Z1 2009 (A)

(11.) $W_p = 600\ MWh$

$\eta_{gen} = 0.86$

$\eta_{pump} = 0.64$

$W_e = W_p \cdot \eta_p \cdot \eta_{gen} = 330.24\ MWh$

(12.) $H = 100\ m$

$W_s = W_p \cdot \eta_p = m \cdot g \cdot H$

$m = \frac{W_p \cdot \eta_p}{g \cdot H} = 1409174312\ kg$

$V = \frac{m}{\rho} = 1.41 \cdot 10^6\ m^3$

(13.) $P = 10\ MW$

$m = 13000\ kg$

$1\ kg - W_t = 11\ MJ$

$W = 10\ MW \cdot 3600\ s = 3.6 \cdot 10^{10}\ J$

$13000\ kg - W_{t_1} = 1.43 \cdot 10^{11}\ J$

$\eta = \frac{W}{W_{t_1}} = 0.252$

14. $m = 0,75$

$$V_m = \frac{W_{god}}{8760 \cdot P_n}$$

$$W_{god} = m \cdot 8760 \cdot P_n \cdot 3600 = 2,365 \cdot 10^{14}\ J$$

$$\eta = \frac{W}{W_{tz}} \Rightarrow W_{tz} = \frac{W}{\eta}$$

$$m = \frac{W_{tz}}{W_t} = 25317,4\ t$$

15. $t = 1\ h$
$M = 6\ t/ha$
$\eta_v = 0,3$

$H = 11\ MJ/kg$
$H_1 = H(1-0,3) = 7,7\ MJ/kg$

$$W_t = M \cdot H \cdot A_{ok}$$

$$\frac{W_{god}}{\eta} = M \cdot H \cdot A_{ok}$$

$$A_{ok} = \frac{W_{god}}{\eta \cdot M \cdot H} = \frac{P_n \cdot 3600}{\eta \cdot M \cdot H} = 3,1\ ha$$

16. $P_{min} = 500\ MW$
$P_{max} = 1000\ MW$
$T_v = 18\ h$
$m = 0,75$
$\alpha = \beta$

$W = ?$

$$m = \frac{W}{24 \cdot P_{max}}$$

$$W = 18\ GWh$$

17.

$N_g = 154$

$N_{\check{S}} = 275$

$l_{\check{S}} = 4{,}2\,m$

$q = 15{,}54\,kW/m$

$P_p = 3{,}75\,MW$

$\Delta p = 600\,kPa$

$c = 5{,}17\,kJ/kgK$

$\rho = 753\,kg/m^3$

$\Delta T = ?$

$$P_i = N_g \cdot N_{\check{S}} \cdot l_{\check{S}} \cdot q$$

$$P_i = 2810{,}69\,MW$$

$$P_i = \dot{m}_p \cdot c \cdot \Delta T \cdot 3$$

$$\dot{m}_p = \frac{\rho}{\Delta p} \cdot P_p = 4706{,}25\,\frac{kg}{s}$$

$$\Delta T = \frac{P_i}{\dot{m}_p \cdot c \cdot 3} = 38{,}5\,K$$

18.

$\eta = 0{,}34$

$P_v = 35\,MW$

$$P_{el} = P_i \cdot \eta = 955{,}6346\,MW$$

$$P_p = P_{el} - P_v = 921\,MW$$

19.

$H = 20\,m$

$\eta = 0{,}87$

$Q_i = Q_{sr}$

$Q = 770 - 60t$

$W_{g\,od} = ?$

$$Q_i = 770 - 60 \cdot 6 = 410\,m^3/s$$

$$W = \frac{8760}{12} \cdot 9810 \left(Q_i \cdot H_n \cdot \eta \cdot 6 + H_n \cdot \eta \cdot \sum_{6}^{12} (770 - 60t) \right)$$

$$= 478\,GWh$$

20.

$$P_{max} = 9810 \cdot Q_i \cdot H_n \cdot \eta = 70\,MW$$

21.

$d = 80\,m$

$P_n = 1,5\,MW$

$P_\delta = 0,7\,MW$

$v_{sr} = 8\,m/s \quad 40\%$

$v_n = 13\,m/s \quad 13\%$

$\rho = 1.225\,kg/m^3$

$c_{pe} = ?$

$$P_\delta = c_{pe} \cdot 0,5 \cdot \rho \cdot \frac{d^2\pi}{4} \cdot v_{sr}^3$$

$$c_{pe} = 0,444$$

22.

$$W_{god} = 8760\,(0,4 \cdot P_\delta + 0,13 \cdot P_n) = 4,106\,GWh$$

23.

$$m = \frac{W_{god}}{t_{god} \cdot P_n} = 0,3165$$

24.

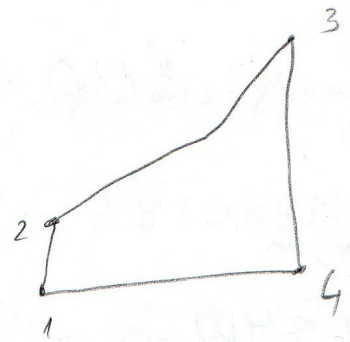
$P = 15\,MW$

$h_3 = 530\,kJ/kg$

$h_4 = 459\,kJ/kg$

$h_1 = 15,2\,kJ/kg$

$h_2 = 18,2\,kJ/kg$



$$\eta_t = \frac{W_t - |W_p|}{Q_{dov}} = \frac{(h_3 - h_4) - |(h_1 - h_2)|}{h_3 - h_2}$$

$$= 0,1328$$

25.

$$P = \dot{m} \cdot W_t = \dot{m}(h_3 - h_4)$$

$$\dot{m} = \frac{P}{h_3 - h_4} = 211,26\,kg/s$$

26.

$n = 10000$

$P_p = 2,2\,kW$ $\quad P_n = n \cdot P_p = 22\,MW$

$P_{smax} = 1000\,W/m^2$

$\eta_{FN} = 0,11$

$H_{n,god} = 1500\,kWh/m^2$

W_{god}

$$W_{god} = W_{el} \cdot A_z = \eta_{FN} \cdot H_{n,god} \cdot A_z$$

$$A_z = \frac{P_n}{P_{el}} = \frac{P_n}{\eta_{FN} \cdot P_{smax}} = 200000\,m^2$$

$$W_{god} = 33\,GWh$$

27.

$P_k = 22 MW$

$m = 1$

$W_k = P_k \cdot m \cdot 8760 = 192720 MWh$

$W_k = W_{el} \cdot A_z$

$W_{el} = \eta_{FN} \cdot H_{nigod}$

$$A_z = \frac{W_k}{\eta_{FN} \cdot H_{nigod}} = 1168000 m^2$$

$$A_z = \frac{P_n}{P_{el}} \rightarrow P_n = A_z \cdot \eta_{FN} \cdot P_{smax}$$

$P_n = 128 MW$

28.

$F = 0,85$

$I_k = 40 A$

$P_{smax} = 1000 \frac{W}{m^2}$

$P_p = 2,2 kW = P_{n1}$

$$A_z = \frac{P_{n1} \cdot A_z}{P_{smax}} = 2,2 m^2$$

$$F = \frac{U_{max} \cdot I_{max}}{I_k \cdot U_0} = \frac{P_{smax} \cdot A_z}{I_k \cdot U_0}$$

$$U_0 = \frac{P_{smax} \cdot A_z}{I_k \cdot F} = \frac{1000 \cdot 2,2}{40 \cdot 0,85}$$

$U_0 = 64,7 V$

29)

$\eta_h = 0,5$

$\eta_t = 0,3$

$\eta_n = 0,2$

$W_0 = 3300\,kWh$

$W_p = \eta_t \cdot W_0 = 990\,kWh$

$m = W_p \cdot 0,5\,kg/kWh = 495\,kg$ //

30)

$m_{10} = 0,9 \cdot m = 445,5\,kg$

$W_{p1} = \frac{m_{10}}{0,5\,kg/kWh} = 891\,kWh$

$\Delta W = W_p - W_{p1} = 99\,kWh$ //