Operational Excellence of a Power Plant

Renusagar Power Plant

A Case Study

by

Er. M. M. Khan

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Former Chief Engineer Renusagar Power Co. Ltd.

Former General Manager-Hindalco:Renupower

Former Group General Manager-NASH Engineering, DUBAI,UAE

Former Dean & Senior Executive Development-Integral University, Lucknow

Kind attention about the word “Operation”

This presentation is about :

- Management, Reliability, Safety, and Overall Performance of the Power Plant.
- The word “operation” has a broader term. It is related to People, Culture, & Long-term Sustainability.

Before coming to the subject
"Operational Excellence,

let me introduce you the Renusagar Power Plant with it's " Benchmarks".

AN INTRODUCTION TO RENUSAGAR POWER DIVISION

Location : Renusagar ;Distt. Sone Bhadra

Objective : Power Generation for Captive Consumption by HINDALCO

No. of Units : Ten (10)

Total Capacity : 742 MW

Highest PLF : 96.87% (1995-96)

RENUSAGAR POWER DIVISION - AN INTRODUCTION

- Renusagar Power Limited started with two (2) units of GE-CE combine with rated capacity of 67.5 MW each. These units were commissioned in 1967-68.
- Two more units of BHEL-Siemens (Germany) make of rating 74 MW each were commissioned in 1981 & 1983, respectively.
- Fifth unit with GDR (Bergmann Borsig) Turbine of 68 MW was commissioned in the year 1989.
- Sixth & seventh units with ABB make Turbo-Generators and BHEL boilers of 74 MW capacity each were added to the plant in March 1997 & 1998, respectively.
- Eight unit with GE-USA Turbo-Generator and BHEL boiler of 76 MW capacity was commissioned in March 1998.
- Unit # 9 and 10 , with Siemens make Turbo-Generator and BHEL boiler were commissioned in 2002-2003

RENUPOWER - AN INTRODUCTION

Source of Water - Rihand Lake.

Source of Coal - Jingurdah Mines, NCL (Distance - 7.6 KM)

Average CV of Coal - 3300 Kcal/Kg (F Grade)

Mode of Transportation - Arial Ropeway & by Road (70%) : (30%).

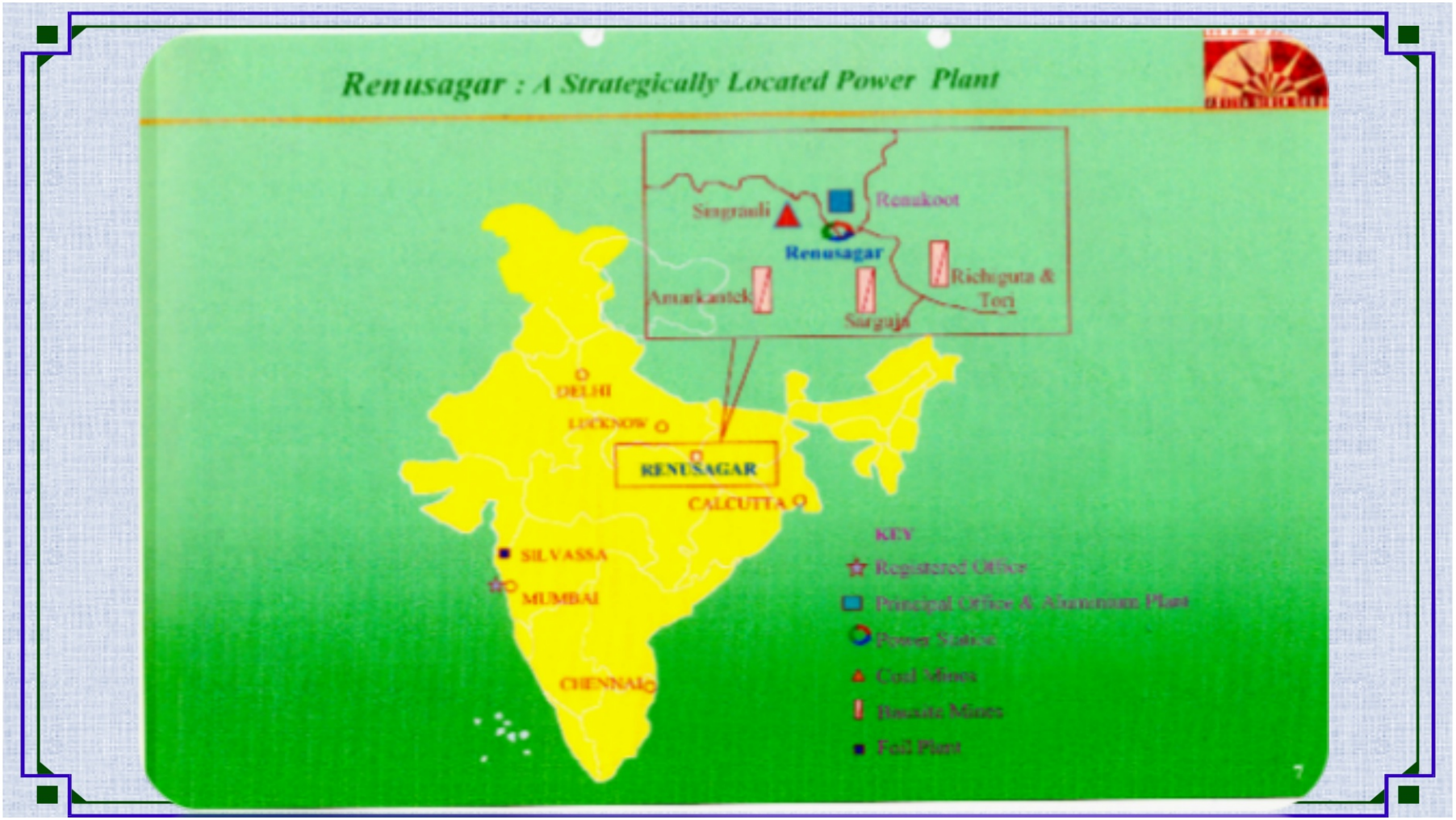
No. of Ropeways - Two (2)

Boilers Type - Top Supported, Bi-drum, Pulverized Coal Firing, Tangential Tilting Burner System.

Turbine - Impulse & Reaction Type.

Boiler Efficiency - 84.32 %.

Overall Cycle Efficiency - 31.2 %


Renusagar : A Strategically Located Power Plant
Singrauli
Renukoot
Renusagar
Amarkantek
Singaji
Richgutta & Tori
DELHI
LUCKNOW
RENUSAGAR
CALCUTTA
SILVASSA
MUMBAI
CHENNAI
KEY
Registered Office
Principal Office & Aluminium Plant
Power Station
Coal Mines
Bauxite Mines
Fuel Plant
7

Our Vision

"To be one of the best operated and maintained Captive Power Plant, with enviable Plant Load Factor, to supply uninterrupted power to Hindalco-Renukoot at the lowest cost."

Our Mission

"To pursue the creation of value at all levels of Plant Operations, for our Customers, Share Holders, Employees and Society at large."

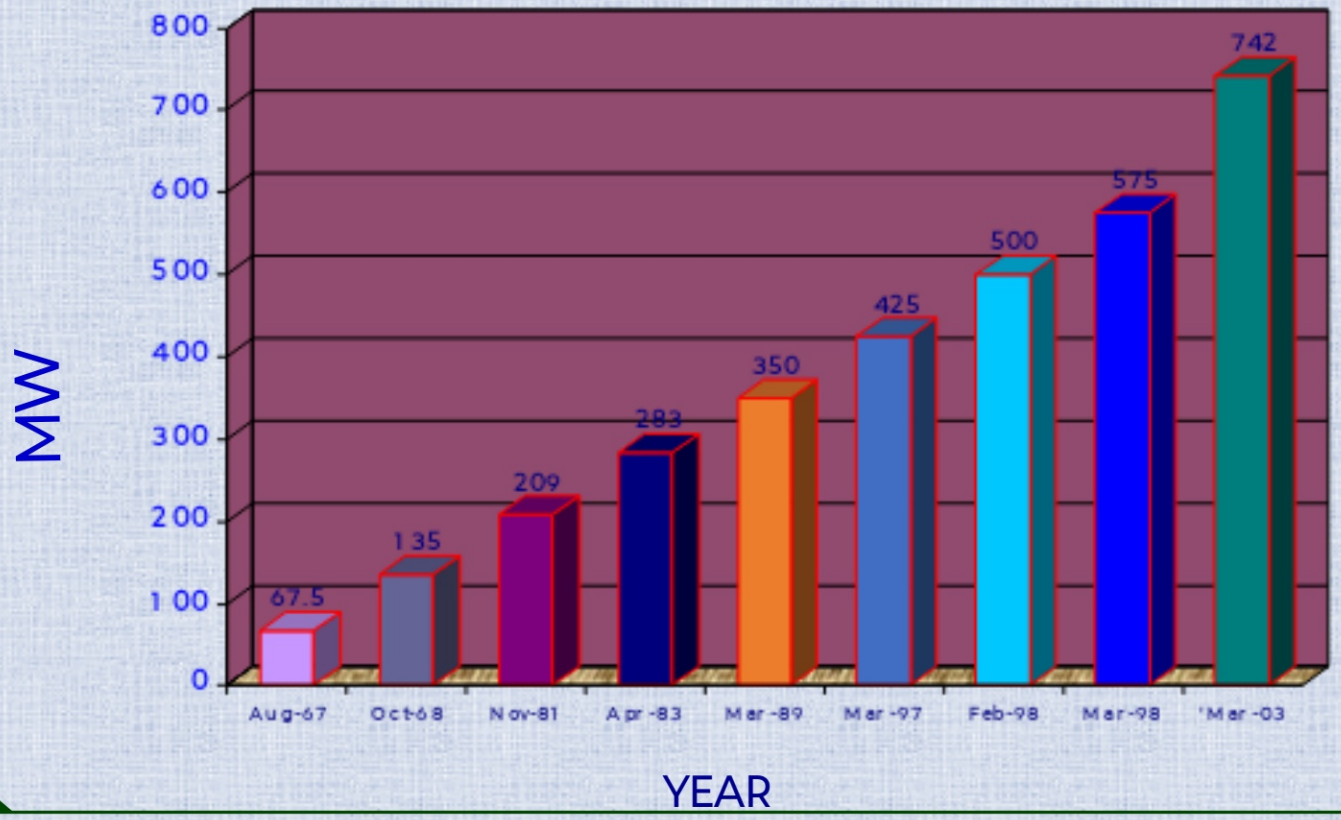
RENUSAGAR POWER DIVISION – AN INTRODUCTION

UNIT WISE CAPACITY IS GIVEN BELOW:

UNIT # 1	67.5 MW	
UNIT # 2	67.5 MW	
UNIT # 3	77.0 MW	
UNIT # 4	77.0 MW	
UNIT # 5	68.0 MW	
UNIT # 6	74.0 MW	
UNIT # 7	74.0 MW	
UNIT # 8	76.0 MW	
UNIT # 9	80.0 MW	
UNIT # 10	80.0 MW	742.0 MW

The entire power generated is exported to Hindalco industries limited, after meeting the auxiliary and colony requirement at Renusagar.

GROWTH OF RENUPOWER CAPACITY



PLANT PERFORMANCE

- GENERATION 742 MW
- EXPORT 659 MW

- PLANT LOAD FACTOR % 96.87
- PLANT AVAILABILITY FACTOR % 96.37
- PLANT UTILIZATION FACTOR 100.00
- BOILER EFFICIENCY % 84.32
- UNIT HEAT RATE (Exp.Basis) BTU/kWh 13014
- COAL CONSUMPTION Kg / kWh Gen 0.98
- OIL CONSUMPTION Ltrs / MWh 0.484

RENUSAGAR HAS THE FOLLOWING GLOWING RECORDS TO ITS CREDIT.

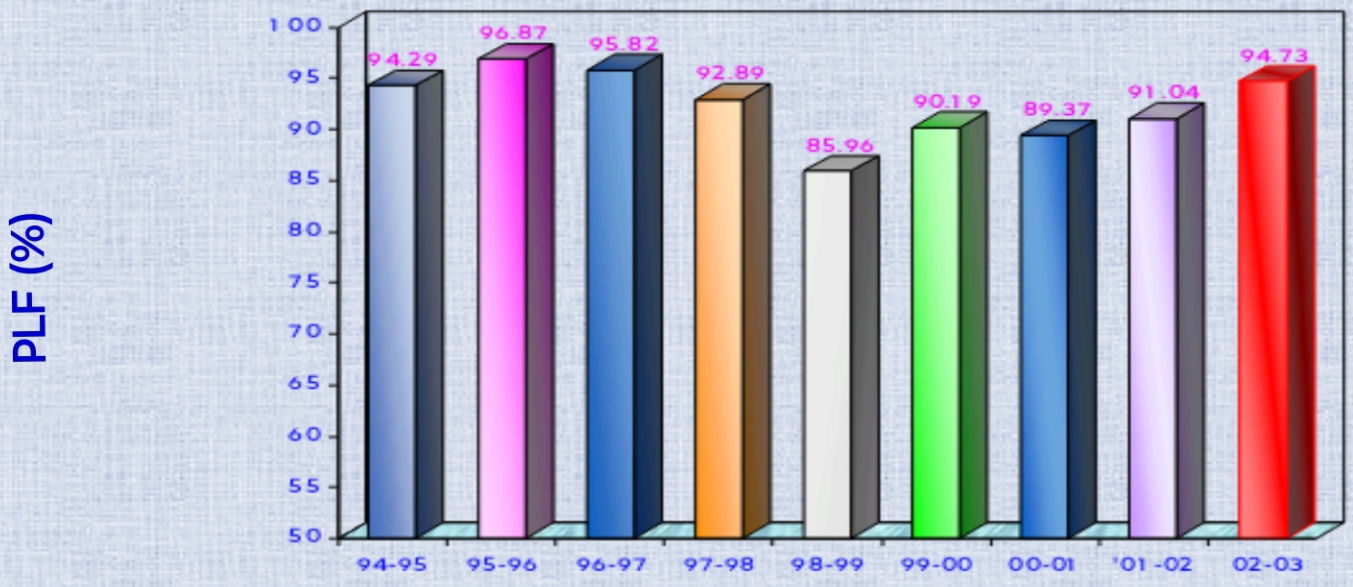
- HIGHEST PLANT LOAD FACTOR.
- HIGHEST PLANT AVAILABILITY FACTOR.
- HIGHEST PLANT UTILIZATION FACTOR.
- LOWEST OIL CONSUMPTION.

OUTSTANDING ACHIEVEMENTS

- Renusagar has been the leader in power generation ever since its inception.
- Right from start, Renupower has maintained Plant Load Factor, Plant Utilization & Plant Availability Factor around 90%.
- Renusagar power division achieved an average PLF of 96.87% in the year 1995-96.
- This was the highest ever achieved by any coal-based power plant in India, till that period.
- PLF at Renusagar is much higher than National Average .
- This becomes outstanding in the background of poor-Quality COAL (Having cv around 3000 K.Cal/Kg).

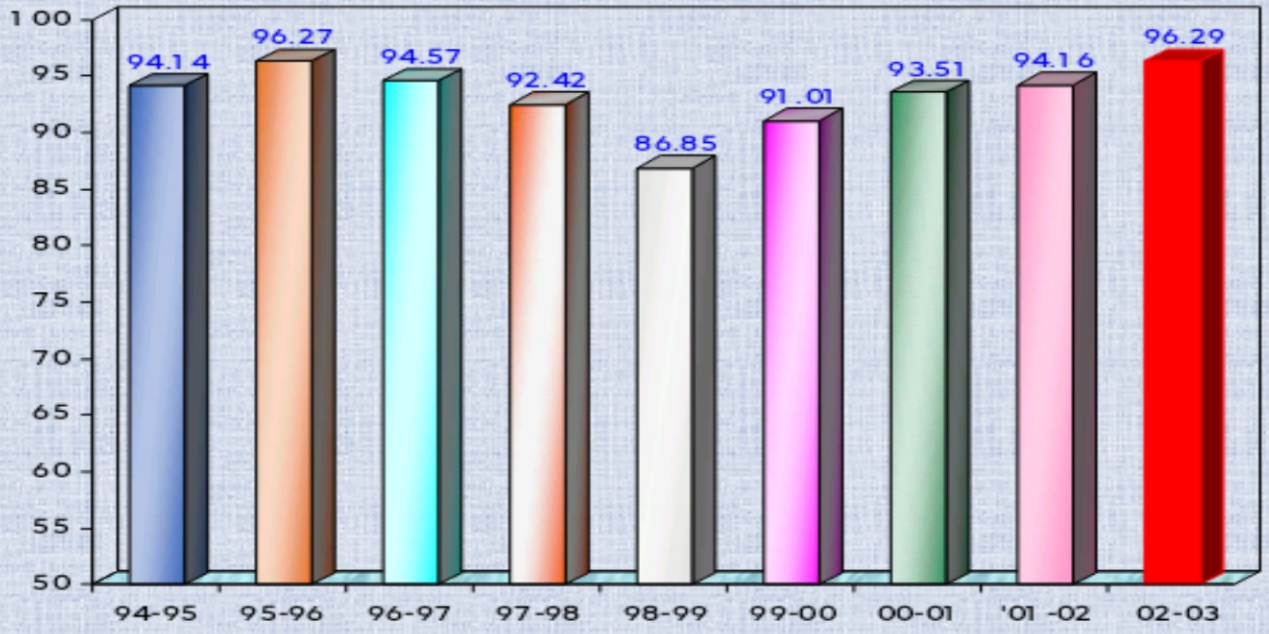
RENUPOWER – PERFORMANCE HIGHLIGHTS

Plant Load Factor(PLF)



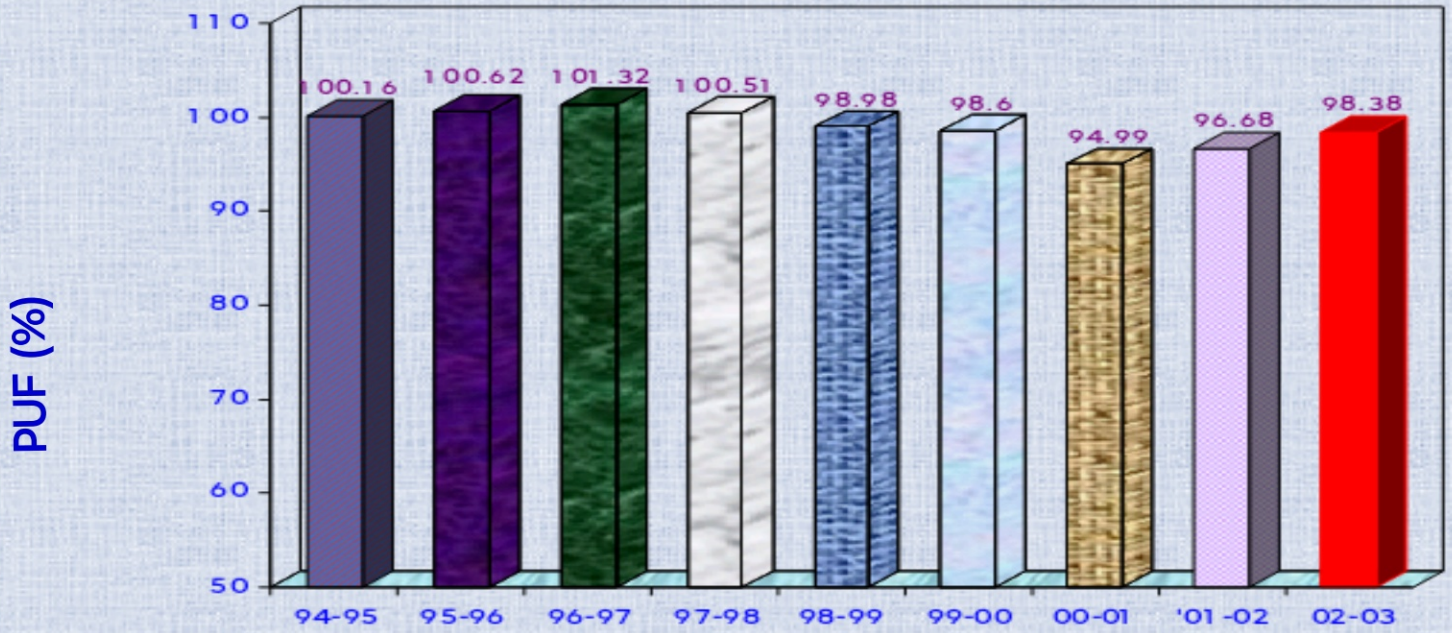
RENUPOWER – PERFORMANCE HIGHLIGHTS

Plant Availability Factor (PAF)



RENUPOWER – PERFORMANCE HIGHLIGHTS

Plant Utilization Factor(PUF)



HINDALCO

ADITYA BIRLA GROUP

RENUPOWER – PERFORMANCE HIGHLIGHTS

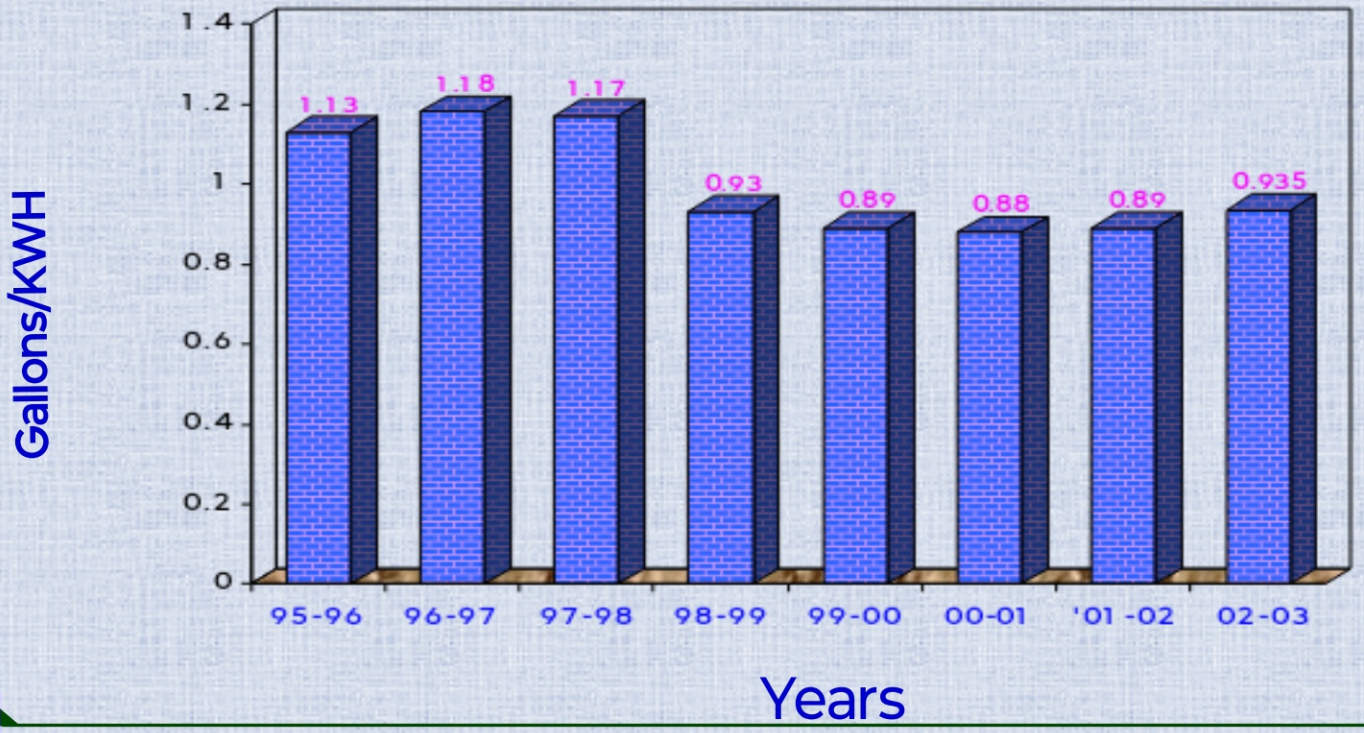
Heat Rate on Export Basis



HINDALCO
ADITYA BIRLA GROUP

RENUPOWER – PERFORMANCE HIGHLIGHTS

Water Consumption per KWH



Heat rate is a measure of a power plant's thermal efficiency, representing the amount of fuel energy (in Btu, kJ, or kcal) required to generate one kilowatt-hour (kWh) of electricity.

A lower heat rate indicates higher efficiency, as less fuel is needed to produce the same power.

It is calculated as:

$$\text{Heat Rate} = \frac{\text{Fuel Energy Input}}{\text{Net Electrical Energy Output}}$$

WATER CONSERVATION

Water is re-cycled

Practice of “ZERO WASTE” is followed in Renupower and

MUDA (Waste Elimination) is practiced, at every step.

You walk around the plant you will not find – water leakage, oil leak leakage , coal spill overs or any unwanted material anywhere ..... etc **that is MUDA**

Calculation Formulae for Plant Performance Parameters

1-Plant Load Factor $= \dfrac{\text{Actual Generation}}{\text{Rated Generation}} \times 100$

2-Plant Availability Factor = 100 – Outages %

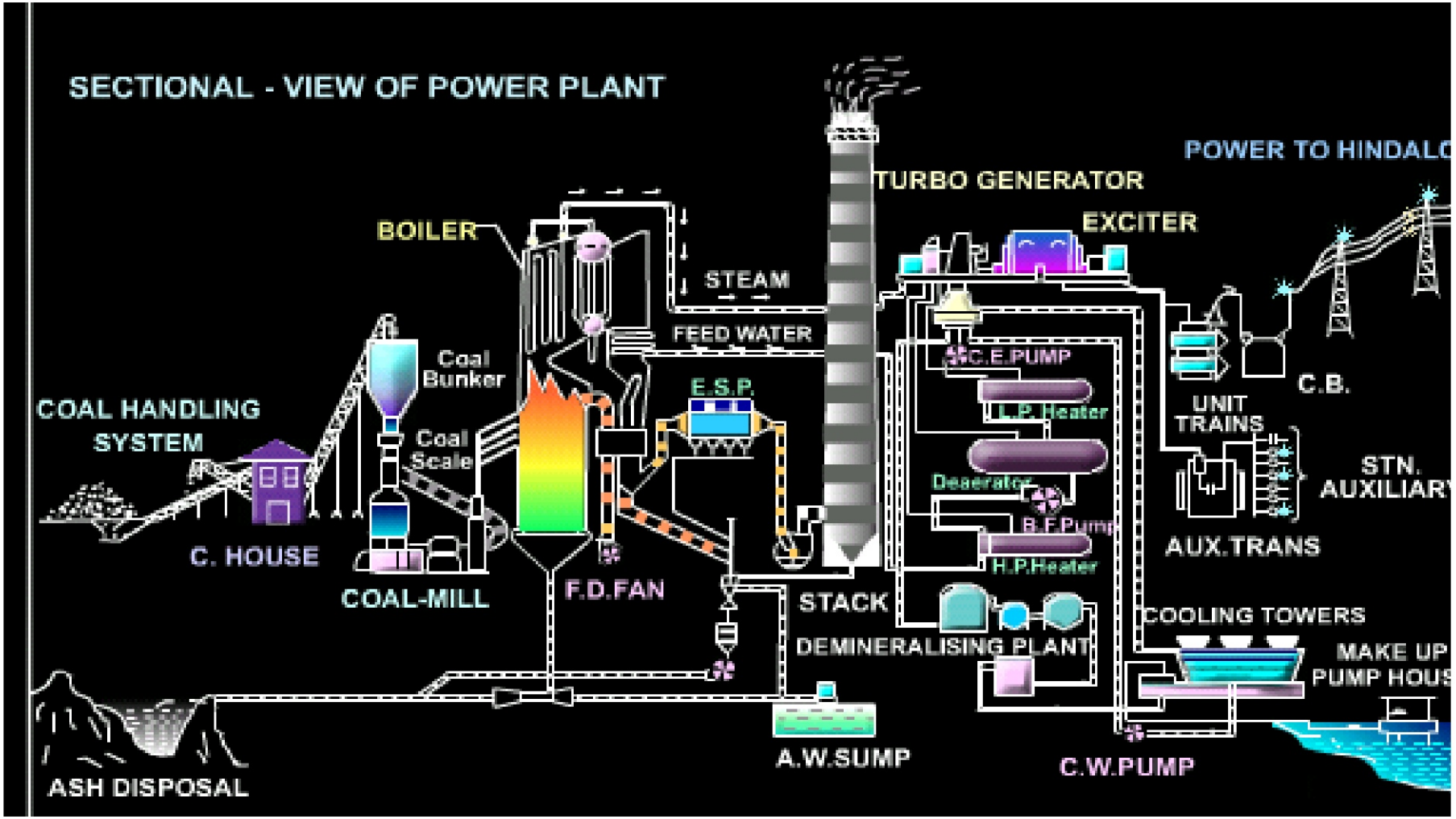
3-Plant Utilization Factor $= \dfrac{\text{Plant Load Factor}}{\text{Plant Availability Factor}} \times 100$

OEE = Availability x Performance x Quality
(PAF x PLF x Quality Rate)

OUTSTANDING ACHIEVEMENTS

While discussing plant operational and maintenance performance, let me share a few more milestone related to its' erection and commissioning of the Units.

- In high-pressure boiler, the number of high-pressure weld joints are more than 1200, due to the vast network of tubes and headers.
- Hydrotest of Boiler No#3 was cleared in one go, "No leakage". Erection and commissioning team always kept in their minds, the concepts : Do-it-right-first-time; Zero-Defect, Quality counts.
- Another feast : lifting both, the upper drums (78 tons) & lower drum(33 tons), in one go. It was not done before and not afterwards.


SECTIONAL - VIEW OF POWER PLANT
POWER TO HINDALC
TURBO GENERATOR
EXCITER
BOILER
STEAM
FEED WATER
C.E.PUMP
L.P.Heater
Deaerator
B.F.Pump
H.P.Heater
UNIT TRAINS
C.B.
STN. AUXILIAR
AUX.TRANS
Coal Bunker
Coal Scale
E.S.P.
COAL HANDLING SYSTEM
C. HOUSE
COAL-MILL
F.D.FAN
STACK
DEMINERALISING PLANT
COOLING TOWERS
MAKE UP PUMP HOUS
ASH DISPOSAL
A.W.SUMP
C.W.PUMP

Maximizing Output in a Coal Fired Power Plant

Measures being taken for achieving Excellence

Power Generation is complex task.

For maximizing output, equal attention is paid to everything from fuel quality, optimum operation of equipment, quality of maintenance , and "Human Resource"

*Great attention is paid to develop this Resource

For achieving Excellence, the following practices were adopted:

Goal Setting - Set a "Professional Tone"

The Core Objective: "Maximizing Yield"

- The importance of efficiency , cost reduction and safety (of equipment and workforce).
- Reduction in auxiliary power consumption to increase net exportable power.

With the help of management tools:

5S ; MUDA; JIT ; KAIZEN; Six Sigma

Step1 :Coal Handling & Fuel Quality

Key Points: Fuel Management:

- Monitoring coal composition in real-time using elemental analyzers.
- Transit Loss:
  Tracking fuel from mines to coal yard with integrated surveillance system used to track aerial rope ways (buckets) & vehicles from mines to yards.
  It helps minimize losses during transit.
- Pulverization:
  Maintaining optimal coal-to-air ratios for complete combustion.

Step2 – Boiler Efficiency & Combustion

Key Points:

- **Steam Parameters:** continuous monitoring of steam temperature and pressure for higher thermal efficiency.
- **Loss Prevention**: Monitoring flue gas heat losses and air heater leakage.
- **Predictive Control**: Reducing temperature excursions and soot blowers' movement to safeguard water walls.

To maximize the output of a coal-based power plant, Operational personnel are required to master the "technical math of combustion" and "the practical discipline of O&M".

1. Boiler Efficiency: The Indirect Method

In power plants, for measuring efficiency instead of using " Input vs Output." the Heat Loss Method, which identifies exactly where energy is being wasted, is used.

The formula for Boiler Efficiency (η) is:

$$\eta = 100-(L_1 + L_2 + L_3 + L_4 + L_5 + L_6)$$

The Key Losses to Track:

L_1: **Dry Flue Gas Loss** – Heat carried away by exhaust gases.
This is usually the largest loss (typically 4 – 6%).

L_2: Loss due to Hydrogen in Fuel – Combustion of H_2 creates water vapor, which carries away latent heat.

L_3: **Loss due to Moisture in Fuel** – Energy spent evaporating water in the coal.

L_4: **Loss due to Moisture in Air** – Humidity in the combustion air.

L_5: **Partial Combustion (CO) Loss** – Energy lost when carbon doesn't burn completely.

L_6: **Surface Radiation & Unaccounted Losses** – Heat leaking through the boiler walls.

2. Specific O & M Strategies for Peak Output

Effective O&M isn't just about fixing what breaks; it's about preventive and predictive actions that keep the plant at maximum capacity and availablity.

A. Combustion Optimization

- Excess Air Control: Keep excess oxygen (O2) between 3 – 4%
  Too much air cools the furnace; too little leads to unburnt carbon and slagging.

- Soot Blowing: Use steam blowers o a strict schedule to remove ash buildup on boiler tubes, which acts as an insulator and drops heat transfer rates.

B. Water Chemistry Management

- Condenser Cleaning: A 1 mm scale buildup in condenser tubes can drop turbine efficiency by 2-3%.
  Implement "On-line Condenser Tube Cleaning Systems
- Silica Control: High silica in steam causes deposits on turbine blades, reducing aerodynamic efficiency and causing vibration.

Step 3 – Turbine & Cycle Optimization

Key Points:

- Rankine Cycle Improvements: Implementing reheat cycles and feedwater heating.
- Vacuum Management: Regular cleaning of condenser tubes to maintain a high vacuum.
- Steam Quality: Ensuring precise gland steam pressure and temperature.

Step 4 – Auxiliary Systems Management

Key Points:

- Draft Fans: Addressing inefficiencies in FD/ID/PA fans that waste auxiliary power.
- Ash Handling: Streamlining ash removal to prevent boiler fouling
- Cooling Systems: Adjusting cooling tower blade angles based on ambient wet-bulb temperatures.

Step5-Maintenance & Reliability (O&M)

Key Points:

- Predictive Maintenance: Detecting potential tube failures before they cause forced outages.
- Overhauling: Critical inspection of turbine glands and bearings during scheduled shutdowns.
- Calibration: Timely calibration of transmitters, gauges, and RTDs for accurate data.

Safety, Environment, and Compliance

Key Points:

- Emission Control: Operating Electrostatic Precipitators (ESPs) and flue gas treatment efficiently.

Renupower Chimneys are almost smokeless.

EXAMPLE OF EMS-SMOKELESS CHIMNEYS



Now your attention is drawn to Major Portion of Iceberg

Technical skills are the visible tip of the iceberg, the massive, non-technical foundation below the surface is what supports and stabilizes the journey to achieve Excellence.



Established in house Training Institute

For developing K-S-A of Employees



TTMDC is equipped with Working Models for Skill Development

Simulators for Real Life Experience



Turbo-Generator



ID Fan-FD Fanr


BOILER MODEL-CUT VIEW
BOILER



RECOGNITION OF THE INSTITUTE BY MINISTRY OF POWER GOVERNMENT OF INDIA

सत्यमेव जयते

Government of India
Ministry of Power
CENTRAL ELECTRICITY AUTHORITY
NEW DELHI- 110 066.

No. 30/Trg./Hindalco/Renusagar/2002 Dated 4th October,2002.

CERTIFICATE
OF
RECOGNITION OF TRAINING INSTITUTE /CENTRE

Techinical Training Centre of M/s. Hindalco Industries Ltd., Renusagar Power Division is hereby granted recognition as category-I Training Institute for a period of Three years with effect from September,2002 by **Central Electricity Authority** under powers vested in Rule 3(2A) of the Indian Electricity Rule, 1956 as amended vide G.S.R. 461 dated 24th April,1981 (Published in Gazette of India, Part-II, Section-3, Sub-Section-I, dated 9th May,1981).

4/10/02
(V.B.GUPTA)
Chief Engineer(HRD)
Central Electricity Authority

Chief Vigilance Officer
Central Electricity Authority
Govt. of India, New Delhi.

C.E.A's Re-inspection & Recognition of Renupower Technical Training & Management Development Centre



Based on the interaction & in-depth inspection carried out, I can say confidently that this Training Institute is the best among the many training centres existing in various power stations of the country.

V.B. Gupta

Chief Engineer & Chief Vigilance Officer

Central Electricity Authority, Govt. of India (10.9.02)

We practiced the much talked about philosophy:

Right Person for the Right Job.

Personality Profiling of Executives using Psychometric Tools

HINDALCO

EXECUTIVE PROFILE

"KNOW YOURSELF"



NAME : SRI RAJENDRA PD. SINGH DESIG : ASST. MANAGER

AGE : 35 DEPTT : ASH PLANT MAINT.

EDUCATION

TECHNICAL : B.E.(M)'92 SPECIFIC : PG DIP(Mgt)'03

EXPERIENCE : 10 Yrs

JOB DESCRIPTION : Working as an Area Incharge of a) Ash Handling System (Blr #6,7,8,9&10), b) LDAD System and c) DFAT Syste
the job involves : Upkeep of the equipments, Improvement in plant performance and availability, Reduction in main
and Sobordinates development.

HOBBIES : Reading Magazines,News Papers

PERSONAL LIKES : Hard Work, Recognition for the efoort made PERSONAL DISLIKES : Backbitting

WHAT ARE YOUR

STRONG POINTS : Creativity, Professional Competence,Leadership skill, Eagerness to learn for self development. WEAK POINTS : Little hesitation in Delegation,Time management

PROBLEM BEING FACED WHILE PERFORMING JOB OR TASK:

Lack of supervisory staff to take care of new systems (LDAD System & DFAT System), Unskilled casual workmen

INVENTORY OF SKILLS :

1. L.O.T SCORE :

A	B	C	D	E	F	G
8	92	15	20	73	44	48

2. COMMUNICATION SKILLS :

SCORE	104

3. TYPE OF PERSONALITY (L.O.C) :

SCORE	TYPE
2	Internal

4. DELEGATION SCALE :

SCORE	24

5. JOHARI WINDOW :

FEEDBACK	EXPOSURE
52	58

6. MANAGERIAL STYLE :

FUNCTIONAL	DISFUNCTIONAL
59	41

7. SOCIAL DISCREDIBILITY :

SCORE	6

8. LEADERSHIP & SUPERVISORY STYLE

BENEVOLENT	CRITICAL	DEVELOPMENTAL
0	0	96

9. HRD CLIMATE :

TOTAL	85

10. CONFLICT MANAGEMENT :

TOTAL SO : 3	TOTAL NC : 5	TOTAL CONTR : 6

11.L.P.C. SCORE :

SCORE	93

12. MOTIVATION :

A : 7	B : 16	C : 22	D : 15

REMARKS : AREAS WHICH NEED ATTENTION AS PER MAP SCORE :-

1. ADMINISTRATIVE COMPETENCY :- 24
2. COMMUNICATION COMPETENCY :- 15
3. SUPERVISOR COMPETENCY :- 3
4. COGNITIVE COMPETENCY :- 10

Updated On : 30/04/2004

Signature Of Facilitator

(M.M.Khan)

General Manager (T)

THREE YEARS TRAINING & DEVELOPMENT PLANS FOR ALL THE EMPLOYEES

INDIVIDUAL RECORD OF TRAINING NEED

NAME : SHRI S.K.PANDE QUALIF: BE(C)''65; MIE	DESIG: Dy.GEN.MANAGER D.O.J: 18.02.66	EMP.CODE: 8334 DEPAT: CIVIL ENGINEERING
1998	1999	2000
FUNCTIONAL -Utilization of Fly Ash -Power Plant Metallurgy MANAGERIAL -Theory of Power Classification SUPPORTIVE -ISO-9000 -EMS -TQM - ISO-14001	FUNCTIONAL -Latest Building Technology at Low Cost -Planning and Budgeting Techniques MANAGERIAL -Motivation of Self and subordinates -Communication -Team Building -Leadership SUPPORTIVE -TPM Implementation -TQM -Computer Application	FUNCTIONAL -Practical Problem Solving and their on the spot Analysis Techniques -Energy Conservation MANAGERIAL -Performance Appraisal , Review and Counselling -Communication -Team Building -Leadership SUPPORTIVE -Problem Solving Tools -KAIZEN -5 s -WCM

WORKMEN COMPETENCY CHART
SKILL GRID

Competency Chart of Workmen

WORKMEN COMPETENCY CHART

(Skill Gap)

Department: Auto shop **Trade- Technician**

Competency	Halder Ali E.Code 705518 Grade : III	Gulab Singh E.Code 707699 Grade : II	U.S.Yadav E.Code-707483 Grade : II	V.K.Srivastava E.Code 707484 Grade : II	O.P.Saini E.Code 705989 Grade : II
Basic /Common					
Knowledge of switches.	2	2	2	2	2
Knowledge of instrument panel / gauges.	1	2	2	0	2
Knowledge of driving controls (knobs / paddles / levers)	1	1	2	2	2
Knowledge of checklist before preparing the vehicle for road.	3	2	1	2	2
Knowledge about lubrication and ignition system of the engine.	2	1	0	0	1
Knowledge / Ability to use lubricant & coolant.	1	0	1	0	1
Job / Department specific					
Knowledge of appropriate tyre pressure, and con sequences of under inflation and over inflation.	3	2	2	2	2
Knowledge of speed range to be maintained in top to first gear.	1	2	1	2	0
Knowledge of load limit to be carried and permissible G.V.W.	2	1	1	2	2
Starting / Stopping the engine.	2	2	2	1	1
Driving, gear shifting braking.	1	1	2	1	1
Knowledge of Air pressure in the tank.	2	1	1	0	2
Precaution / Operation of tipper to tip/ Lower the body.	2	2	1	1	2
Knowledge of tyre dismantling & fitting.	2	0	0	0	0
Knowledge of remove air lock and minor troubles.	1	1	0	0	0
Knowledge of operation in hilly terrains.	1	0	1	0	0
Others					
Knowledge of power generation process.	1	0	0	0	0
WCM awareness.	-1	-2	-2	-2	-2
Quality system awareness.	-1	-2	-1	-1	-1
Environment management system awareness.	0	-1	-1	-1	-1
OHSAS awareness.	0	-1	-1	-1	-1
Interpersonal skill and teamwork.	1	1	0	0	0

Proficiency

1. Know the job but needs practice to do correctly, quality is an issue.
2. Can perform with supervision, acceptable quality.
3. Can perform the job independently.
4. Can perform high quality, critical jobs.
5. Can try alternative methods, teach others.
- Not applicable.

Yearly Training Calendar

Technical Training and Management Development Centre

Training Programme Calendar

Year 1998

Month	Technical / Functional Skill	Behavioural / Managerial	General Development
Jan. 98	Turbine & its Auxiliaries (10-days Mr. Vivekananda)	Convergence of Visions and Goals (2 days Walter E.Vierie a)	TPM Module on Work Environment - 5 S (18 Programmes for staff)
Feb. 98	1-Boiler water Chemistry and Acid Cleaning of Boiler (1- day BHEL - Trichy)	1-Communication and Leadership (2-days Er. M.M.Khan)	TPM Module on 1-Work Environment - 5 S (6 Programmes for workers)
	2- Compressor Maintenance (6-days RP-G M / M)	2-TPM Implementation issues (1-day Dr.Chandan Chowdry)	2-KAIZEN (6 Programmes for staff)
			3- O.E.E 6 Prog for Staff
Mar. 98	1-Fire Prevention & Protection (2-days RCCO-Calcutta)	Problem Solving Tools and Steps (6- Programmes of 1-day each)	TPM Module on 1-KAIZEN (6 Programmes for staff)
	2- Machine Tools Practices	(Faculty Er. M. M. Khan)	2 - O.E.E (6 Programmes for

Training Andragogy:

- Classroom Training Supported With Audio-Visuals & Group Discussions
- Demonstration With the help of Models
- Plant Visit
- On-The-Job Training
- Practices In Labs & Work-Shop
- Group Discussions
- Self Study In Training Centre's Library
- Feed Back & Evaluation

Supportive Skills Development For creating a vibrating* work culture*

- Quality Circles activities 1988
- ISO - 9002 Certification - 1994
- WCM/TQM 1996
- ISO – 14001 1998
- CII-EXIM Commendation for Commitment to TQM. 1999
- ISO-18001 (OHSAS) 2003
  Organizational Health & Safety Assessment Standard

* Such activities help in breaking 'comfort zone'

Mention about a few more activities to keep people engaged and motivated: like in military you are engaged in war or be at parade ground

- LSC
- Mock Drills
- Communication Meets with staff and workers
- Benchmarking of Best Practices by others by sending our personnel to other units.
- Departmental picnics with families.

etc. etc.

These activities pay rich dividends in terms of “Productivity”

FACULTY SUPPORT
In-house and External
(to name a few)

- IIM-Ahmedabad : Prof.Udai Pareek, Prof. TV Rao, Prof DM Pestonji
- IIM Lucknow : Prof. Satish Karla, Prof.Rajen Gupta
- IIM-Calcutta : Prof.Chattopadhya
- IIT-Kanpur : **Prof.Dhande Director of IIT Kanpur, Prof. JP Gupta**
- **IIT-Kharagpur : Prof. P.K.Nag**
- IIT-Delhi : Prof. Vinayshil Gautam
- BHEL : Hyderabad : Haridwar; Hyderabad & Tirchi
- ISTD Delhi : Prof. Upinder Dhar ; Dr. P.N.Singh
- XLRI -Jamshedpur

Power Minister- Mr. Vasant Sathe - Industry & Institution Interface

- Mr. Sharu Rangnekar
- Prof. K.K.Mehan, Mehan Associate
- NPC –Delhi & Kanpur
- Mr. MSS Varadan Om Consultant (I) Pvt. Ltd
- Mr. Scott Parry of USA , MAP Fame

etc. list is long

Recognition of Q.C Teams at National & International Level
2002



Renupower was awarded First Prize in National Competition of
" Innovative Training and Creative HR Practices"
in the year 2004, at IFTDO World Conference

RECEIVING TROPHY AT IFTDO WORLD CONFERENCE





In the picture above , ONGC Chairman Dr. Subir Raha, UGC Chairman Dr. Arun Nigavekar, Director IIM Lucknow Dr.Pritam Singh are seen complimenting

National Award For Innovative Training and Creative HR Practices in the Year 2003-2004
At International World Conference IFTDO in the Year



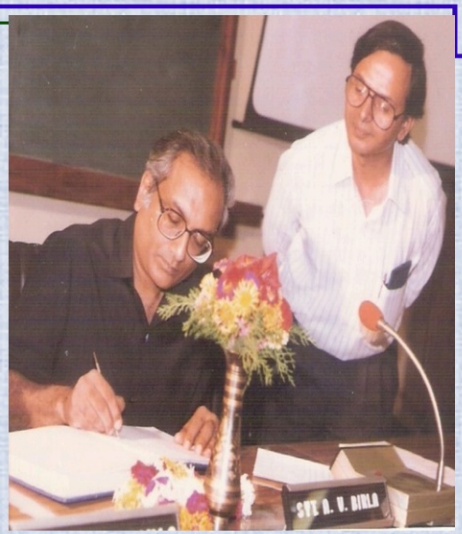
Quality Award by RWTUV GmbH.



RWTÜV is a German **holding company** and Technical Inspection Organization

A few comments by visiting dignitaries

COMMENTS OF DISTINGUSHED VSITORS TO TTMDC



- I am very happy, proud and satisf ied that my dreams vision and aspirations are being realized at this excellent training Centre, led by Mr. Khan. It is a jewel in our organization I wish this Centre, to illuminate a thousand lamps throughout our organization.

  Aditya V. Birla, Chairman AVB Group

- Visiting this training Centre has been tremendous learning experience for me, as it will be for the hundreds of graduate engineers who undergo training and visit it. It is one of its kinds in our Group. Congratulations to Mr. Khan and his dedicated team.

  Kumar Mangalam Birla, Vice Chairman AVB Group

- To visit the training Centre is like having a dream come true. Congratulations to Mr. M.M. Khan and wishing multiple growth and success to the Training Centre.

- In the last 35 years, in 16 countries, working for several global players , I have not seen contents and standards of training, innovation and support of this category, a truly World Class Enterprise. Keep it up . Regards

A.M.Singhvi, President
Corporate WCM, AVB Group, Mumbai

This training institute is an excellent one and I am impressed. Our company has designed and built many Power Plant in the USA and I have to say that your plant and this institute is as good as any we have seen. You must be proud of this institute and I wish you continued success.

L.M.Elledge, Chief Engineer
Reynolds International Inc.
Richmond, VA 23261 USA

L.B.Reddy, Vice President
United Engrs. & Constructors
Downers Grove IL 60515 USA

- ISO 9000 consultants from RWTUV wrote about his work:
  "Everything speaks of excellence here. An ideal place for grooming future generation."

- TPM (Total Productive Maintenance) Consultant wrote:
  Renupower - TTMDC is a living model of application of 5 S and Visual Management system".

❖ Visiting this technical and Managerial development Centre, as a part of Hindalco Industries is a pleasure and one can realize how much effort has been done by hard working and experienced manager of the Group, by all means. From the bottom of my heart wish you and your great country all success and happiness.

A.R. Esmeili, Managing Director
Iran Aluminum Co.

Conclusion and Call to Action

Key Points:

Summary:

Productivity is synergy between Men, Methods; Machines and Material.

Message :

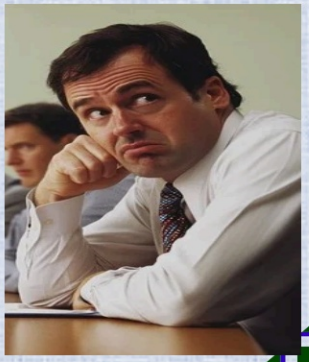
Take care of your men and they will take care of other three Ms.

Final Quote:

"Operational excellence is not a one-time act , but a habit, a journey" ; cultivate habit to excel in whatever you do.

Thanks to all the
attentive Listeners





and thanks to those also, who were simply hearing .

FAQ
Frequently Asked Questions

Q-What is All India Average PLF of Coal Fired Power Plants?

Answer:

- National Average of PLF of Coal Fired Power Plants for FY 2024-25 was 69.95 %
- PLF of NTPC Coal fired Units was 77.44% - Highest in Last 7 Years

Q- How is it possible to get 100 % Plant Availability Factor in a Coal Fired Power Plants in India with ash contents as high as 40 %?

A- The word "possible" has a very large possibility of happenings provided we work for it. Example of Roger Banister , the fastest running person

In 1954, British medical student Roger Bannister achieved a historic milestone by becoming the first ever person to run a mile in under four minutes, completing the distance in 3 minutes, 59.4 seconds.

This feat had long been viewed as an unattainable barrier in athletics, with many believing it was beyond human capability.

So to answer your question:
It was done by adding one additional boiler.
At that time, 1981-83 we had four units with one additional boiler that means total 4 turbines & 5 boilers. We introduced a concept of parallel operation. 5 boilers running at 80% load and 4 turbines at 100% load .....

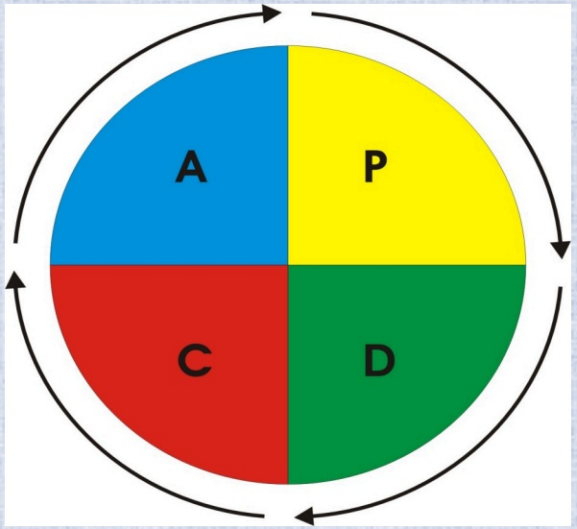
Designing work of Main steam Piping was done more than 100 times (PDCA Cycle)

Example : Taj Mahal

PDCA CYCLE – A WHEEL OF IMPROVEMENT

ACT

PLAN

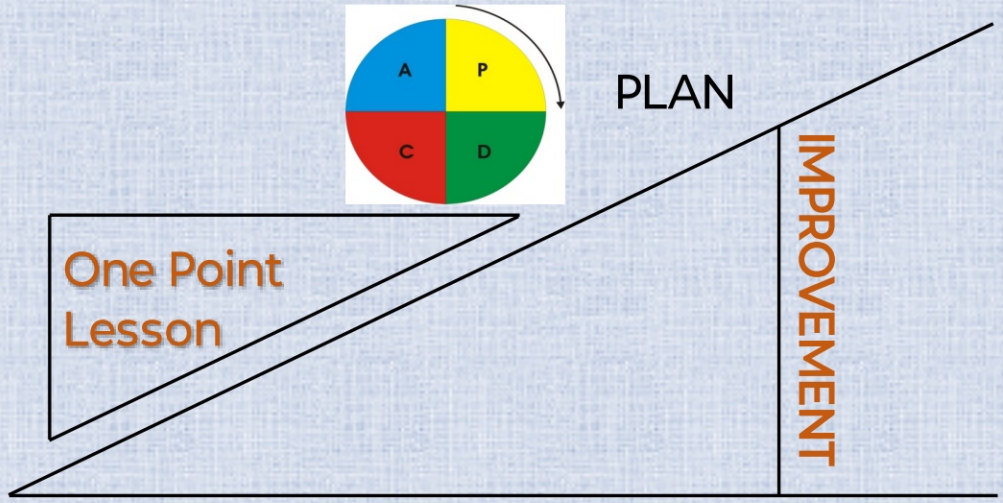


CHECK

DO

Not one turn of PDCA wheel, but hundreds, thousands .....

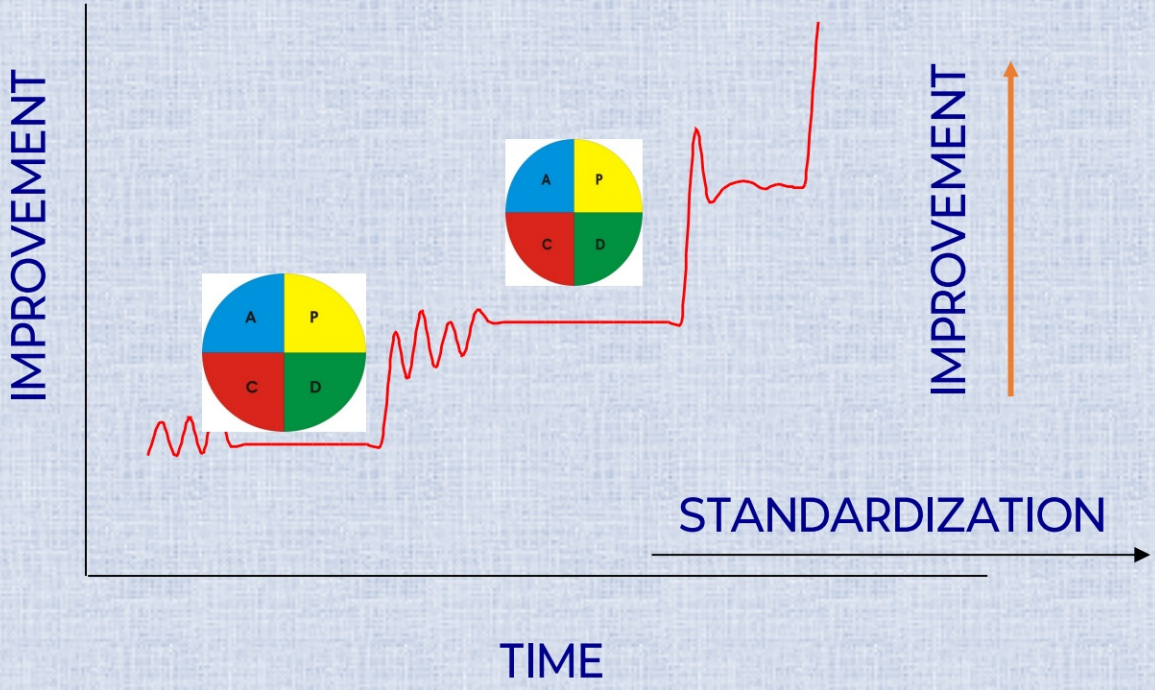
STANDARDIZATION IS THE KEY TO SECURING IMPROVEMENT



What is a "Standard"?

A standard is a documented procedure which ensures that everything we do is done by everyone in the same way

PDCA AND STANDARDIZATION TOGETHER HELP US TOWARDS CONTIUOUS IMPROVEMENT



Standardization is the key to securing improvement

Any Question related to T & D
or
HRD in its' Totality
?

Hand Tools , Machine Tools, Tube , Piping, Valves
Switchgear vs Circuit Breaker; Induction Motor vs Synchronous Motor

Turbine efficiency is 95 % ; Boiler efficiency is 81 % then over all efficiency of coal fired power plant is 32 % (on average)

The average overall efficiency of a coal-fired power plant is indeed around 32% to 35 % , even with a turbine efficiency of 95 % and a boiler efficiency 81 % , because overall efficiency is limited by thermodynamic cycles (Rankine Cycle) and multiple systemic losses.

1. Calculate Component Product

The total efficiency of a power system is the mathematical product of its individual component efficiencies:

Multiplying just the boiler and turbine efficiencies yields:

$$81\% \times 95\% = 76.95\%$$

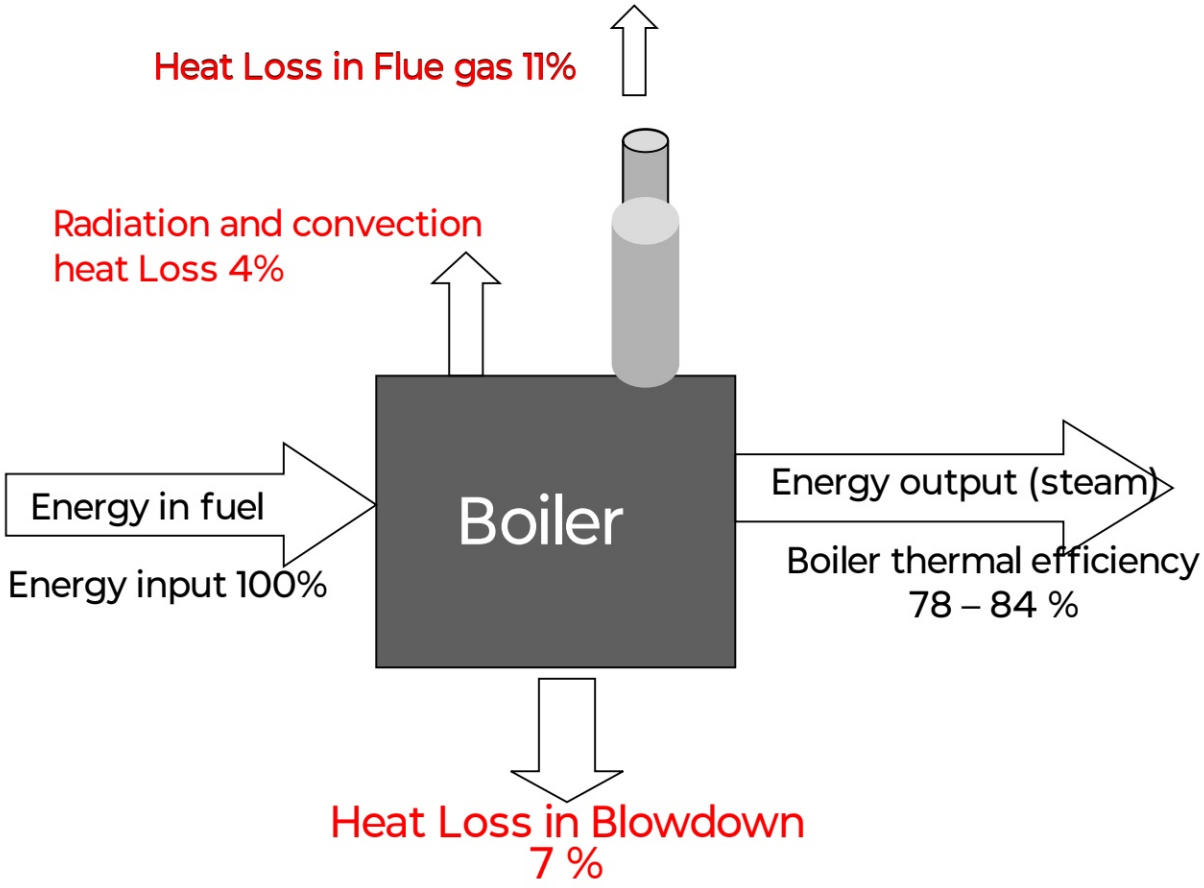
Identify the Missing Factor

2. Identify the Missing Factor

The signif icant drop from 76.95 % to 32 % is caused by the Rankine thermodynamic cycle limitations and internal plant losses:

- Thermodynamic Cycle Limits: A large amount of heat energy is inherently lost when condensing steam back into water after it passes through the turbine. This is dictated by the Second Law of Thermodynamics.
- Generator Losses: Mechanical energy conversion to electricity is highly efficient but still loses roughly 1 % to 2% energy.
- Auxiliary Power Consumption: The plant uses its own electricity to run massive coal pulverisers, cooling towers, conveyor belts, and high-pressure water pumps.

ENERGY BALANCE DIAGRAM OF BOILER

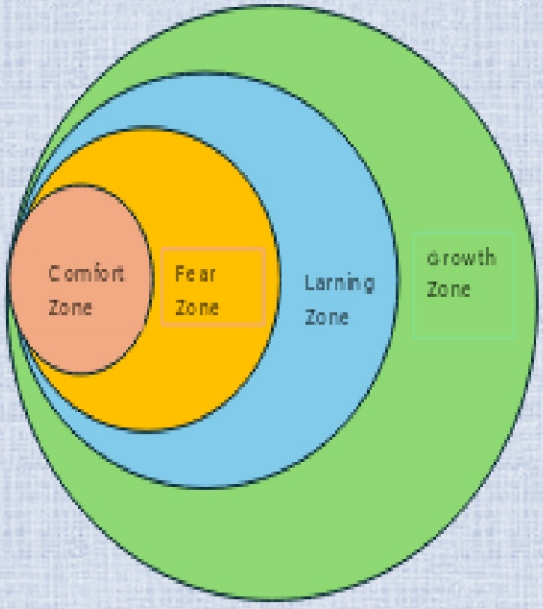


Teaching vs Training

- Transfer of knowledge
- Transfer of Knowledge, developing skill and attitude

For Personality Profiling and Development lots of information about individuals personality traits is required

Process or steps to come out of Comfort Zone





WITH PROFESSORS OF IIM AHMEDABAD

Prof.Udai Pareek, Prof.TV Rao, Prof. Srinivas Rao







TRAINING TO TEACHERS OF ADITY VIKRAM BIRLA INTER COLLEGE




RAJBALI MISHRA

VISIT OF JAPANESE AMBASSADOR TO TTMDC



MPR MEETING WITH HODs



An Oxford English Dictionary has 470,000 words out of which 171,000 are in use.

There are 100 common adjectives.

