ECE 333 Green Electric Energy

Homework 8

Solve the following problems:

Text: 6.6, 6.8, 6.1, 6.2 (skip part c), 6.3 (skip part c)

P402-6.6

Since some modules are connected in series to form a string with increased voltage output, we determine the value of the number of modules in a string so as to satisfy

$$N_s \le \min\left\{\frac{v^M_{inverter}}{v_{MPP}}, \frac{v^M_{MPPT}}{v_{MPP}}\right\} = \min\left\{\frac{600}{34}, \frac{550}{34}\right\} = 16.1$$

$$N_s \ge \frac{v^m_{MPPT}}{v_{MPP}} = \frac{250}{34} = 7.4$$

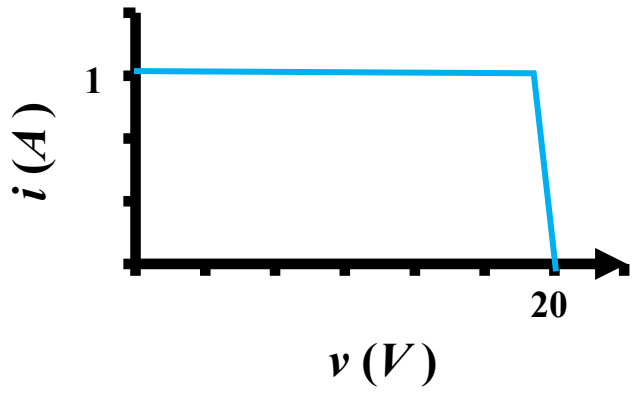
For the modules connected in parallel so as to increase the current output, we determine N_p that satisfies:

$$N_p \le \frac{i^M_{inverter}}{i_{MPP}} = \frac{11}{(\frac{150}{34})} = 2.5$$

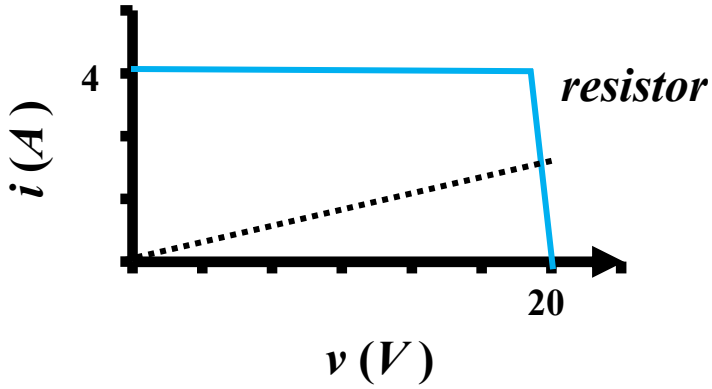
Thus (16S, 1P) and (8S, 2P) are feasible

P408-6.6

For a single module

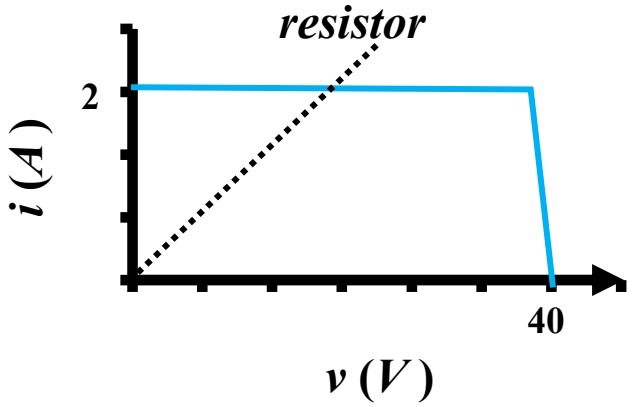


For (a)



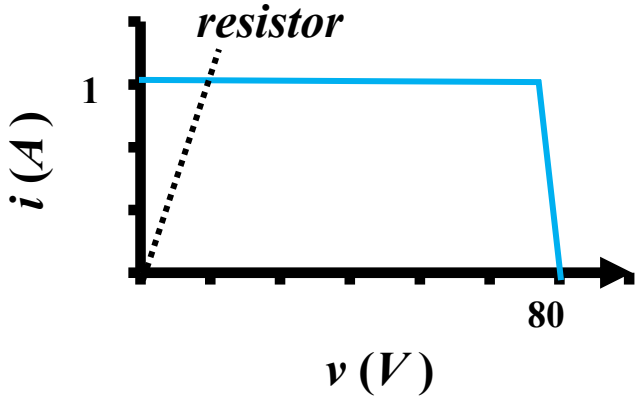
$v \approx 19V,\ i \approx 1.9\,A$

For (b) **best with the maximum power output among the three**



$v = 20V,\ i = 2\,A$

For (c)



$v = 10V,\ i = 1\,A$

P400-6.1

(a)

$$p_{DC,stc} = (1kW/m^2)(1m^2)(0.15) = 150W$$

(b)

$$energy = (\frac{6}{1})(150)(0.90)(1-0.005(45-25)) = 0.729kWh$$

P400-6.2

(a)

$$\chi' = \frac{annual\ energy}{p_{DC,stc} \times \left(\frac{daily\ insolation}{1\,kW/m^2} \right) \times 365}$$

$$= \frac{1,459}{1 \times \left(\frac{5.56}{1} \right) \times 365}$$

$$= 0.718$$

(b)

$$temperature\ derate = \frac{0.718}{0.77} = 0.932$$

P401-6.3

(a)

$$p_{DC,stc} = \frac{annual\ energy}{\chi' \times \left(\frac{daily\ insolation}{1\,kW/m^2} \right) \times 365} = \frac{4,000}{0.72 \times \left(\frac{5.5}{1} \right) \times 365} = 2.76kW_p$$

(b)

$$area = \frac{p_{DC,stc}}{1 - sun \times \eta} = \frac{2.76}{1 \times 0.18} = 15.4 m^2$$