1. (a) Trobem directament

$$P_{\text{útil}} = P_{\text{elèctrica}} \cdot \eta_m \eta_r = 4,5 \cdot 0,88 \cdot 0,92 = 3,643\,\text{kW}$$

(b) Fem un factor de conversió per la velocitat angular

$$120\,\frac{\text{rev}}{\text{min}} \cdot \frac{2\pi\,\text{rad}}{1\,\text{rev}} \cdot \frac{1\,\text{min}}{60\,\text{s}} = 4\pi\,\text{rad/s}$$

i el parell es pot calcular com

$$\Gamma_2 = \frac{P_2}{\omega_2} = \frac{3643}{4\pi} = 289,9\,\text{Nm}$$

(c) Trobem directament

$$\tau = \frac{\omega_2}{\omega_1} = \frac{n_2}{n_1} = \frac{120}{1440} = 0,083$$

2. (a) En primer lloc calculem

$$P_1 = \Gamma_1 \omega_1 = 20 \cdot \frac{2\pi}{60} = 1000\pi = 3141,6\,\text{W} = 3,142\,\text{kW}$$

on hem fet implícitament el factor de conversió per la velocitat angular. ara calculem

$$P_2 = P_1 \eta = 3141,6 \cdot 0,95 = 2984,5\,\text{W} = 2,985\,\text{kW}$$

(b) Podem escriure

$$\omega_1 d_1 = \omega 2 d_2 \rightarrow n_1 d_1 = n_2 d_2 \rightarrow n_2 = n_1 \frac{d_1}{d_2} = 1500 \cdot \frac{100}{250} = 600\,\text{min}^{-1}$$

(c) El càlcul del parell és immediat

$$\Gamma_2 = \frac{P_2}{\omega_2} = \frac{2984,5}{20\pi} = 47,5\,\text{Nm}$$

on hem tingut en compte que

$$600\,\frac{\text{rev}}{\text{min}} \cdot \frac{2\pi\,\text{rad}}{1\,\text{rev}} \cdot \frac{1\,\text{min}}{60\,\text{s}} = 20\pi\,\text{rad/s}$$

3. (a) Amb un factor de conversió

$$28\,\frac{\text{MJ}}{kg} \cdot \frac{45\,\text{t}}{\text{h}} \cdot \frac{1000\,\text{kg}}{1\,\text{t}} \cdot \frac{1\,\text{h}}{3600\,\text{s}} = 3,5 \cdot 10^5\,\text{W} = 350\,\text{MW}$$

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(b) El rendiment demanat es pot calcular com

$$\eta = \frac{110}{350} = 0,314$$

(c) Podem escriure

$$110\,\text{MW} = 110 \cdot 10^3\,\text{kW}$$

i ara

$$110 \cdot 10^3\,\text{kW} \cdot 24\,\text{h} = 2{,}64 \cdot 10^3\,\text{kWh}$$

L'energia demanada serà

$$110 \cdot 10^6 \cdot 24 \cdot 3600\,\text{J} \cdot \frac{1\,\text{MJ}}{1 \cdot 10^6\,\text{J}} \cdot \frac{1\,\text{kg}}{28\,\text{MJ}} = 339\,428{,}57\,\text{kg}$$

en realitat, degut al rendiment, la quantitat serà més gran

$$\frac{339428,57}{\eta} = 1{,}081 \cdot 10^6\,\text{kg} = 1{,}081 \cdot 10^3\,\text{t}$$

4. (a)

$$\frac{220\,\text{MW}}{\eta} = \frac{220 \cdot 10^6}{0,55} = 400 \cdot 10^6 = 4 \cdot 10^8\,\text{W}$$

en 1 s

$$4 \cdot 10^8\,\frac{\text{J}}{\text{s}} \cdot \frac{1\,\text{kg}}{48 \cdot 10^6\,\text{J}} = 8,33\,\frac{\text{kg}}{s}$$

(b) Mitjançant un factor de conversió

$$8,33\,\frac{\text{kg}}{\text{s}} \cdot \frac{3600\,\text{s}}{1\,\text{s}} \cdot \frac{1\,\text{m}^3}{0{,}8\,\text{kg}} = 37\,485\,\text{m}^3/\text{h}$$

(c) Finalment

$$\frac{1\,\text{kWh}}{\eta} = \frac{1\,\text{kWh}}{0,55} = 1{,}818\,\text{kWh}$$

llavors

$$1{,}818\,\text{kWh} \cdot \frac{0,045\,€}{1\,\text{kWh}} = 0,082\,€$$

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