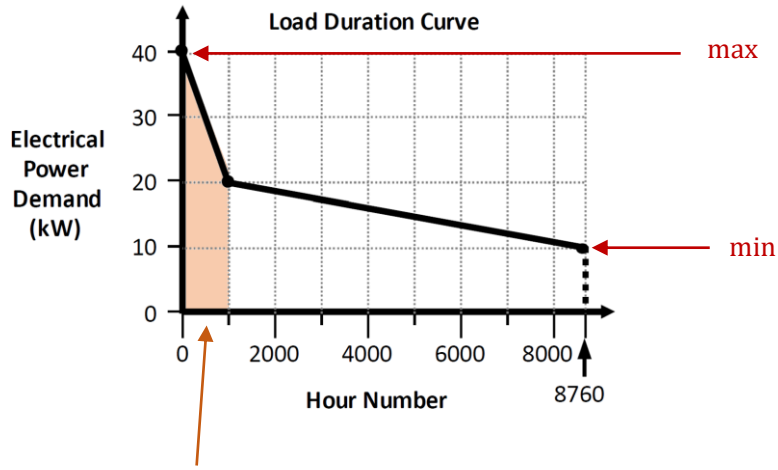
Solutions

1.



2.

a) 3 (1 h) (80 kW) + 2(1 h)(140 kW) = 520 kWh

b)

$$E_{in} = \frac{E_{out}}{\eta} = \frac{520\ kWh}{0.8} = 650\ kWh$$

c) À 80 kW

$$PLR = \frac{80}{200} = 0.4$$

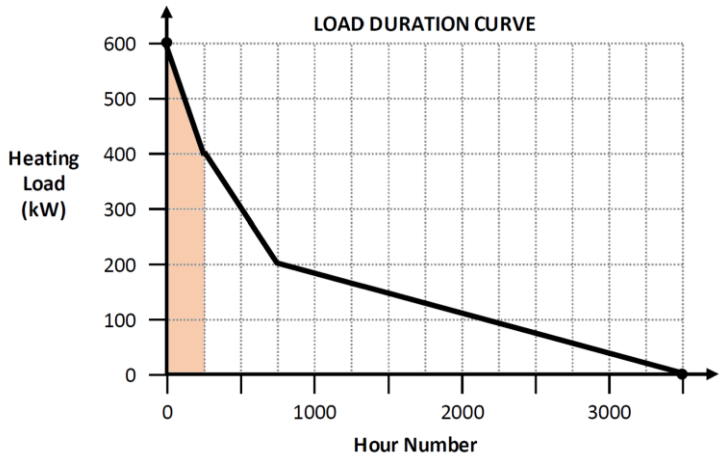
$$\frac{\eta_{PL}}{\eta_{FL}} = 1.15 - 0.27PLR + 0.12PLR^2 \cong 1.06$$

$$\eta_{PL} = \eta_{FL}\left(\frac{\eta_{PL}}{\eta_{FL}}\right) = 80\%(1.06) = 84.8\%$$

$$\dot{E}_{in} = 80kW/0.848 = 94.3\ kW$$

$$E_{in} = (3\ hrs)(94.3\ kW) = 283\ kWh$$

3.



a) La chaudière 3 brûle environ 250 heures par an
(c.à.d. lorsque la charge totale est supérieure à 400 kW)

b) Charge totale pendant l'incendie de la chaudière 3 : en orange ci-dessus

(250 h)(200 kW)(1/2) + (250 h)(400 kW) = 125 000 kWh

c) Charge de la chaudière 3 = (250 heures)(200 kW)(1/2) = 25 000 kWh

$$E_{in} = \frac{E_{out}}{\eta} = \frac{25{,}000\ kWh}{0.7} = 35{,}714\ kWh$$

4.

a)

$$\dot{W}_{sh} = \frac{\Delta P \cdot \dot{V}}{\eta_p} = \frac{(160\ kPa) \cdot (15\ L/s)}{0.60} = 4000\ W$$

b)

les brûleurs sont allumés/éteints

$$input = \frac{output}{\eta} = \frac{85\ kW}{0.8} = 106.25\ kW \qquad \text{(chaque brûleur)}$$

$$2(106.25\ \cancel{kW})\frac{1\ m^3}{10.33\ \cancel{kWh}} = 20.6\frac{m^3}{hr}$$

c) extraction = = $30 + 12 + 22 = 64\ kW$

ajout = $4\ kW$ (par pompe)

extraction nette = $64\ kW\ - 4\ kW = 60\ kW$

BLR-1 = $60\ kW$ (PLR = 70,6 %)

BLR-2 = $0\ kW$

5.

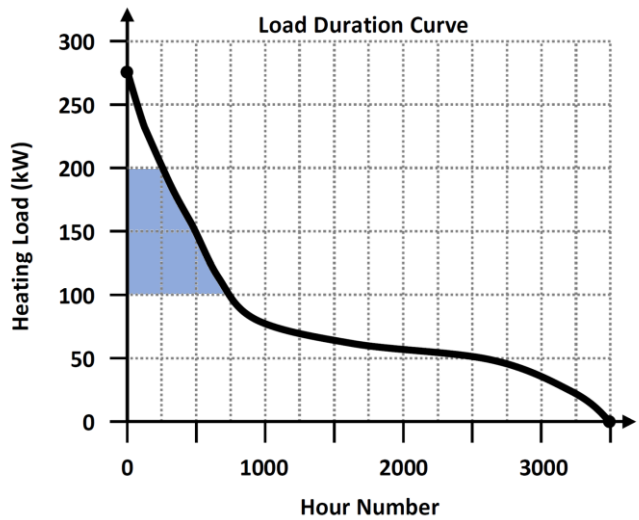
a)

heures lorsque la charge totale ≥ 200 kW → 250 hrs

b) heures où la charge totale < 100 kW (mais > 0 kW)

$\rightarrow 3500 - 750 \cong 2750\ hrs$

c) zone entre 100 et 200 kW $\approx 50{,}000\ kWh$



d)

$$input = \frac{output}{\eta} = \frac{50000\ kWh}{0.7} = 74429\ kWh$$

e)

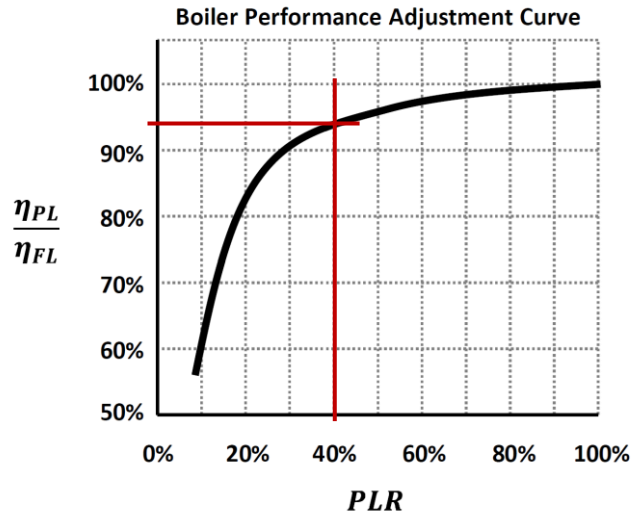
B-1 100 kW
B-2 100 kW
B-3 40 kW ← ANS = 40 kW

f)

À 40 kW : PLR = 40/100 = 0,4

$\frac{\eta_{PL}}{\eta_{FL}} \approx 0.94$

$\eta_{PL} = (0.94)82\% = \mathbf{77\%}$



g)

brûleur marche/arrêt

$$input = \frac{output}{\eta} = \frac{100\ kW}{0.82} \cong 122\ kW\ each$$

$$3(122\ kW)\left(\frac{1\ m^3}{10.33\ kWh}\right) \cong \mathbf{35.4\ m^3/hr}$$