STEAM POWER PLANT

A thermal power station is a power plant in which the prime mover is steam driven. Water is heated, turns into steam and spins a steam turbine, which drives an electrical generator. After it passes through the turbine, the steam is condensed in a condenser and recycled to where it was heated; this is known as a Rankine cycle. The greatest variation in the design of thermal power stations is due to the different fuel sources. Some prefer to use the term *energy center* because such facilities convert forms of heat energy into electricity. Some thermal power plants also deliver heat energy for industrial purposes, for district heating, or for desalination of water as well as delivering electrical power. A large proportion of CO_2 is produced by the worlds fossil fired thermal power plants; efforts to reduce these outputs are various and widespread.

VAPOUR CYCLE:

STEAM FORMATION:

1-stage (1) :warming phase start from (25 ℃) to (100℃) at atmospheric pressure)

2- stage (2): water to steam at boiling temperature phase change liquid (f) to gas (g)

3- dry steam to superheated

Saturated temperature: is the temperature at which the liquid boils at a certain pressure (saturated liquid)

Wet mixture: liquid + its vapor

Moisture content: (y)

$$y=\frac{m_l}{m_t}=\frac{m_l}{m_{l+}m_v}$$

EX(1): Steam at (110 bar) has ($v=0.0146\ m^3/kg$) find its t,h and u?

sol: from steam tables at 110 bar and v=0.0146we find

t=350℃ h=2887.3 kJ/kg u=2671.6 kJ/kg

EX(2): Steam at 150 bar ,h=3309 kJ/kg find t,u,v?

sol: from steam tables at 150 bar and h=3309 kJ/kg (super vapor)

we find

t=500 ℃ u=2997 kJ/kg and $v=0.0208\ m^3/kg$

REVERSIBLE AND IRREVERSIBLE PPROCESSES:

1) CONSTANT VOLUME PROCESS (ISOCHORIC PROCESS):

= solid boundaries =no work (assume)

N.F.E.E [NON FLOW ENERGY EQUATION]

$Q=(u_2-u_1)+W=(u_2-u_1)$

thus:

all heat input is to increase internal energy

for perfect gas:

$Q=mc_v(T_2-T_1)$

2)CONSTANT PRESSURE PROCESS(ISOBARIC PROCESS)

e.g fluid in cylinder

$$W=\int_{V_1}^{V_2} p\,d_V=p(V_2-V_1)$$

$Q=u_2-u_1+W=u_2-u_1+p(V_2-V_1)$

$$=(u_2+p V_2)-(u_1+p V_1)$$

$Q=h_2-h_1$=difference in enthalpy