Consumed by Three Phase Load

Power consumed by three phase load

The power consumed by the three phase load is given by sum of power consumed by each individual load in each phase.

$$P = |V_R|\ |I_R|\ \cos\varnothing_R + |V_Y|\ |I_Y|\ \cos\varnothing_Y + |V_B|\ |I_B|\ \cos\varnothing_B$$

Where, θ_R = Phase difference between V_R and I_R
θ_Y = Phase difference between V_Y and I_Y
θ_B = Phase difference between V_B and I_B
Since the system is balanced,
$|V_R| = |V_Y| = |V_B| = V$
$|I_R| = |I_Y| = |I_B| = I$
$\theta_R = \theta_Y = \theta_B = \theta$
$P = VI\cos\theta + VI\cos\theta + VI\cos\theta$
$= 3VI\cos\theta$
In balanced star system, $V = V_L$ and $I = I_L / \sqrt{3}$
$P = 3V_L (I_L / \sqrt{3}) \cos\theta$
$P = \sqrt{3}\ V_L\ I_L \cos\theta$

The above equation represents the power consumed by a three phase star connected load in a four wire system.