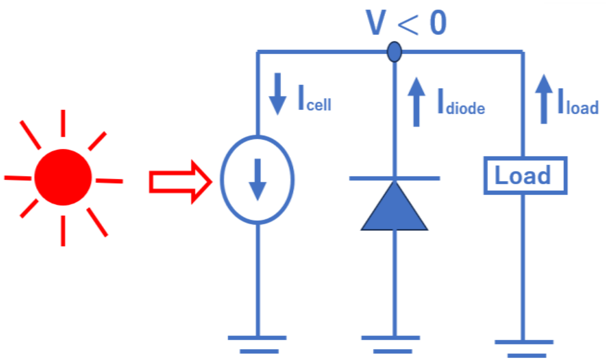
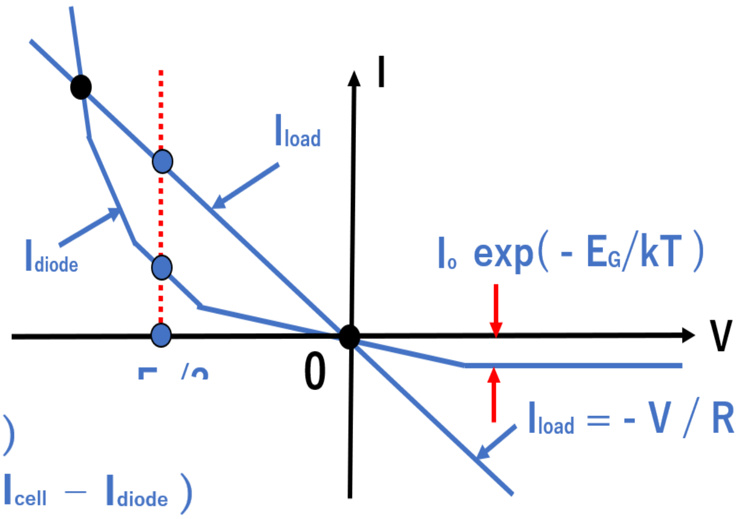
Forward_Bias_Current_Loss_of_Solar_Cell





$$(\text{Output Power}) = (V\, I_{load}) = (V)(I_{cell} - I_{diode})$$

$$I_{cell} = I_{diode} + I_{load} \qquad I_{load} = -V/R$$

$$I_{diode} = I_o \exp(-E_G/kT)\left\{\exp(-V/kT) - 1\right\}$$

$$I_{diode} \longrightarrow I_o\,(-V/kT)\exp(-E_G/kT) \quad \text{as } V \longrightarrow 0$$

$$\frac{I_{diode}}{I_{load}} = \frac{I_o \exp(-E_G/kT)}{(kT)\,R} \longrightarrow 0 \quad \text{as } V \longrightarrow 0$$

Keep R small so that $\dfrac{I_{diode}}{I_{load}}$ gets kept small.

$$I_{cell} = I_{diode} + I_{load} \qquad I_{load} = -V/R$$

d (Output Power) / dV = 0 gives

$$(\text{Power})\,\max = \frac{(V_{max}^2/kT)\,(I_{cell})}{1 - (V_{max}/kT) - \exp(V_{max}/kT)}$$

As V_{max} goes zero, $(\text{Power})_{max}$ goes $\dfrac{1}{2}(I_{cell})(V_{max})$

When $V_{max} \sim -E_G/2$, $(\text{Power})_{max} \sim (I_{cell})(V_{max})$