

Geotermia:

$$1) \text{ C\acute{a}gua} = 4186 \text{ J kg}^{-1} \text{ K}^{-1} \quad \dot{m} = 22,5 \text{ kg/s}$$

$$P_{\text{f\acute{a}cil}} = - \eta \dot{m} c \Delta T = -0,9 \times 22,5 \times 4186 \times (-30) \\ = 2,54 \times 10^6 \text{ W} = 2,54 \text{ MW}$$

Energia anual total:

$$E = 162 \times 24 \times 2,54 = 9875 \text{ MWh}$$

E prim\`aria poupada (petr\`oleo):

$$E_p = \frac{9875}{0,7} = 14\,108 \text{ MWh} = 1213 \text{ tep}$$

$$2) \eta \leq 1 - \frac{T_c}{T_H} = 1 - \frac{5+273}{250+273} = 0,47$$

$$P_{\text{max}} = \eta_{\text{max}} \dot{m} \times c \times \Delta T = 0,47 \times 0,40 \times 4186 \times (250-5) \\ = 19,3 \times 10^6 \text{ W} = 19,3 \text{ MW}$$

3) E prim\`aria necess\`aria:

a)

$$E = \frac{80}{0,95} = 84 \text{ GJ/ano}$$

$$\text{Emiss\`oes: } 84 \times 50 = 4210 \text{ Kg CO}_2/\text{ano}$$

b) Eletricidade necess\`aria:

$$E = \frac{80}{3,2} = 25 \text{ GJ/ano} \Rightarrow 6,9 \times 10^{-3} \text{ GWh}$$

$$\text{Emiss\`oes: } 6,9 \times 10^{-3} \times 676 = 4,7 \text{ Kg CO}_2/\text{ano}$$