

ANNEXURE I:

TOE Calculation method

The details of toe calculation method is given below. The SO 394(E) dated 12th March, 2007 can also be referred for the same.

- i. Tonnes of Oil Equivalent (toe): One ton of oil equivalent (toe) is, unit of energy, based on the amount of energy released by burning one tonne of oil.

$$1 \text{ toe} = 1 \text{ tonne} \times \text{Oil GCV (Gross Calorific Value)}$$

$$= 1000 \text{ kg} \times 10000 \text{ kcal/kg}$$

$$= 10^7 \text{ kcal}$$

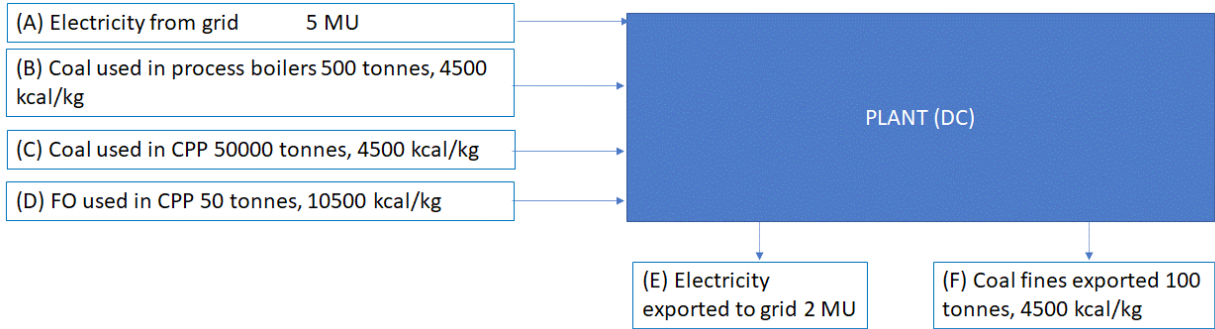
- ii. Purpose of toe: To convert all energy sources into a single comparable terminology

- iii. Gross Calorific Values of Common Fuels for calculation of toe

Solid Fuels (kcal/kg)	
Name	Range/ Around
Coal (Indian)	2800-5000
Lignite	2500-3000
Coal (Indonesian)	5500
Coal (South African)	6000
Pet Coke	7500-8500
Rice Husk	3200
Bagasse	1900-2100
Wood	3400 (depending on moisture)
Liquid Fuels (kcal/kg)	
Name	Range/ Around
Furnace Oil	10000-10500
Diesel	10000
Kerosene	11100
LDO	10700
LSHS	10600
LPG	11600-12500
Naptha	10050
HSD	11840
Petrol	11200
Gaseous Fuels (kcal/NM3)	
Name	Range/ Around
Natural Gas	8600-10500
Propane	22200
Butane	28500

Electricity (kcal/kWh)	
Name	Range/ Around
Grid Electricity	860
CPP Electricity	Actual Heat Rate of CPP

iv. Calculation of energy (in toe) in a plant



$$\begin{aligned} \text{Energy Input to the plant (kcal)} &= A + B + C + D - E - F \\ &= (5 \times 10^6 \times 860) + (500 \times 10^3 \times 4500) + (50000 \times 10^3 \times 4500) + (50 \times 10^3 \times 10500) \\ &\quad - (2 \times 10^6 \times \text{CPP NHR}) - (100 \times 10^3 \times 4500) \end{aligned}$$

Energy input to the plant (toe) = energy input to the plant (kcal) / 10⁷

$$\begin{aligned} \text{CPP Gross heat Rate (CPP GHR)} &= 50000 \times 10^3 \times 4500 / \text{Gross Generation} \\ \text{CPP Gross heat Rate (CPP NHR)} &= \text{CPP GHR} / (1\% \text{ Auxiliary Power Consumption}) \end{aligned}$$