Tutorial 5 Solar Energy 25.01.2021

1) a) Add up the demand of each device

$$E = 10 \cdot (20W \cdot 2h) + (100W \cdot 2h) + (40W \cdot 2h) + (100W \cdot 2h) = 880Wh$$

b) Only the power ~~of~~ for the DC loads

$$P_{DC} = 10 \cdot 20W = 200W$$

c) Add up the rest (All − DC = AC)

$$P_{AC} = 100W + 40W + 100W = 240W$$

d) Calculate the needed Energy generation for each inverter efficiency

$$E_{AC} = \frac{P_{AC} \cdot t}{\eta_{AC}} = \frac{240W \cdot 2h}{0{,}96} = 500Wh$$

$$E_{DC} = \frac{P_{DC} \cdot t}{\eta_{DC}} = \frac{200W \cdot 2h}{\cancel{0{,}8}\ 1} = 400Wh$$

Calculate the total energy

$$E_{tot} = \cancel{E_{tot}} \frac{E_{AC} + E_{DC}}{\eta_{bat}} = \frac{500Wh + 400Wh}{0{,}9} = 1000Wh$$

e) Use equivalent run hours to get the needed power

$$P_{tot} = \frac{1000Wh}{3{,}5h} = 285{,}7W$$

With 100W per panel it means we need <u>three panels</u>.

f) Calculate the capacity from the total energy needed

$$C_{bat} = \frac{E_{tot}}{DoD \cdot V_{bat}} \cdot 2\,(\text{days}) = \frac{1000Wh}{50\% \cdot 24V} \cdot 2\,(\text{days}) = 166{,}7Ah$$

g) Keep in mind that this is at 24V

So 2 in parallel and 2 in series makes <u>4 batteries</u>.