Name: **Ramchandra V Nesari**
Designation: Dy. General Manager (Chemicals)
Company name: Rashtriya Chemicals & Fertilizers Ltd.
Complete address: 29A, technical Building,
RCF, Trombay Unit,
Chembur, MUMBAI- 400074
Fax no: 022-25522235
Email ID : nesarirv@vsnl.net

Topic 1

The first equation given above for calculating efficiency is used in direct method and is a fundamental equation of efficiency of any system including a boiler. The second equation based on energy losses is used in "indirect method" of calculation of efficiency.

By taking energy balance of a steam boiler system, following general equation can be written:

Energy input = Useful energy output (as steam) + Energy losses …….. (1)

Where energy losses are:

- Loss of heat in dry flue gas
- Loss of heat due to moisture in fuel and combustion air
- Loss of heat due to combustion of hydrogen resulting in water vapour
- Loss of heat due to radiation
- Loss of heat due to unburnt fuel

If both sides are divided by Energy input,

$$1 = \frac{\text{Useful energy output}}{\text{Energy input}} + \frac{\text{Energy losses}}{\text{Energy input}} \quad \ldots\ldots\ldots\ldots\ldots \quad (2)$$

$$\text{Therefore } 1 = \eta + \frac{\text{Energy losses}}{\text{Energy input}} \quad \ldots\ldots\ldots\ldots\ldots\ldots \quad (3)$$

$$\text{Therefore } \eta = 1 - \frac{\text{Energy losses}}{\text{Energy input}}$$

which will be always be **< 1** as Energy losses as mentioned in equation (1) in the system are always positive