PRESENTATION
ON
PAT TARGET
&
HEAT RATE IMPROVEMENT

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COVERAGE

- Power Plant – PAT coverage and target
- Areas for Heat Rate Reduction
- Capital Projects

PAT COVERAGE AND TARGET

Total No of DCs -144

Threshold Limit:

30,000 tons of oil equivalent (TOE) per annum

Total Target Set

3.1 MTOE

Thermal Power Plants

[DC :144 Nos]

Coal/Lignite [97]	Gas [40]	Diesel [7]

TARGET SETTING IN TPPs

Net Design Heat Rate

$$= \frac{\text{Gross Design Heat Rate}}{1 - \text{APC\% operative}}$$

Net Operative Heat Rate

$$= \frac{\text{Gross Operative Heat Rate}}{1 - \text{APC\% operative}}$$

Heat Rate Deviation (%)

$$= \frac{(\text{Operating Heat Rate} - \text{Design Heat Rate})}{\text{Design Heat Rate}} \times 100$$

Heat Rate Deviation

= (Operating Heat Rate – Design Heat Rate)

NET HEAT RATE TARGET

Ex-NHR Calculation

Parameter	Unit	Plant-1	Plant-2
Gross Heat Rate (GHR)	kcal/kwh	2500	2500
Auxiliary Power Consumption (APC)	%	8%	10%
NHR = GHR / (1- APC%)			
Net Heat Rate (NHR)	kcal/kwh	2717 (= 2500/0.92)	2777 (=2500/0.90)

% Reduction Target for deviation in NHR

Deviation in Net Station Heat Rate from Design Net Heat Rate	Reduction Target for Deviation in Net Station Heat Rate (%)
Up to 5 %	10 %
More than 5% and Up to 10 %	17 %
More than 10% and Up to 20%	21 %
More Than 20 %	24 %

PREVAILING NORMS OF CERC

Parameter and Units Size	Normative value
Coal Fired Units	
Unit Heat Rate	
200/210/250 MW Units	2500 kcal/kWh
500 MW and above Units	2425 kcal/kWh
New Thermal Generating Station achieving COD on or after 1.4.2009	1.065 X Design Heat Rate (kcal/kWh)
Secondary Fuel Oil Consumption*	1.0 ml/kWh

GROSS STATION DESIGN HEAT RATE

STAGE	GTCHR	BOILER EFF.	GHR (KCAL/KG)
I (2*210MW)	1982.7	84.67	2342
II (2*210MW)	1964.9	86.866	2262
III (2*210MW)	1964.9	85.284	2304
		GSHR	**2302**

HEAT RATE VARIATION WITH LOAD

LOAD MW	BOILER EFF.	GTCHR	GHR (KCAL/KG)
210	84.67	1982.7	2342
126	84.69	2103.1	2483

Net Heat Rate = Gross Heat Rate / (1- APC%)

TYPICAL NET HEAT RATE AND TARGETS - PAT 1 CYCLE

Power Plants	Net heat rate Kcal/Kwh	Target Net Heat Rate Kcal/Kwh	% Improve-ment
Coal Based Power Plant:			
Plant 1	2520	2498	0.87%
Plant 2	2571	2566	0.19%
Plant 3	3016	2929	2.88%
Plant 4	2920	2827	3.18%
Gas Based Power Plant:			
Plant 1	1936	1931	0.26%
Plant 2	2071	2049	1.06%
Plant 3	2173	2166	0.32%

HEAT RATE ISSUES

Coal Plants:

- Combination of old and new units – Station heat rate
- Common facilities energy & unit generation
- GCV variation in coal – monitoring
- GCV & Cost of Indian / Imported coal
- Boiler design GCV and Imported coal GCV
- Coal Accounting
- Repair & Replacement – Shutdown time requirements
- Start up fuel consumption
- Support fuel optimization

HEAT RATE ISSUES

Gas Based Plants:

- Open Cycle Operation
- Cost of Fuel and Power
- Backing down of the units
- Number of Start ups

AREAS FOR HEAT RATE REDUCTION

- Review of operating performance – PG test and actual operation
- Combustion control system – Normal load / Part load
- O2 & CO control systems for multi fuel boilers
- Review of heat recovery systems
- Flue gas temperature variation across heat recovery system
- Effectiveness of feed water heat exchangers
- Performance of air pre-heater – Design actual

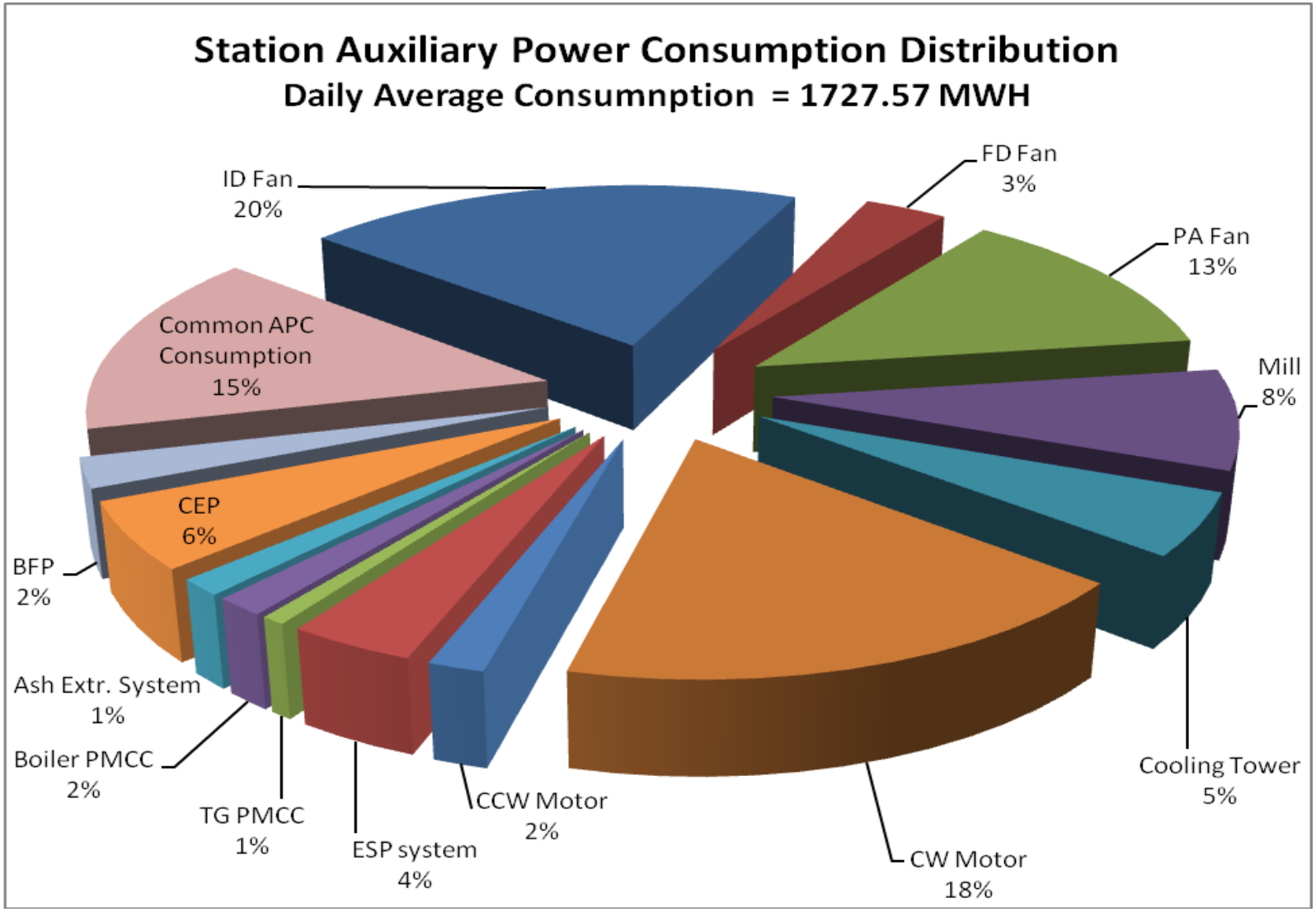
AREAS FOR HEAT RATE REDUCTION

- Energy efficiency capacity controls
- Review of heat loss in steam network
- Cooling water system and Turbine vacuum
- Auxiliary power consumption
- Metering & Monitoring
- Trip analysis
- Annual part load operation hours
- Fuel consumption monitoring for start ups (cold / hot)

PREVAILING NORMS OF CERC

Auxiliary Energy consumption**	
200 MW series	8.5 %
500 MW & above (Turbine BFP)	6.0 %
--do--------(Motor Driven BFP)	8.5 %
	For stations with induced draught cooling towers, the norms shall be further increased by 0.5 %.

2*600MW POWER STATION - APC



Areas of Opportunities for reduction in APC

1 CHP – Coal size – Conveyer combination - SEC

2 Milling System – Fines %

3 Draft System – Air ingress / Combustion control

4 AHP – Ash water ratio

5 Cooling Tower – Effectiveness, basin temp. / COC

6 Pumping System – Effective capacity control

7 Lighting System

8 Compressed Air System

9 Air Conditioning System

10 Water Balance

CAPITAL PROJECTS

- Decommissioning of old and inefficient units
- Installation of energy efficient units
- Refurbishing of power plant subsystems
- Installation of variable frequency drives for energy efficient capacity control
- Investment towards metering and monitoring systems

THANK YOU