Thermal Power Plant

Perform Achieve Trade

5th January 2013, Bangalore

Thermal Power Plants in PAT - I

- Total No of DCs = 144
- Threshold limit to be DC = 30,000 tons of oil equivalent (TOE) per annum
- Total Target Set = 3.1 MTOE

Thermal Power Plant Groups under PAT Scheme

Thermal Power Plants

[DC :144 Nos]

Coal/Lignite [97]

Gas [40]

Diesel [7]

Target Setting in TPPs

- Net Design Heat Rate

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

- Net Operative Heat Rate

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

Target Setting in TPPs

- Heat Rate Deviation (%)

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

- Heat Rate Deviation

$$\text{Heat Rate Deviation} = (\text{Operating Heat Rate} - \text{Design Heat Rate})$$

Net Heat Rate Target

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

Parameter	Plant-1	Plant-2
Gross HR(GHR)	2500 kcal/kWh	2500 kcal/kWh
APC	8%	10%
Net HR (NHR)	2717(= 2500/0.92) kcal/kWh	2777(=2500/0.90) kcal/kWh

Target Setting for Reduction of 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 %

Fuel Quality

Heating Value

N.C.V. = G.C.V. – 6(9H+M) kcal/kg

Hydrogen & Moisture by % weight.

Fuel Ratio

The fuel ratio means the weight ratio of fixed carbon to the volatile matter. Higher the fuel ratio of fuel, the poorer the ignitability and slower the combustion speed. It can be said the coal with fuel ratio around 2 is preferable to lower unburned losses.

Correction factor considered for effect on heat rate due to coal quality:

- Average "ash", moisture, and gross calorific value for the previous three years in case of baseline for first cycle and as per rule 14 for consequent cycles and specified year in case of target year, shall be taken into account for the baseline year and correction factor shall be worked out based on the following boiler efficiency formula:-

$$\text{Boiler Efficiency} = 92.5 - \frac{[50*A+630(M+9H)]}{GCV}$$

where,

A= Ash % in Coal

M = Moisture % in Coal

H = Hydrogen % in Coal

GCV = Gross Calorific Value in Kcal/Kg

Station heat rate (Kcal/kWh) = Turbine heat rate or Boiler efficiency

(b) The permissible error shall be ±0.05 % in terms of toe for the purpose of determining entitlement of energy savings certificates.

Effect of Moisture and GCV on Boiler Efficiency

$$\text{Boiler Efficiency} = 92.5 - \frac{[50*A+630(M+9H)]}{GCV}$$

Eff Calculation of a 250 MW TPP

Elements	Design	Operating
Ash	42	35.45
H	2.44	2.47
Moisture	12	16
GCV	2824	2776 ↓
% Eff	84.18	83.19 ↓
Factors		
Ash Factor	2100	1772.5
H and M Factor	21394.8	24084.9

- Decrease in GCV will not be necessarily decreasing the Boiler Efficiency directly
- The Hydrogen and Moisture factor will also be playing a major role

Eff Calculation of a 500 MW TPP

Elements	Design	Operating
Ash	30	32.1
H	2.33	3.1
Moisture	20.5	9.6
GCV	3700	3541 ↓
% Eff	85.03	85.37 ↑
Factors		
Ash Factor	1500	1605
H and M Factor	26126.1	23625

- The GCV has been decreased by 4.3% but the Boiler Eff increased by 0.34%
- The Hydrogen and Moisture factor will also be playing a major role

Normalisation

- Non availability of fuel and schedule :-

Station operating at part load condition following factors to be consider:-

1. Design heat rate
2. Operating heat rate

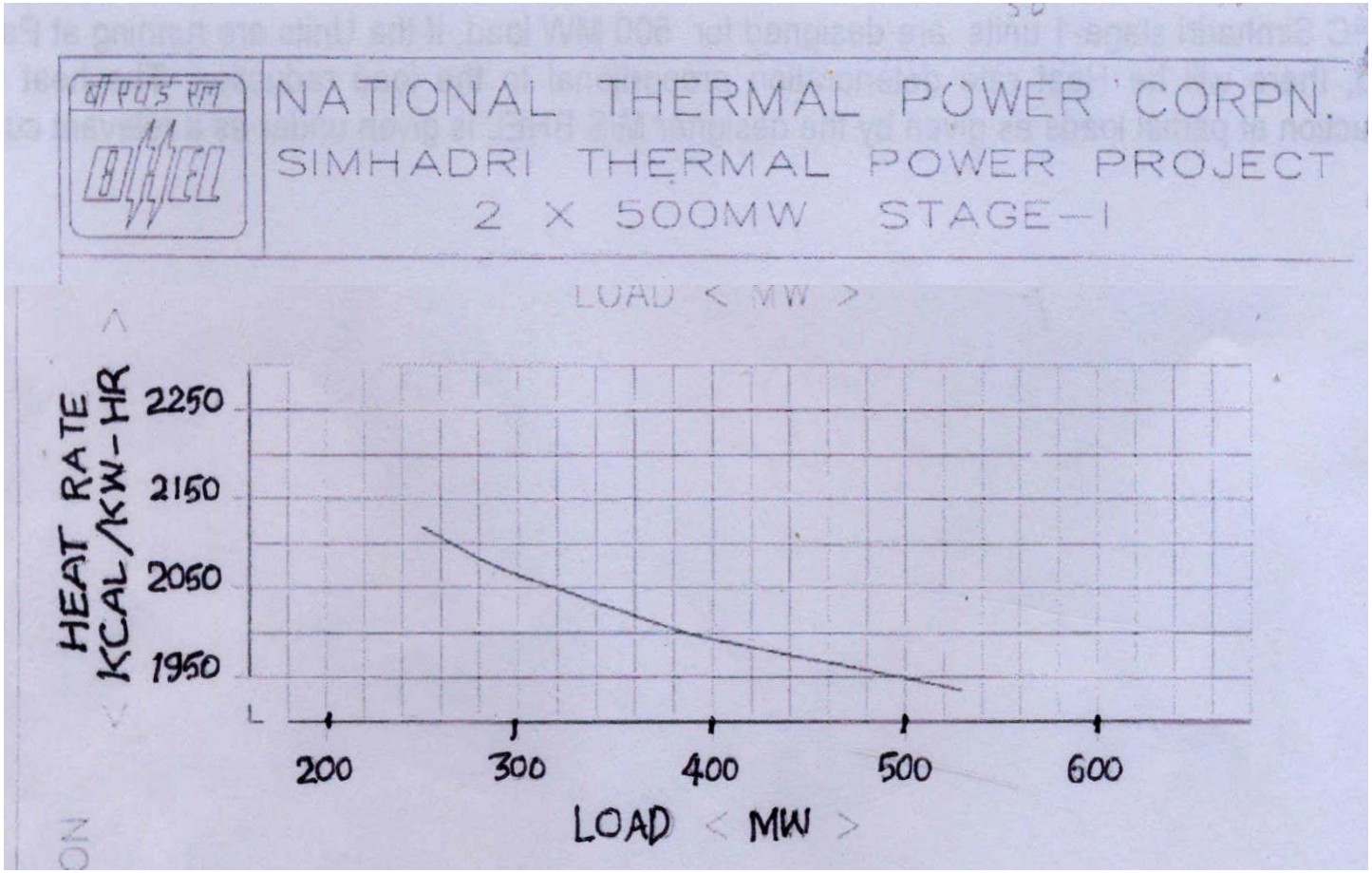
- Environmental Factors:-

Increase in auxiliary power consumption due to change in environmental condition may be consider during target year.

Characteristics Curve

(Load Vs Heat Rate)

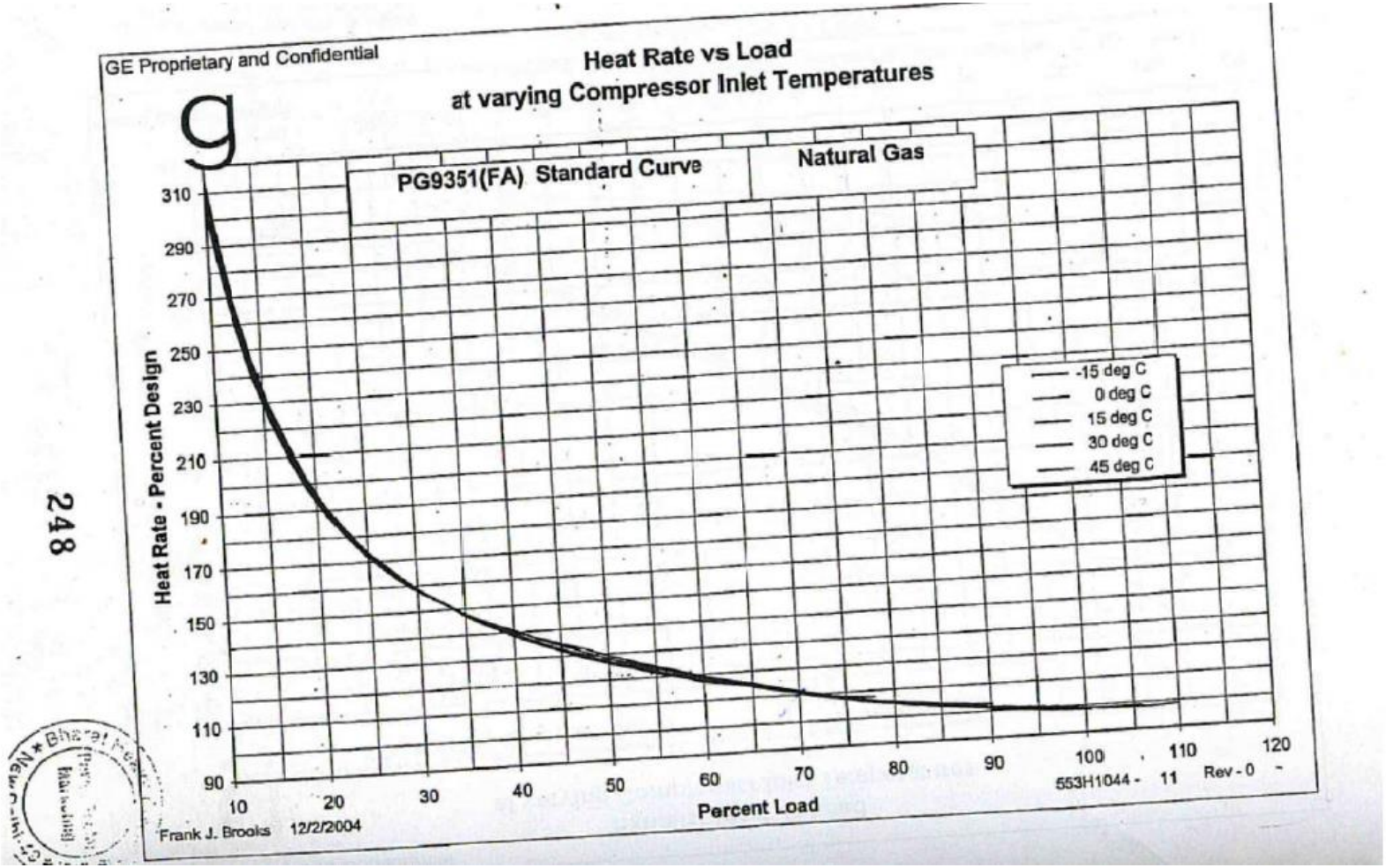
Coal Based Thermal Power Plant (NTPC Simhadri 500 MW)



Characteristics Curve

(Load Vs Heat Rate)

Gas Based Thermal Power Plant [Pragati Power, 104 MW)



Thank you for your patient listening