Z1 2013

11. $P_t = 1000\,MW$

$p_1 = p_2 = 8.5\,MPa$ $T_2 = 650\,°C$

$p_3 = p_4 = 10\,kPa$

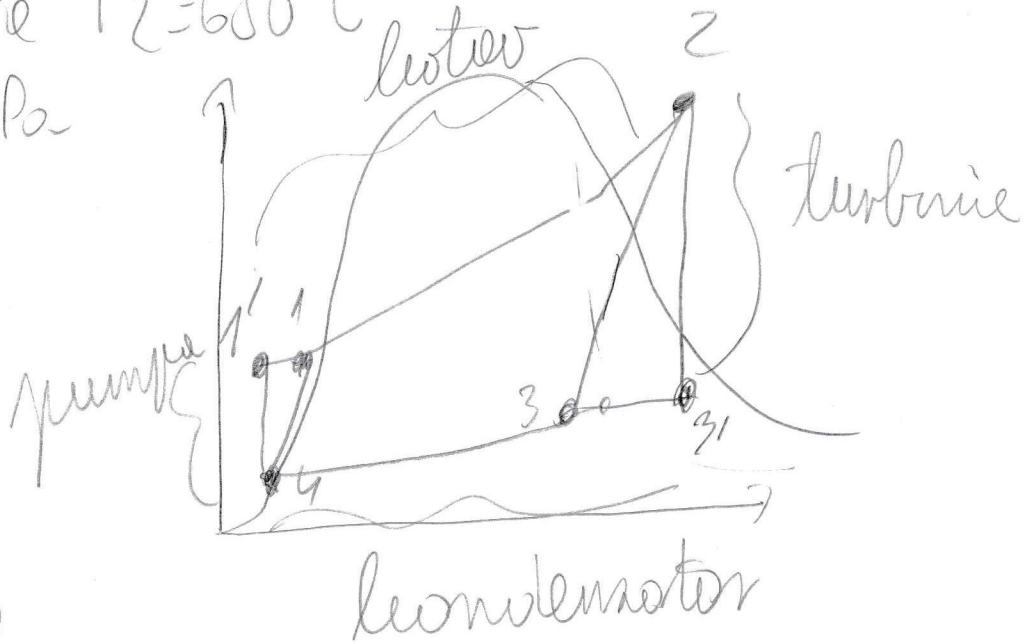
$\eta_t = 0.9$

$\eta_p = 0.85$

$h' = 191.8\,kJ/kg$

$h'' = 2585\,kJ/kg$

$v' = 0.001\,m^3/kg$



$h_2 = 3756\,kJ/kg$

$h_3'' = 2256\,kJ/kg$

$h_4 = h' = 191.8\,kJ/kg$

a) $x=3$ $h_3' = h' + x(h'' - h') \Rightarrow x = \frac{h_3' - h'}{h'' - h'} =$

$= 0.8625$

b) $w_{41} = v''(p_4 - p_1') = v'(p_4 - p_1) = -8.490\,kJ/kg$

$= w_{ideal}$

$\eta_p = \frac{w_{ideal}}{w_{real}} = \frac{-8.490\,kJ/kg}{h_4 - h_1} = 0.85$

$h_1 = h_4 + \frac{8.490}{0.85} = 201.78\,kJ/kg$

c) $\eta_t = \frac{W_{real}}{W_{id}} = \frac{h_2 - h_3}{h_2 - h_3'} = 0.9$

$h_3 = h_2 - 0.9(h_2 - h_3') =$

$h_3 = 2406\ kJ/kg$

$\eta = \frac{W_{23} + W_{41}}{q_{12}} = \frac{h_2 - h_3 + h_4 - h_1}{h_2 - h_1}$

$\boxed{\eta = 0.377}$

12. $n = 4$

$P_j = 3990\ MW$

$m_{UO2} = 105\ t$

$\Phi = 3 \cdot 10^{17}\ n/m^2 s$

$\sigma = 580 \cdot 10^{-28}\ m^{-2}$

$\Delta T_j = 329 - 295 = 34K$

$h_1 = 650\ kJ/kg$

$h_2 = 2760\ kJ/kg$

$\dot{m}_{1G} = 975\ kg/s$

$c_j = 5.9\ kJ/kgK$

a) $\dot{m}_{UKG} = n \cdot \dot{m}_{1G} =$

$= 1900\ kg/s$

$P_G = \dot{m}_{UKG}(h_2 - h_1)$

$= 4009\ MW$

$P_G = P_j + \dot{m} P_p$

$\boxed{P_p = \frac{P_G - P_j}{n} = 4.75 MW}$

c) $P_j = m_j \cdot c_j \cdot \Delta T_j$

$m_j = \frac{P_j}{c_j \cdot \Delta T_j} = 198\ 90 kg/s$

$\boxed{\dot{m}_p = \frac{m_j}{n} = 4972 kg/s}$

b) $P_j = 200 \cdot 1.6 \cdot 10^{-13} \cdot N_{235} \cdot \phi \cdot \varphi$

$\Rightarrow N_{235} = 7.16 \cdot 10^{27}$

$N_{235} = e \cdot m_{UO2} \cdot \frac{238 N_A}{270 \cdot 235}$

$e = \frac{N_{235} \cdot 270 \cdot 235}{m_{UO2} \cdot 238 \cdot N_A} \rightarrow 6.022 \cdot 10^{26} =$

$= \frac{4.543 \cdot 10^{32}}{1.5 \cdot 10^{34}} = 0.03$

e = 3%

13. $Q_i = 300 m^3/s$

$Q = 450 - 30t$ (mjesec)

$H_{nadk} = 230m$

$H_{dnv} = 90m$

$H_{er} = 50m$

$\eta = 0.95$

a) $H_{nadc} = 40m$

$H_n = H_{nadc} + (H_{nadk} - H_{dnv}) = 200m$

$t_{ii} \Rightarrow Q_i = 300 m^3/s = 450 - 30 t_i$

$\Rightarrow t_i = 5$ mj.

$$P = \eta \cdot 9.81 \cdot \rho \cdot Q \cdot H_m$$

$$W_{gol} = \int_{t_i}^{t} P = 730 \cdot \eta \cdot 9.81 \cdot 10^3 \cdot H_m \cdot \left(\int_0^{t_i} Q_i \, dt + \int_{t_i}^{t} Q_0(t) \right) =$$

$$= 1360647000 \left(Q_i t_i + \int_5^{12} (450 - 30t) \, dt \right)$$

$$= 1360647000 \left(300 \cdot 5 + 450(12-5) - 15(12^2 - 5^2) \right)$$

$$W = 3.89\,10^{12}\ Wh = 3.89\ TWh$$

b) $H_{GV} = Q/10$

$H_{DV} = Q/50$

PMAX $Q = Q_i = 300$ $H_{GV} = 30m$ $H_{DV} = 6m$

$H_m = (H_{GV} - H_{DV}) + (H_{mach} - H_{dmw}) = 184m$

$$P_{MAX} = 9.81 \cdot 10^3 \cdot Q_i \cdot H_m \cdot \eta = 514\ MW$$

PMW $Q = Q(12mg) = 90$ $H_{GV} = 9m$ $H_{DV} = 1.8m$

$H_m = 167.2m$

$$P_{MW} = 140\ MW$$

14. $P_e = 600\,MWe$

$\eta = 0.4$

$m = 0.65$

$H = 25\,MJ/kg$

$w(C) = 0.75$

$M(C) = 12\,g/mol$

$M(O) = 16\,g/mol$

$m(CO_2) = ?$

$$m = \frac{We\ god}{P_e \cdot 8760} \Rightarrow$$

$$We\ god = m \cdot P_e \cdot 8760 = 3.416 \cdot 10^{12}\ We$$

$$= 1.23 \cdot 10^{16}\ J$$

$$\eta = \frac{We\ god}{Wt\ god} \rightarrow Wt\ god = \frac{We\ god}{\eta}$$

$$Wt\ god = 3 \cdot 10^{16}\ J$$

$$m_g = \frac{Wt\ god}{H} = 1.23 \cdot 10^{9}\ kg$$

$$m(C) = w(C) \cdot m_g = 9.2 \cdot 10^{8}\ kg$$

$$C + O_2 \rightarrow CO_2$$

$$m(C) - m(O_2) - m(CO_2)$$

$$\frac{m(C)}{M(C)} = \frac{m(CO_2)}{M(CO_2)}$$

$$m(CO_2) = \frac{M(CO_2)}{M(C)}\ m(C) = \frac{12+32}{12} \cdot 9.2 \cdot 10^{8}$$

$$\boxed{m(CO_2) = 3.37 \cdot 10^{9}\ kg}$$

15. $r = 30m$

$V_m = 15 m/s$ 15%

$V = 8 m/s$ 25%

$V = 12 m/s$ 25%

$\rho = 1.225 kg/m^3$

$C_{PE} = 0.593$

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a) $W_{GOD} = 8760 \cdot P =$

$= 8760 \cdot \eta \cdot C_P \cdot 0.5 \cdot \rho \cdot N^2 \Pi \cdot (0.25 \cdot 8^3 +$

$0.25 \cdot 12^3 + 0.15 \cdot 15^3) \simeq$ **9592 MWh**

b) $P_{MAX} = \eta \cdot C_{PE} \cdot 0.5 \cdot \rho \cdot N^2 \Pi \cdot 15^3$

$= 39.66 MW$

$$\eta = \frac{W_{GOD}}{P_{MAX} \cdot 8760} = 0.316$$

16. $P_V = 1 kW/m^2$

$H_{GOD} = 1600 kWh/m^2$

$\eta_{FM} = 0.11$

$A = 9000 m^2$

$\eta_{prevedanje} = 1.2$

$\eta_{USM} \Rightarrow$ niže nadeno mesto

a) $W_{usmj,god} = \eta_{USM} \cdot H_{GOD} \cdot \eta_{PAN} = 1920 \frac{kWh}{m^2}$

$W_{el,god} = \eta_{FM} \cdot W_{usmj,god} =$

$= 211.2 kWh/m^2$

$W_{el} = A \cdot W_{el,god} = 1900800 kWh =$

$= 1900.8 MWh$

b) $P_{el} = \eta_{FM} \cdot P_V = 110 W/m^2$

$P_m = A \cdot P_{el} = 0.99 MW$

c) $I_{KS} = 20A$

$U_0 = 450V$

$f = 0.9$

$P = 1 kW/m^2 \Rightarrow P_{MAX} = P_N = 0.99 MW$

$f = \frac{P_{MAX}}{I_{KS} \cdot U_0} \Rightarrow U_0 = 550000$

$n = \frac{U_0}{U} = 122.22 \approx 123$ panela

17.

t[h]	0-4	4-6	6-9	9-12	12-13	13-16	16-18
P[MW]	800	1000	1300	2000	1600	1900	1500

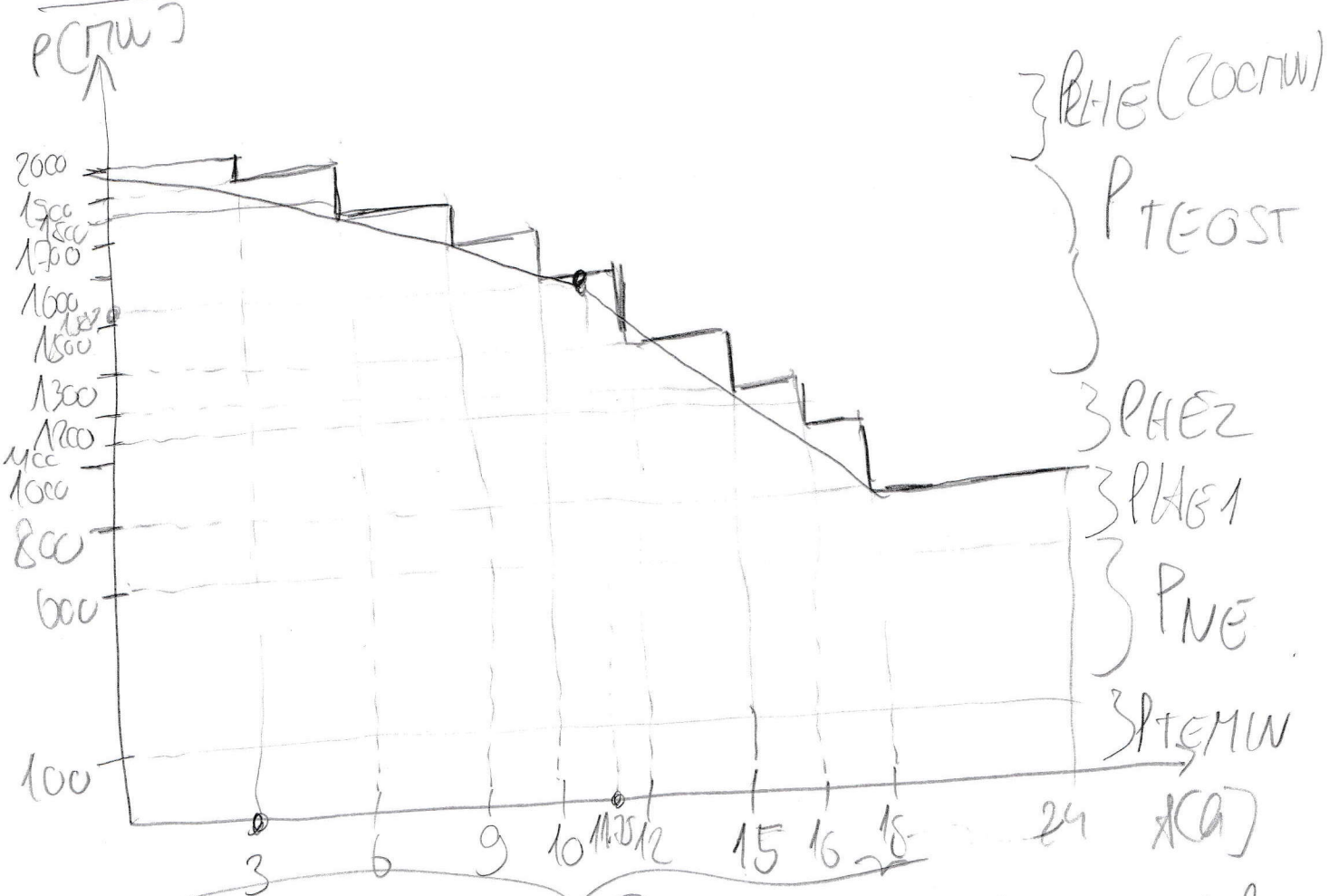
18-21	21-22	22-24
1700	1200	800

$P_{HE1} = 200\,MW$

$P_{HE2} = 300\,MW$

$P_{NE} = 500\,MW$

$P_{TE} = 800\,MW$ $P_{TEMIN} = 100\,MW \Rightarrow P_{TEOST} = 700\,MW$



$P_{MAX} = 2000\,MW$

$P_{MIN} = 800\,MW$

$T_V = 18\,h$

T_V

$W_K = 24 \cdot P_{minj} = 19200\,MWh$

$W = \{\text{površina}\} = 33300\,MWh$

$W_V = W - W_K = 14100\,MWh$

$$m = \frac{W}{P_{MAX} \cdot \frac{t}{24h}} = 0.69375$$

$$t_{MAX} = \frac{W}{P_{MAX}} = 16.65\,h$$

$\alpha - \beta \Rightarrow$ $P_V = P_{MAX} - P_{MIN} = 1200\,MW$

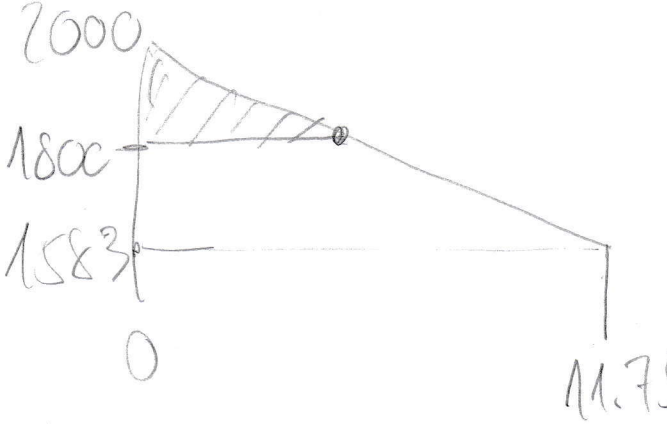
$$\alpha + \beta = 2 \cdot \frac{W_V}{T_V \cdot P_V}$$

$$\alpha = \frac{W_V}{T_V R} = 0.653 = \beta$$

$$(x, y) = (\alpha T_V \mid P_{MIN} + \beta P_V)$$

$$= (11.75\,h \mid 1583.6\,MW)$$

b) $W(HE)$ = površina



$$y - y_1 = \frac{y_2 - y_1}{x_2 - x_1}(x - x_1)$$

$$y - 2000 = \frac{1583 - 2000}{11.75 - 0}(x - 0)$$

$$y - 2000 = \frac{-917}{11.75}x$$

$y = 1800 \quad x = 5.63\,h$

dalje ne kužim

$$W(HE) = P' = \frac{1200 \cdot 5.63}{2} = 563\,MWh$$