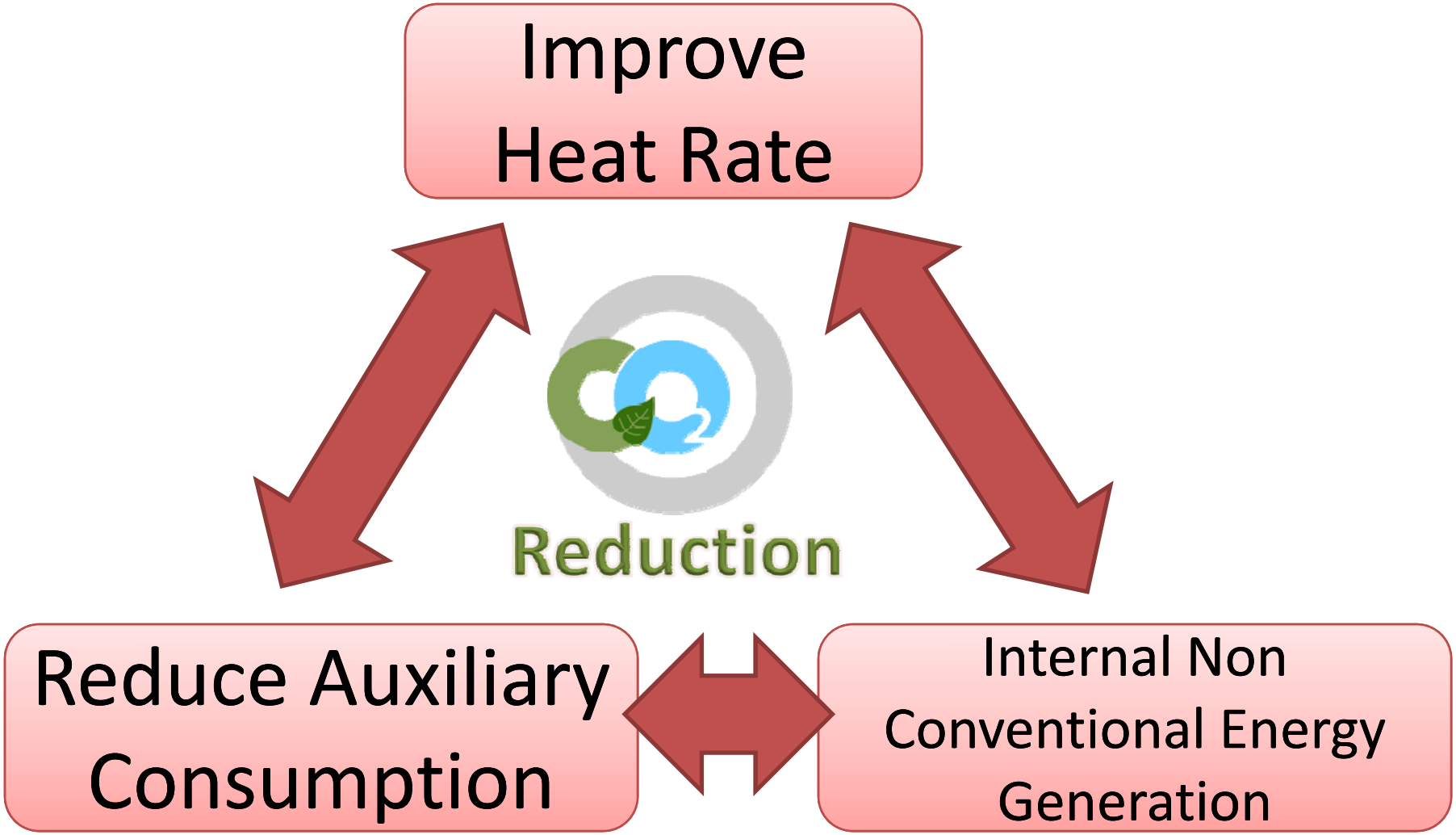


Saving Water & Reducing Carbon Emission



Reducing Carbon Emission

Reducing Carbon Emission



HEAT RATE IMPROVEMENT

Improvement of Heat Rate means improvement in efficiency which reduces coal consumption and benefits cost effectiveness and environment

1 Million Unit of Energy saved
is equivalent to
1000 Tons of CO_2 reduction

HEAT RATE IMPROVEMENT

What we have done:

1. **Time bound checking and replacement of Turbine Seals.**

   We do it meticulously in 5 years or as recommended by OEM

2. **Use of Thermography to detect hotspots**

   We do it on routine basis on various flanges and valves, different turbine drains and traps to detect minor leakages, Insulations for early detection of heat loss.

3. **Blending of coal.**

   We blend various grades of coal/ adopted tier blending method to optimize operational heat rate

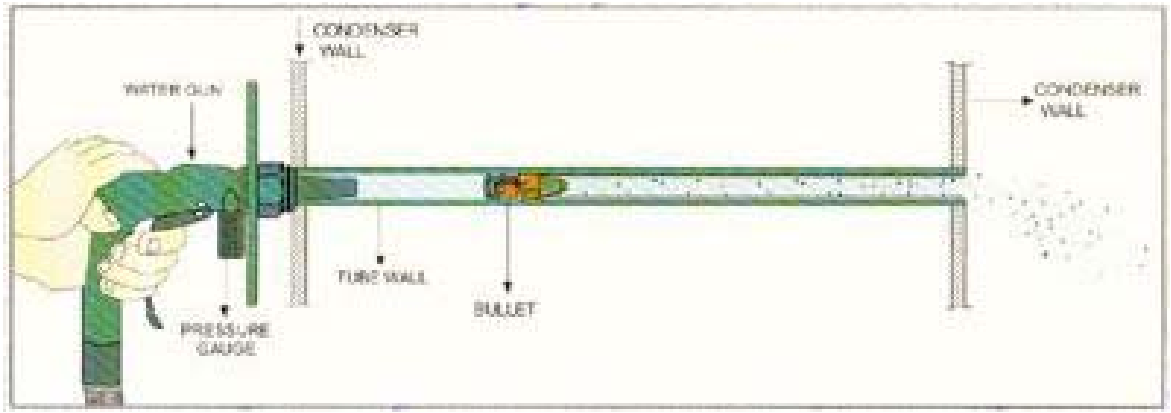
4. **Special chemical dozing in cooling tower to eliminate condenser fouling**

HEAT RATE IMPROVEMENT

What we have done:

5 **Condenser Tube Cleaning.**

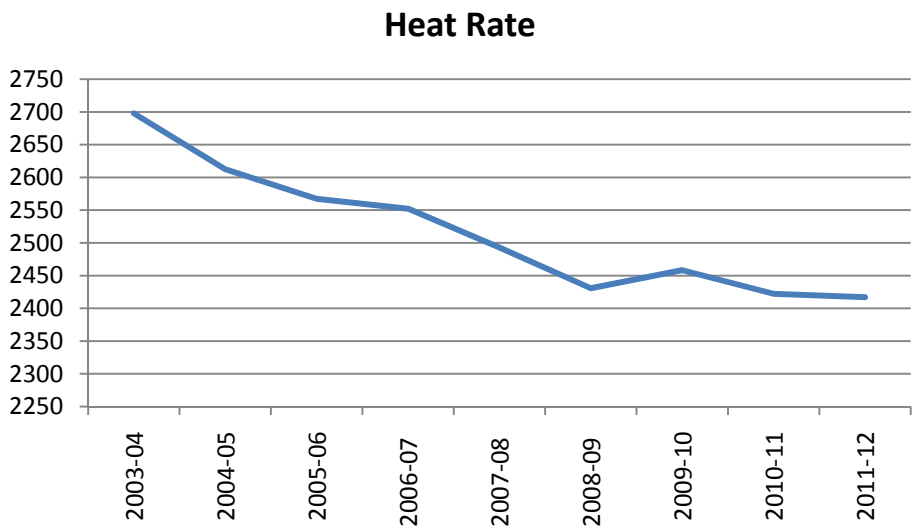
to improve/retain thermal conductivity



6 **Air Heater metallic Bellow replacement with non metallic fabric bellow**

HEAT RATE IMPROVEMENT

In last 8 years the combined Heat Rate of CESC's power plants has improved to around 10%



At our present level of output this savings of heat rate is :

- **520, 735 Tons of Coal Saving (Equivalent 147 Rakes)**
- **966,311 Tons of CO_2 Reduction**

AUXILIARY IMPROVEMENT

Improvement of Auxiliary means less internal energy consumption i.e. more output for same input. It reduces fuel consumption for per unit output.

We have revisited and modified various processes

- **Operational optimization of various high auxiliary consuming equipments like Feed Pumps, CW Pumps, Ash Water Handling Pumps etc.**
- **Implementing various Innovative practices**
- **Implementing Energy Efficiency Projects**
- **Implementing Various Energy Saving Projects**

AUXILIARY IMPROVEMENT

What we have done: Energy Efficiency & Improvement Projects

1 Introduction of Variable Voltage Variable Frequency Drive :

AC motor-driven applications that **do not require full speed** can save energy by controlling the motor with a variable speed drive. Energy cost saving with variable torque can be significant (25 -35%). We have introduced VVVFD in ID & FD Fans of Titagarh Generating Station & Southern Generating Station and decided to implement the same at PA fans of Budge Budge Generating Station

2 Stage Blinding of Condensate Extraction Pump

Sometimes auxiliary equipments of power plant are designed over sized. CEP is one such equipment. To optimize energy consumption by CEP stage blinding is one of the solution. We have applied this solution in Budge Budge and Southern Generating Stations.

The bare pump rotor with 8 stages

The pump rotor after stage blinding with 6 stages

AUXILIARY IMPROVEMENT

What we have done: Energy Efficiency & Improvement Projects

Few Other Projects

3. Reduction of Boiler Efficiency Loss due to blow down by achieving All Volatile Treatment (AVT)/ Zero Solid Treatment Tier Blending of coal at TGS
4. Conversion of steam to air atomisation of oil
5. Modification of Furnace Draft Control logic
6. Reduction in CTCW blowdown by changing operating Cycle of concentration
7. Changing of ISS blow down from continuous to intermittent mode
8. Optimizing number of CW Pump operation
9. Refurbishment of Air Heater including use of Non-metallic sealing for reducing air leakages
10. Reduction of throttling loss across PA Fan suction dampers by increasing vane links
11. Optimizing number of conveying compressor operation, based on ash hopper levels
12. Incorporation of auto Cut-off timer for Power Supply system of office blocks

Reducing Carbon Emission

AUXILIARY IMPROVEMENT

What we have done: Energy Conservation Projects

1. **Reduction of Energy Consumption in Lighting Circuits by reduction of Transformer Tap**

   It is found that Operating voltage level is on higher side than required causing more losses. It is required to reduce the voltage level by tap changing.

2. **Reduction of throttling loss across Feed Control Station by reducing DP**

   To reduce the huge throttling loss across the Feed Control Valve, the DP set point was gradually lowered from OEM recommended 10kg/cm2 to 3.8 Kg/cm2 and then further reduced to 1.8 kg/cm2. Appropriate modification in control loop has been incorporated in the DCS to minimize the risk of loosing the unit in case of transient disturbance. This has resulted in reduction of Boiler Feed Pump energy consumption.

3. **Acoustic Soot Blowing in Air Heaters**

   Compressed air from plant is passed through an Air Handling Unit, followed by a Solenoid on to the Aquastic Horn. The sound thus produced very rapid powerful pressure fluctuation which are then transmitted to fly ash particles to dislodge. This system eliminates the use of high energy content steam used for the same purpose.

AUXILIARY IMPROVEMENT

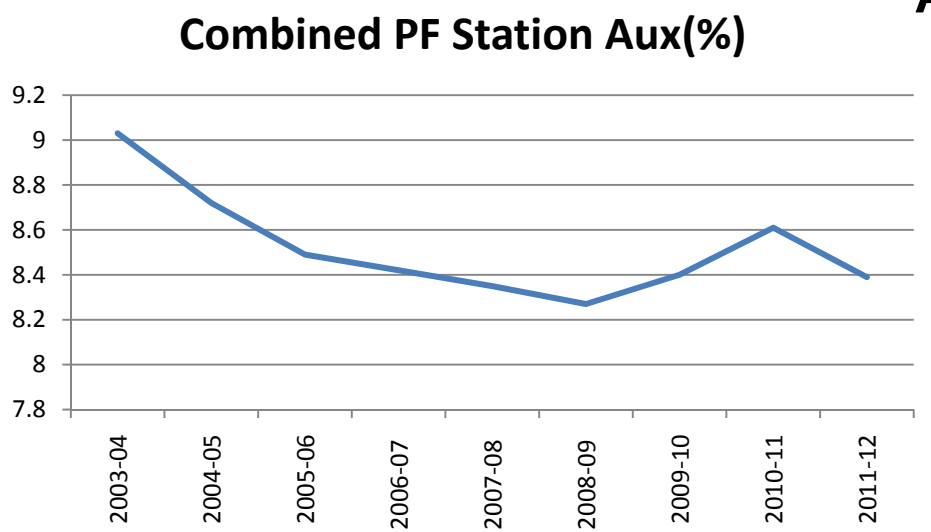
What we have done: Energy Conservation Projects

Few Other Projects

4. Optimising number of conveying compressor operation, based on ash hopper levels
5. Modification in CT Fan logic to enable switching of fans from 'High speed' to 'Low speed' & vice versa from UCR
6. Incorporation of Timer circuit for controlling outdoor lighting
7. Optimum Draft set (one ID, FD & PA fan) operation vis-à-vis level of generation
8. Online laser based digital Coal bunker level measuring instruments for enhancing operational flexibility and energy savings in LDO and auxiliary consumption
9. Reduction of LDO consumption by Oil Burner sprayer plate modification
10. Cooling Tower for Auxiliary Cooling Water System

AUXILIARY IMPROVEMENT

In last 8 years the combined Auxiliary Consumption of CESC's power plants has improved to around 0.93%



At our present level of output this savings of auxiliary is :

43, 498 Tons of Coal Saving (Equivalent 12 Rakes)

- **80,800 Tons of CO_2 Reduction**

CDM BENEFITS

Project 1: Energy Efficiency thro' change of Power Cycle Chemistry & Modification in Furnace Draft Control at BBGS.

Registered by UNFCCC (Regn. No 0479), Estimated CER:3841/ Year.
Verified for the period Apr'02 to Sep 06, Audit completed till Apr-08, Total CER issued: 16,487

CESC scores global first with green initiative

THE
DT-2

TIMES NEWS NETWORK

Kolkata: The electricity that you get has just got greener. Not that city-based power utility has switched from coal to renewables, but it has taken significant strides in reducing greenhouse gases emitted by power plants.

In doing so, it has scored a global first. CESC has become the only thermal power generation company to be rewarded by the United Nations Framework Convention on Climate Change (UNFCCC) for its efforts to better the environment. UNFCCC is the nodal agency for monitoring greenhouse gas reduction under the Kyoto Protocol. "UNFCCC ratified the energy efficiency programme at Budge Budge thermal unit on September 16. The project has earned CESC 3,894 carbon emission reduction (CER) notes that can be traded for cash," said RPG Enterprises vice-president (corporate finance) B L Chandak.

CESC was given the award by UNFCCC for its effort to reduce greenhouse gases

With CER trading at 12-15, CESC foreign exchange earnings could touch 600,000 in a couple of years if two more CDM projects with potential of 40,000 CER are approved.

But more than revenues, it will help CESC pitch itself as an eco-sensitive company. "Projecting a 'green' image is key to gaining global acceptance. Not only will CESC be seen as a company that practices corporate responsibility, it will impress billion dollar venture funds like CalPER's," Chandak explained.CESC has lined up investment worth over Rs 5,000 crore over the next five years.

Budge Budge Generating Station is the first thermal power station in the world to have registered a CDM project.

Project 2: Energy Efficiency thro' Alteration of Fuel Oil Atomizing Media at TGS.

Registered by UNFCCC (Regn No 0987).
Estimated CER: 31,878/ Year
Registration and Verification completed

Project 3: Optimization of Electrical Energy Consumption in Furnace Draft Control System thro' installation of VVFD and Installation of Cooling Tower for Auxiliary Cooling Water System at TGS.

Estimated CER:9,392 /Year
Registered by UNFCCC

We have so far earned Rs. 18 Crore from CER

Internal Non Conventional Energy Generation

Reducing Carbon Emission

Solar PV module for Lighting

Solar PV Modules are installed in the roofs of various buildings of our power plant. This power is used for internal street lighting

Reducing Carbon Emission

Installation of Micro Hydel Unit in CW Outfall

Upstream

Downstream

In power plants CW outlet falls freely in river. We have used this small head energy loss to drive micro hydel power generation units. 2 nos 15 kw units has already installed. The installation of third unit is underway.

Annual CO_2 Reduction
250
Ton

Saving Water

100% RECYCLING

One of the key mission of CESC in water management is

"Not A Single Drop of Effluent Will Flow Out of The Plant"

To accomplish the mission a cross functional team was set up. The Cross Functional team made a detail study with of all the types of effluents

- **Quantity of effluent (Amount, flow rate etc.)**
- **Quality of effluent (chemical analysis etc.)**

The cross functional team also made a detail study about the intake water requirement of every internal processes.

- **Quantity of effluent (Amount, flow rate etc.)**
- **Quality of effluent (chemical composition like pH, TDS etc.)**

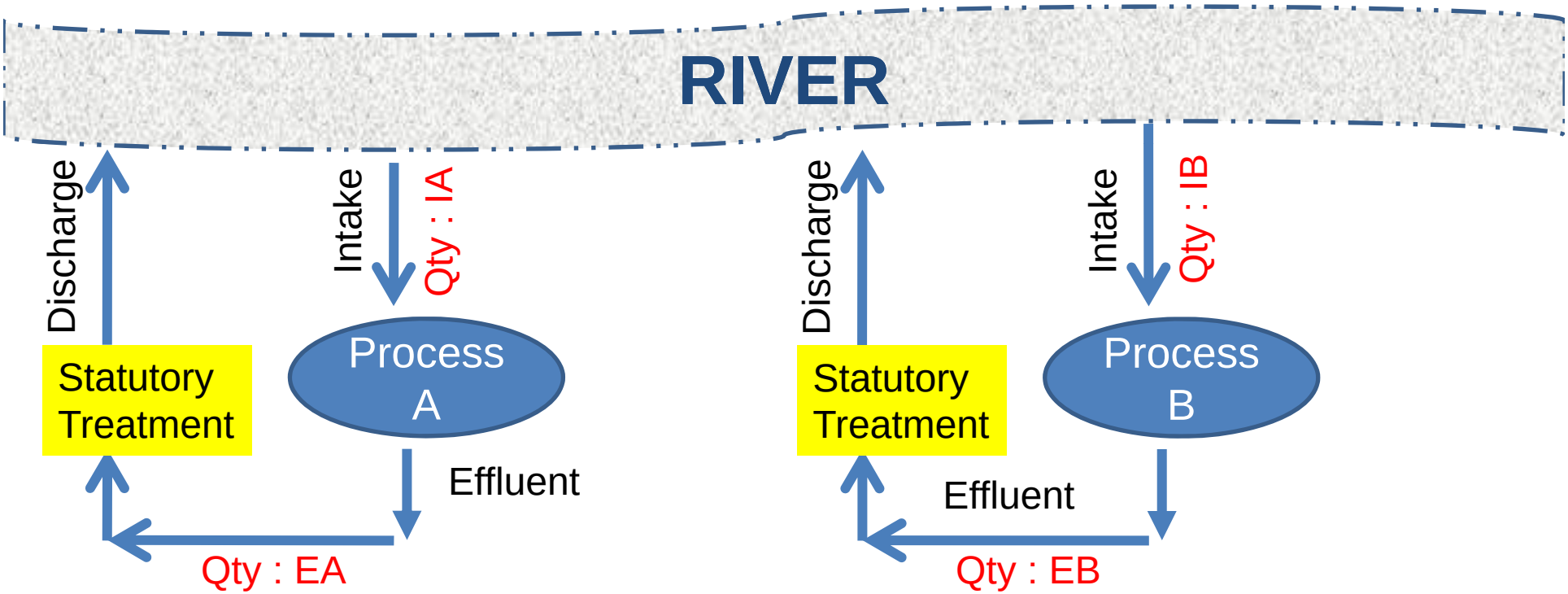
100% RECYCLING

In the next step the water balance blue print was designed.

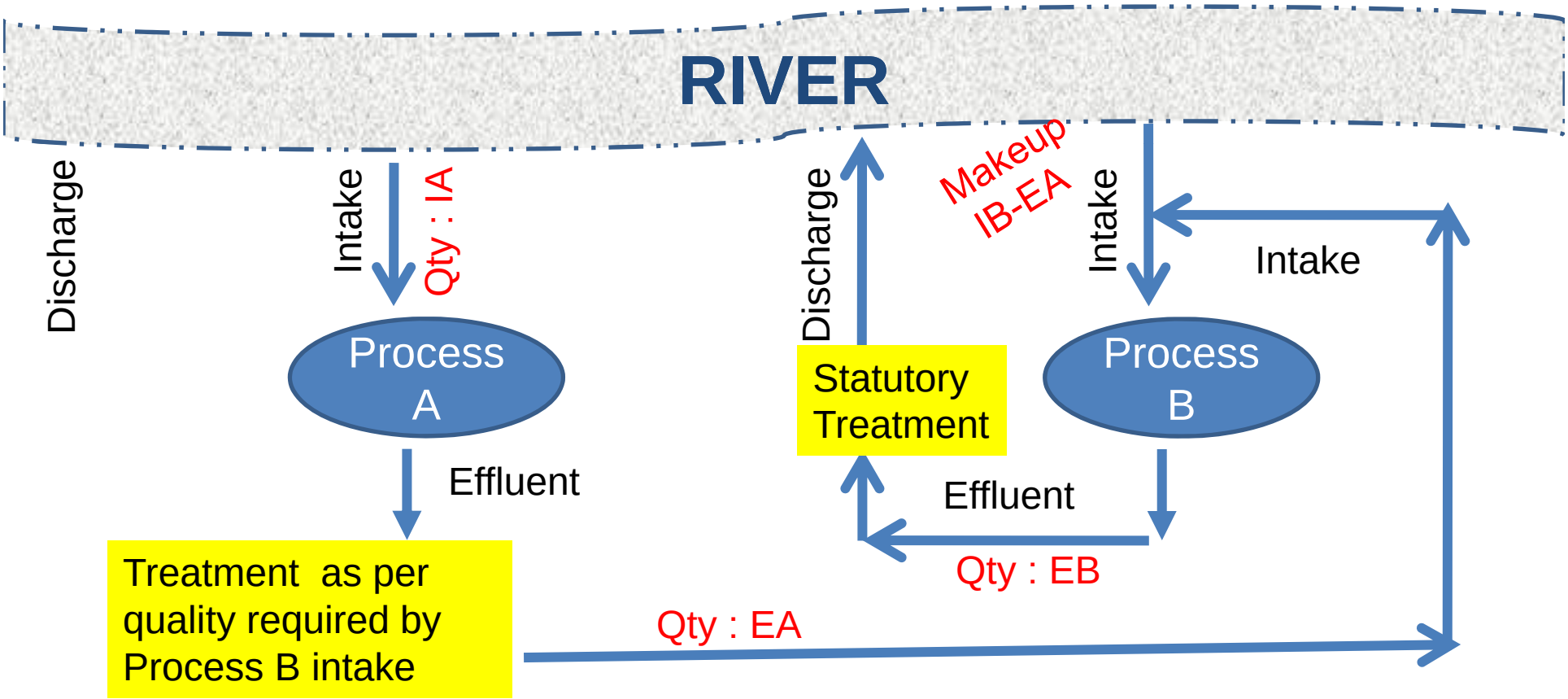
Here it was considered how the effluent of one process can be treated and can be made suitable for another process intake

Let us see a very simple illustration

CONVENTIONAL INTAKE & DISCHARGE

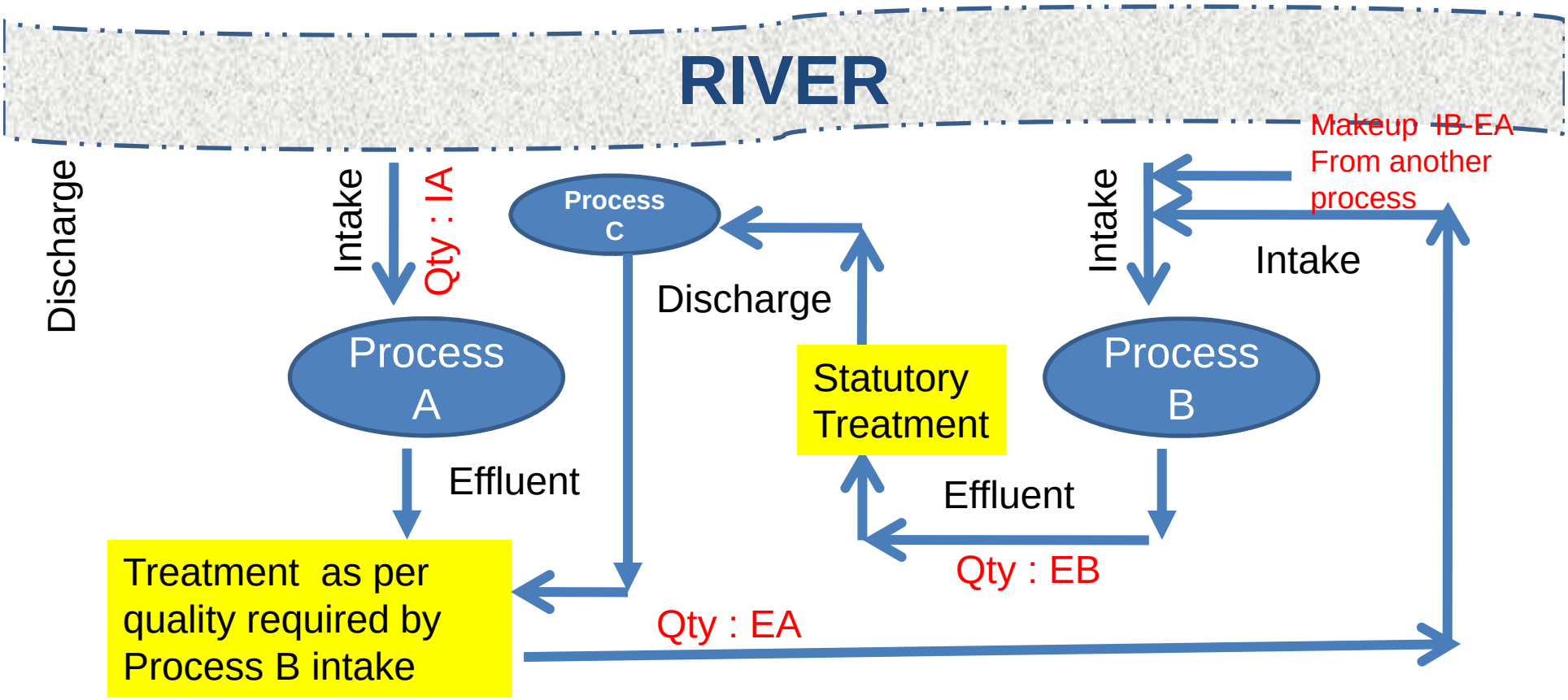


First Step of Recycling



Saving Water

100% RECYCLING



Saving Water

100% RECYCLING

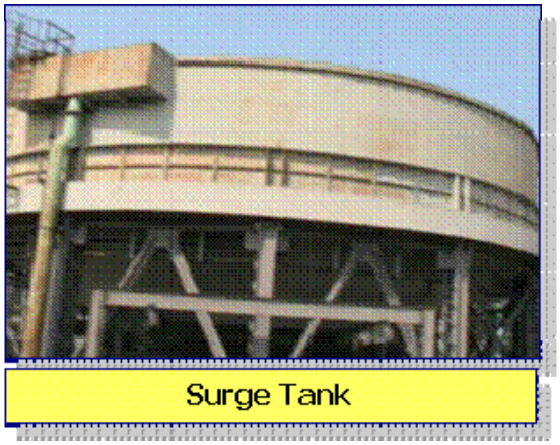
Major Equipments Used

PSF & ACF for Process Water Recycling

RECIRCULATION PUMPS for Bottom Ash Handling System

Settling Tank

De-watering Bin

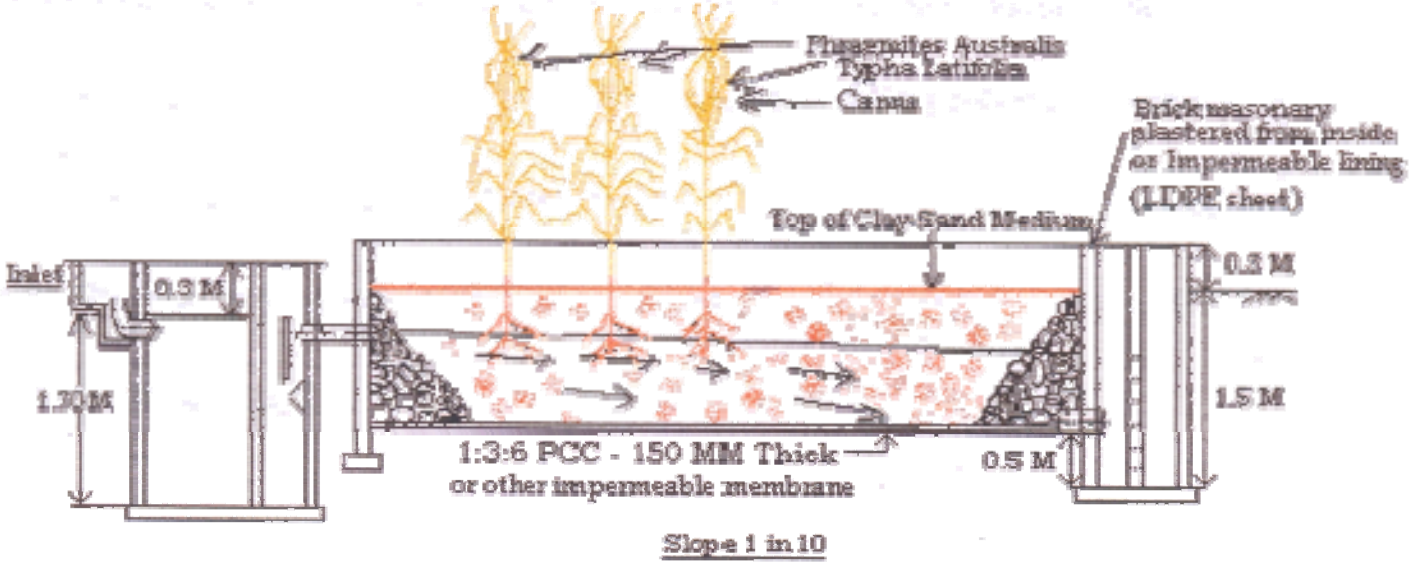


Surge Tank

ROOT ZONE SYSTEM: TREATMENT OF WASTE WATER

•Root zone technology is a low energy, low maintenance and natural approach to treat domestic sewage.

•Root Zone filters are type of constructed wetlands commonly known as subsurface flow wetland. Root Zone Treatment System are planted filter-beds consisting of sand / gravel/ soil. Breakdown of contaminants and the treatment of waste water are achieved by controlled seepage of the water borne pollutants through the root zone of the plants. Organic pollutants are broken down as a food source for the variety of micro organisms present in soil & plants.



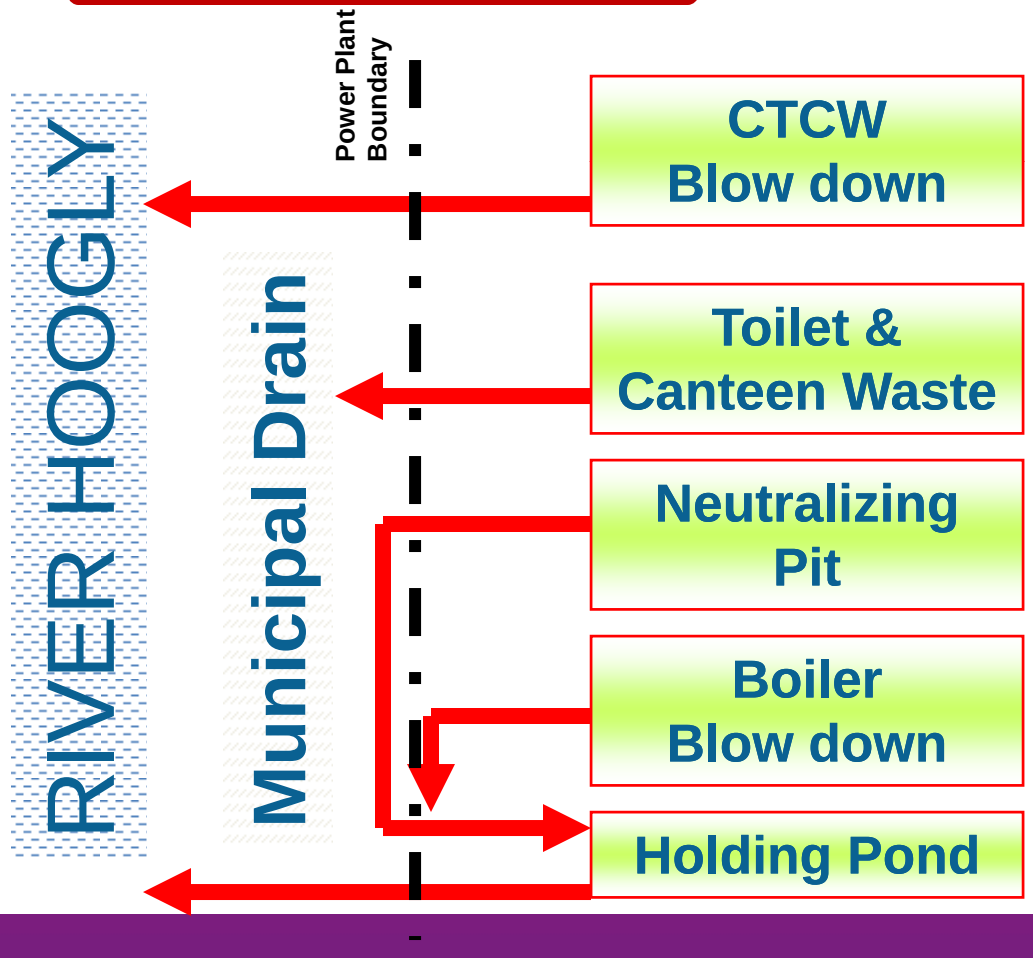
ROOT ZONE SYSTEM: TREATMENT OF WASTE WATER A GREEN TECHNOLOGY

Saving Water

100% RECYCLING

The Real Scenario

Previous State

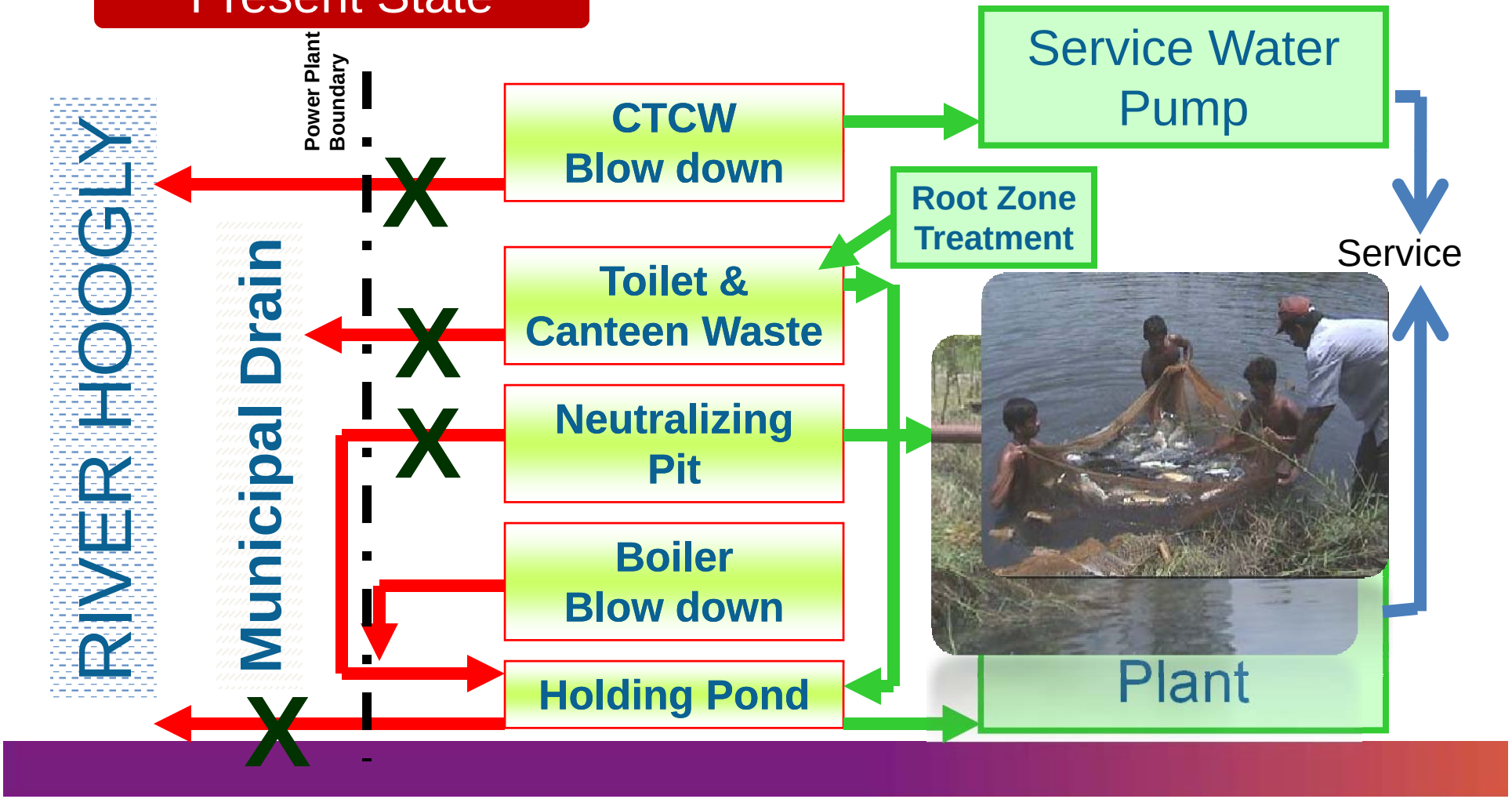


Saving Water

100% RECYCLING

The Real Scenario

Present State



Green Belt Around Power Plant

Green belt around Budge Budge Generating Station

How We have Achieved

Our Vision

- Uninterrupted Power Generation
- Cost Effective Power Generation
- Environment Friendly Power Generation
- Safe Power Generation

Remove all the Bottlenecks / Innovate / Benchmark

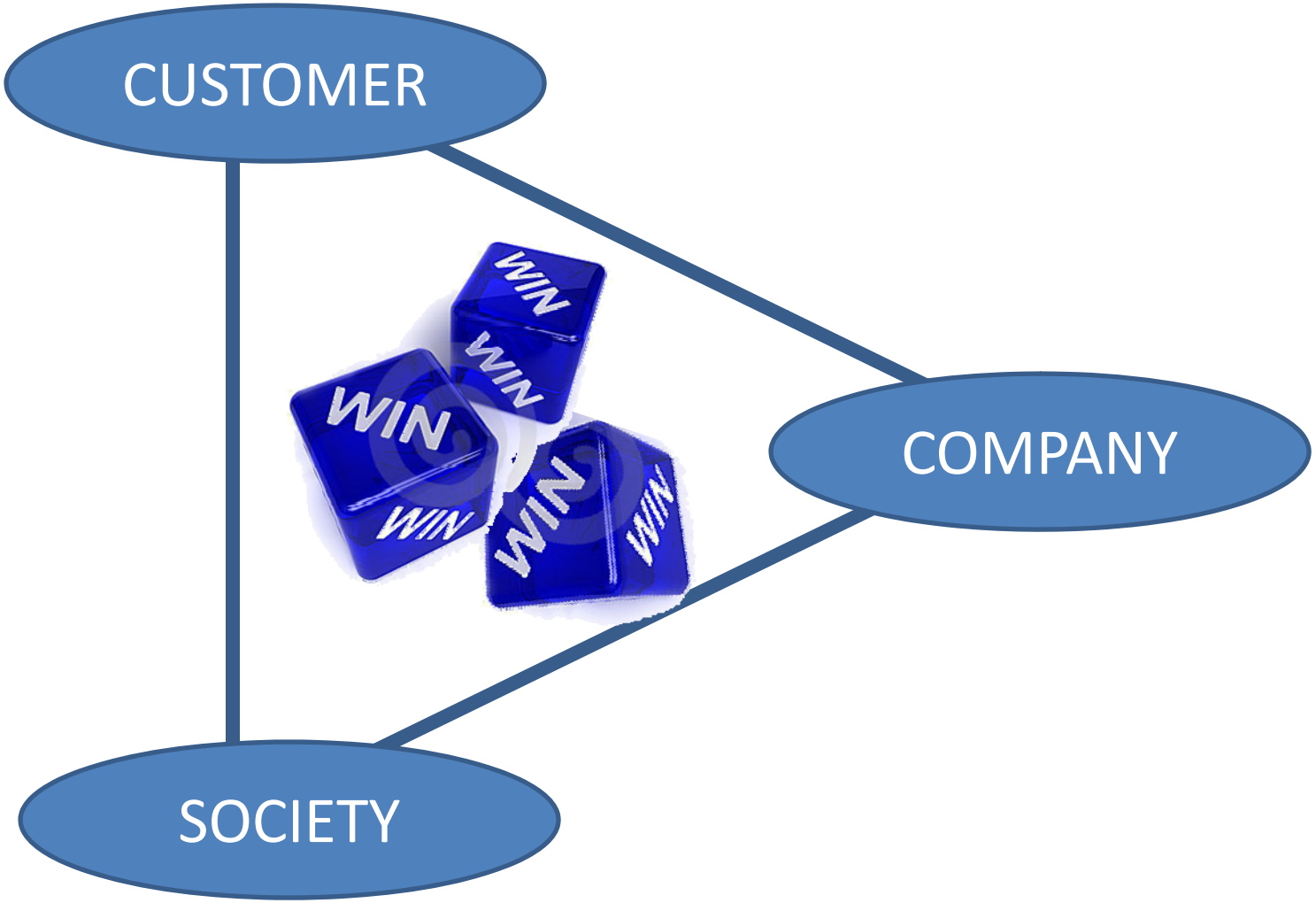
Problem Solving Team

Best In Class

World's First

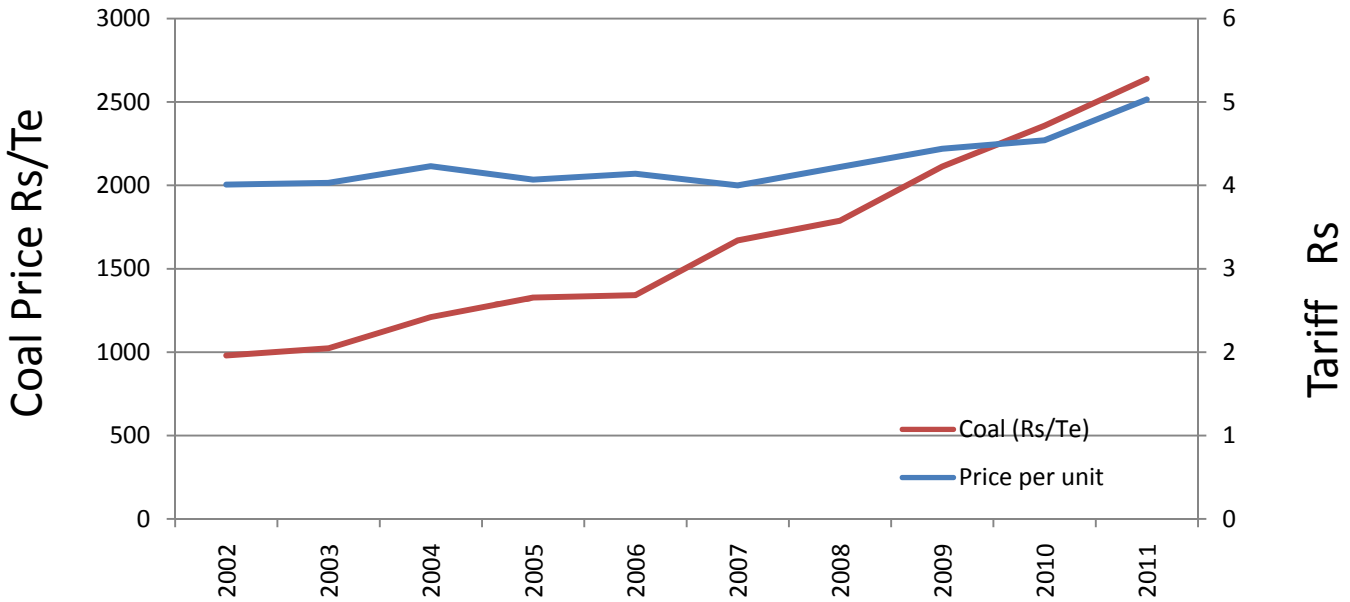
- BBGS : World's first power plant to earn **CER from UNFCCC**
- BBGS : World's first power plant to achieve **100% recycling of effluent**
- SGS : World's first power plant to install **micro hydel in CW out fall**
- NCGS : World's first power plant to install **Wet ESP**

Philosophy for Sustainability



Philosophy for Sustainability

CUSTOMER BENEFIT



In spite of average increase of coal price to 300% the average tariff increase is only 25%

Philosophy for Sustainability

SOCIETY BENEFIT

Clean Energy : Green Energy

Emission : Carbon reduction

: SPM Reduction

We operate at 33% of statute value

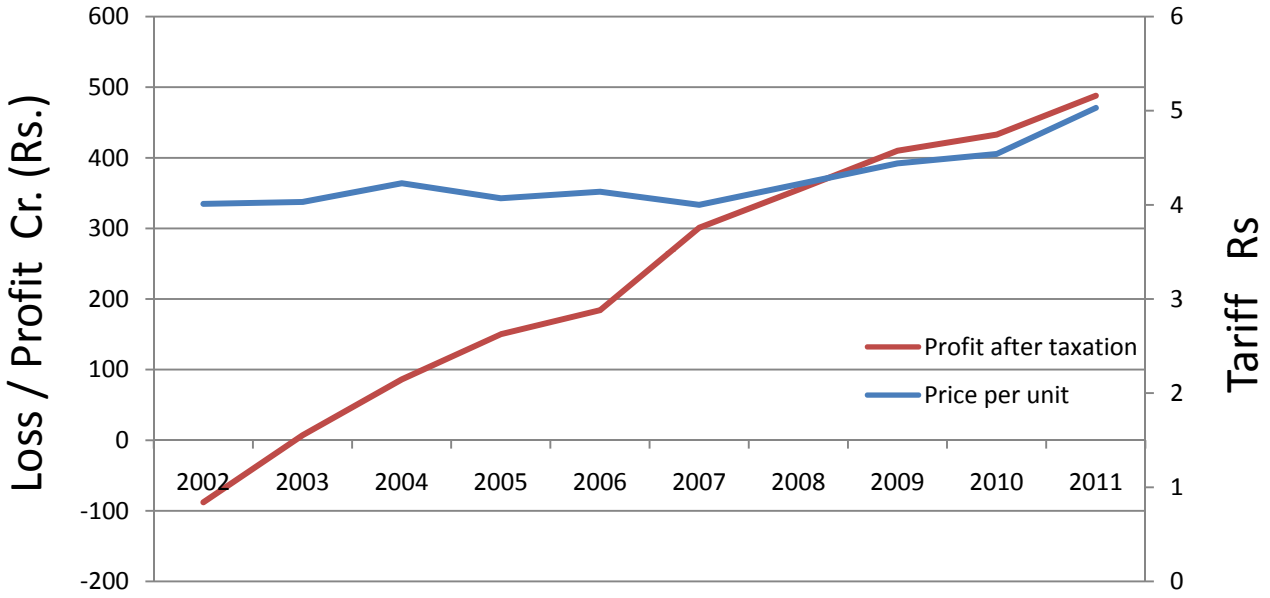
Effluent : Not a single drop of effluent flows outside the plant

Solid Waste : 100% utilization of Ash

More emphasis towards value added product like cement, bricks etc.

Philosophy for Sustainability

COMPANY BENEFIT



In spite of average increase of tariff to 25% the profitability of company has increased many times through efficient operation

Recognition

AWARDS & ACCOLADES

Thank You !

The author may be contacted at : sanjoy .chakraborti@rp-sg.in
Please visit our website : www.cesc.co.in