

# Wind Turbine Total Power Analysis

The following is the equivalent circuit for a wind turbine.

$E_g$  = the open circuit voltage with  $R_L$  open.

$R_g$  = the internal generator resistance

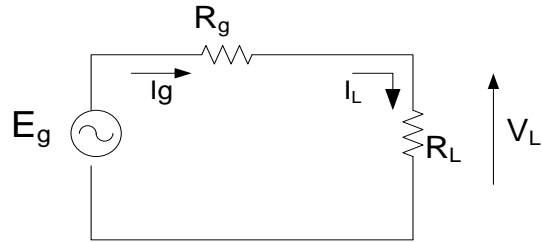
$I_g$  = the current flowing out of the generator

$R_L$  = the load resistance

$I_L$  = the load current

$V_L$  = load voltage

Equivalent Circuit



Consider the total electrical power

$$P_{\text{Total}} = P_{\text{Load}} + P_{\text{Generator}} = P_T$$

$$P_T = P_L + P_g$$

$$P_L = I_L V_L$$

$$I_L = V_L / R_L$$

$$P_L = V_L [ V_L / R_L ]$$

$$P_g = I_L V_g$$

$$V_g = I_L R_g$$

$$P_g = I_L (I_L R_g) = I_L^2 R_g$$

substitute for  $I_L$ :

$$P_L = V_L^2 / R_L$$

$$P_g = ( V_L^2 / R_L ) ( R_g / R_L )$$

$$P_T = V_L^2 / R_L + ( V_L / R_L )^2 R_g$$

Simplify

$$P_T = ( V_L^2 / R_L ) ( 1 + R_g / R_L )$$