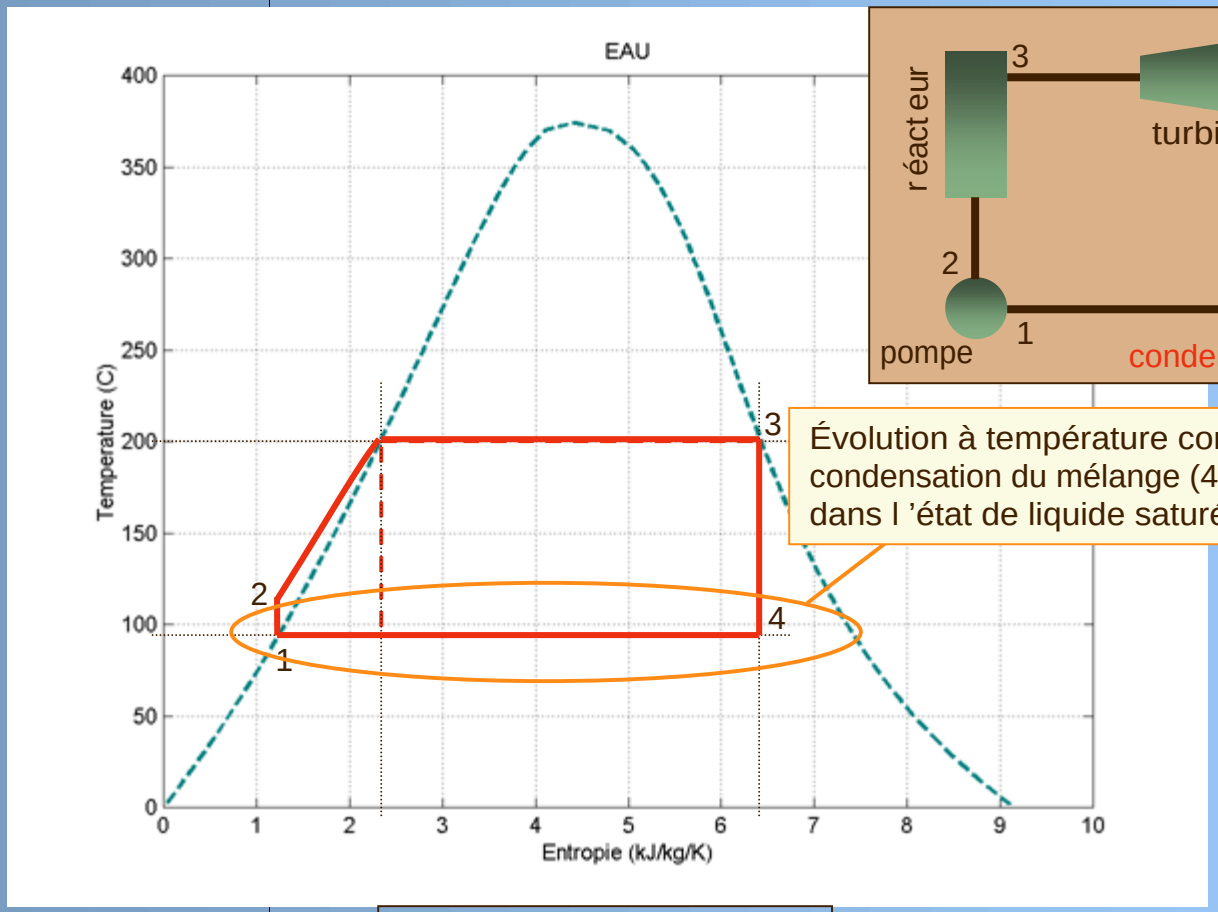
Thermodynamique
V-2/3

Phs 2101

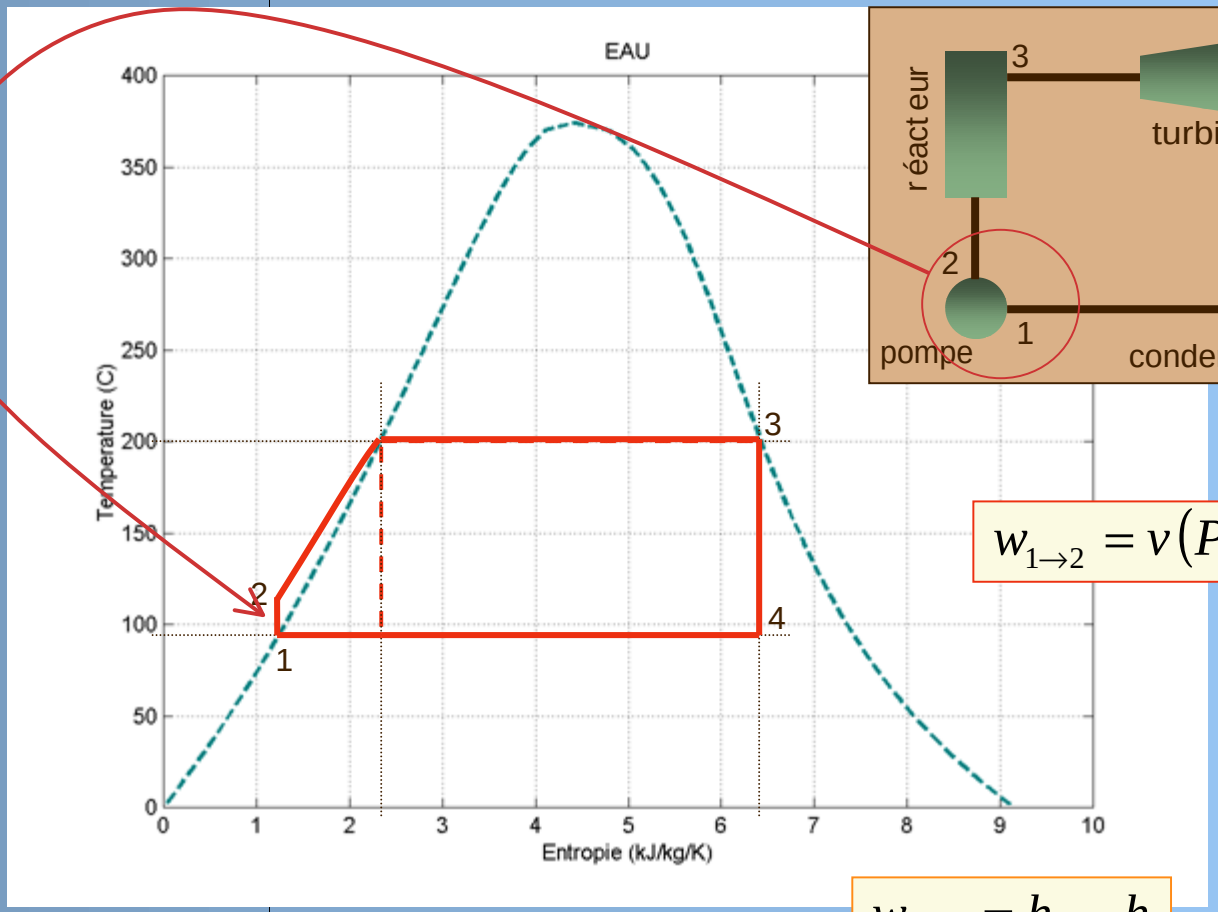
Automne 2001

http://www.crm.umontreal.ca/~physnum



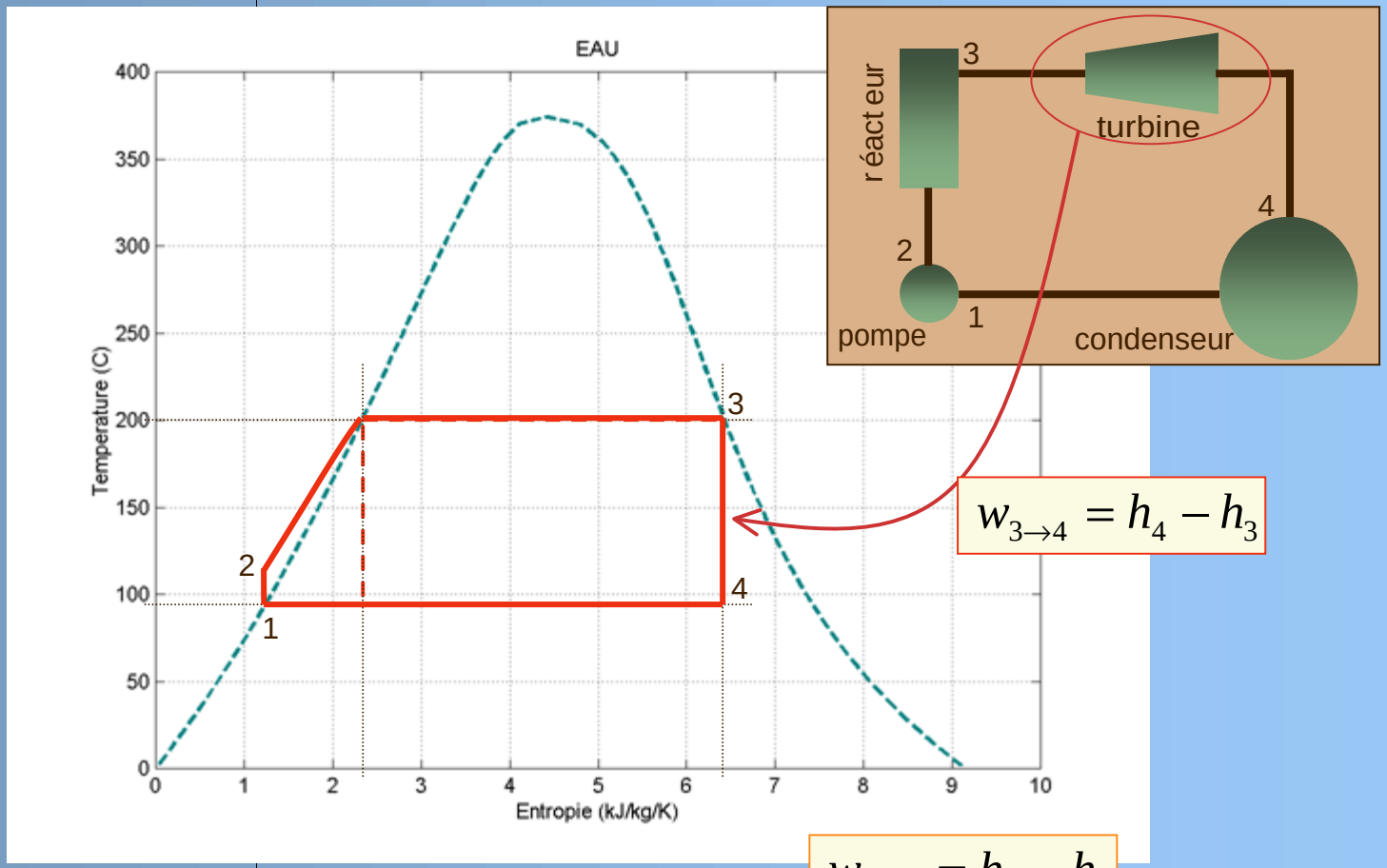
Évolution à température constante: condensation du mélange (4) pour l 'amener dans l 'état de liquide saturé (1).

CYCLE DE RANKINE



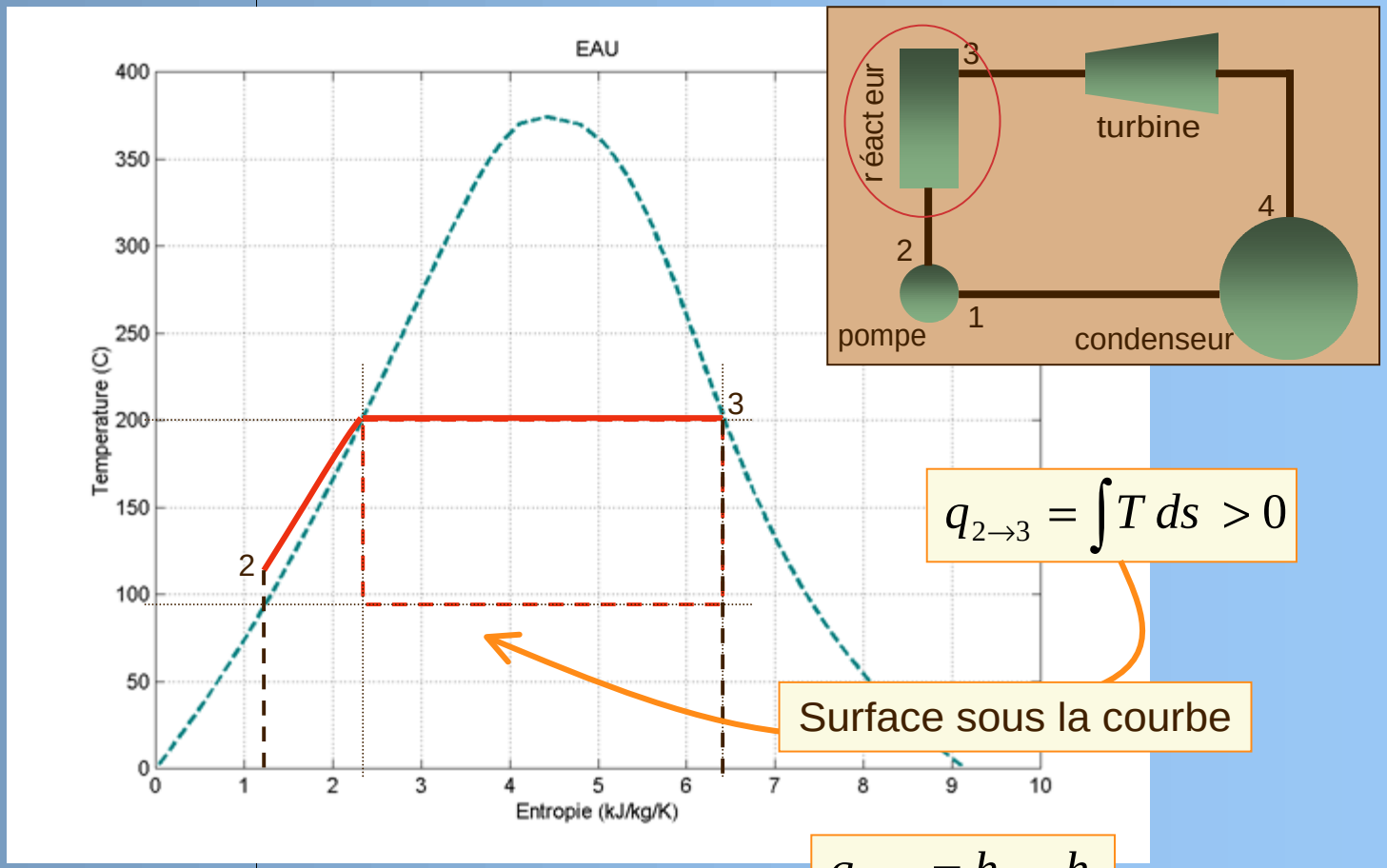
$$w_{1\to 2} = v\left(P_2 - P_1\right)$$

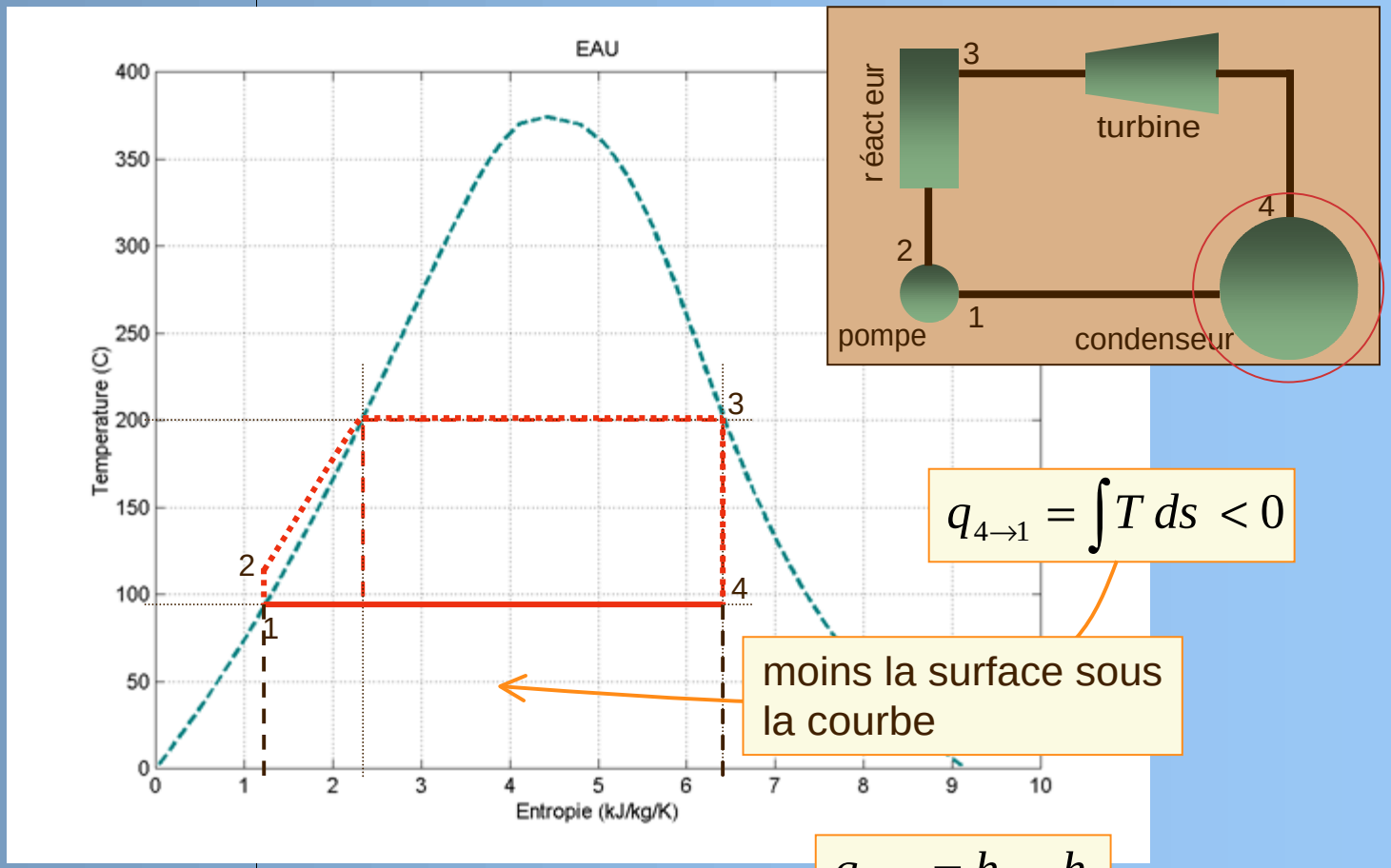
$$w_{1\to 2} = h_2 - h_1$$



$$w_{3\to4} = h_4 - h_3$$

$$w_{3\to4} = h_4 - h_3$$

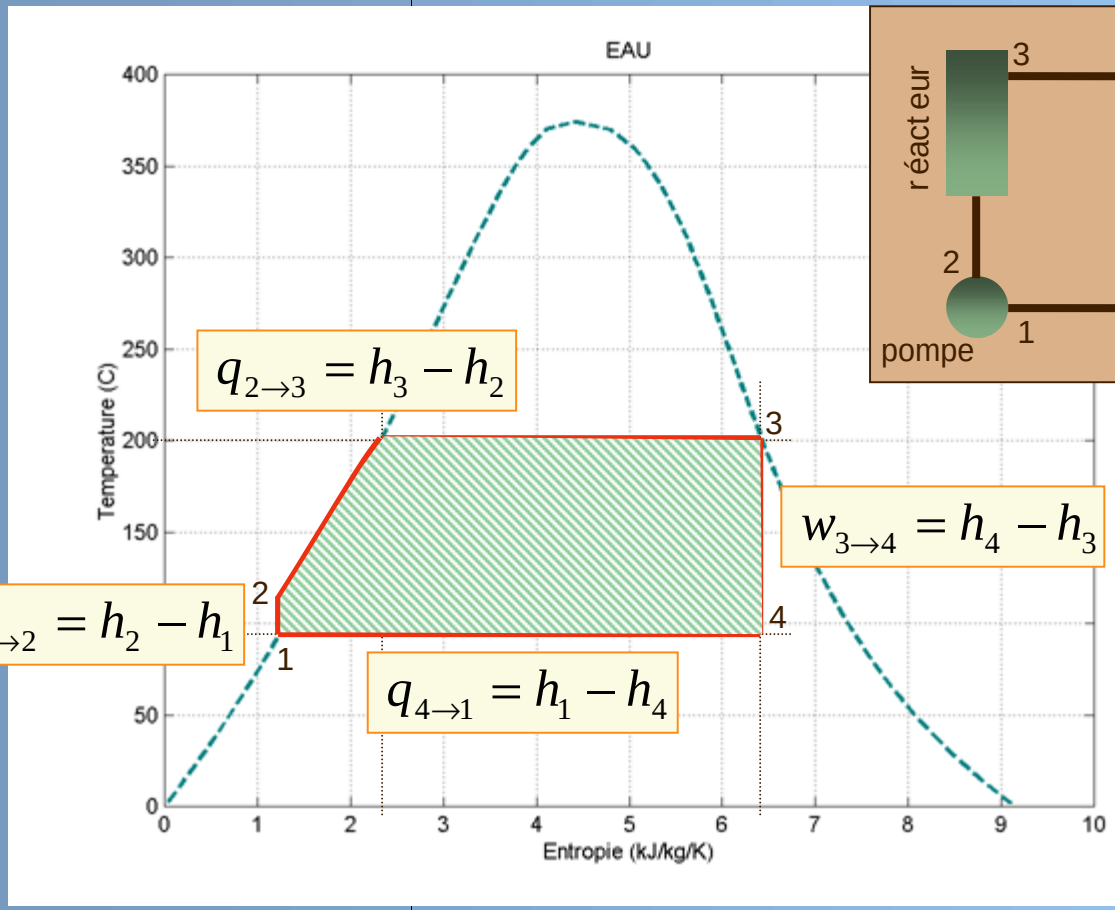

EAU
Temperature (C)
Entropie (kJ/kg/K)
0
50
100
150
200
250
300
350
400
0
1
2
3
4
5
6
7
8
9
10
2
3
r éact eur
turbine
4
2
1
pompe
condenseur
$q_{2\to3} = \int T\,ds > 0$
Surface sous la courbe
$q_{2\to3} = h_3 - h_2$

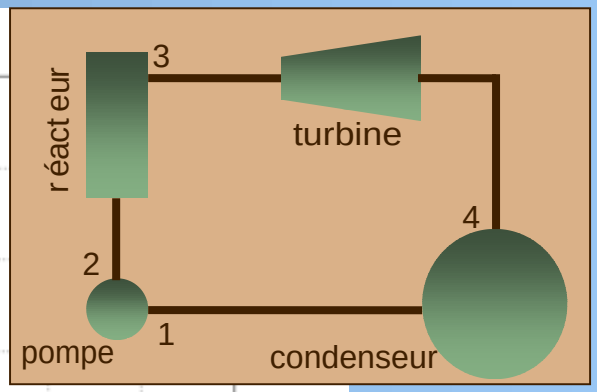


$$q_{4\to1} = \int T\,ds < 0$$

moins la surface sous la courbe

$$q_{4\to1} = h_1 - h_4$$

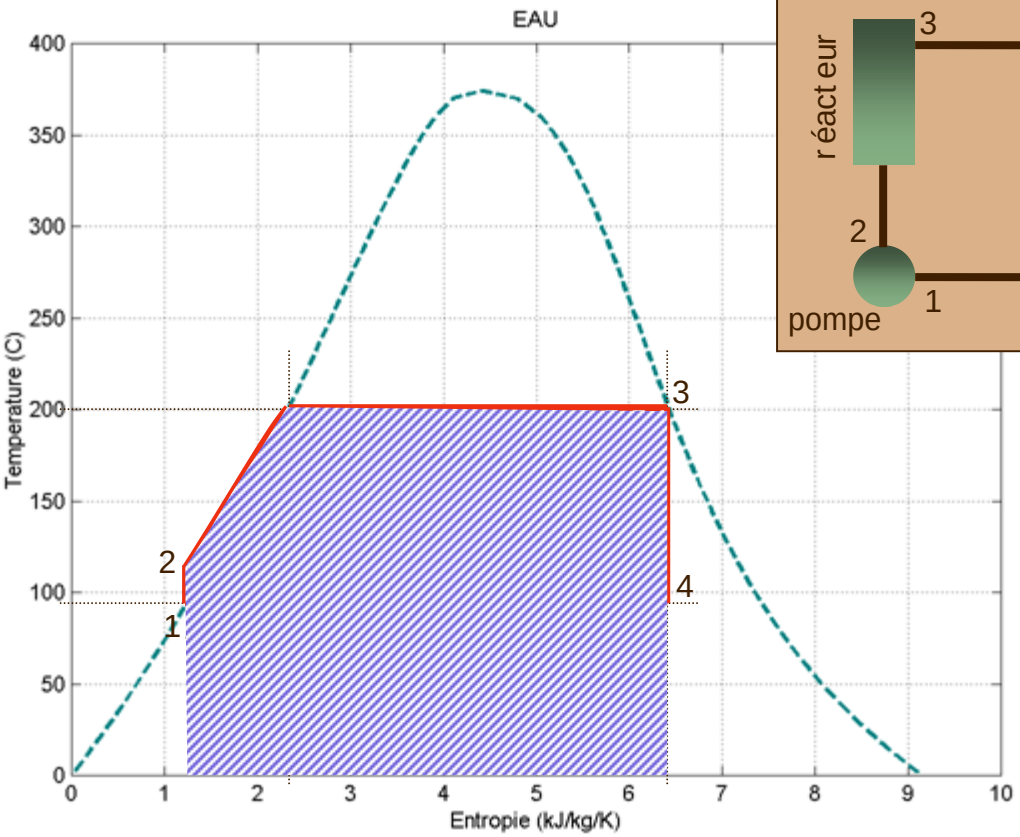


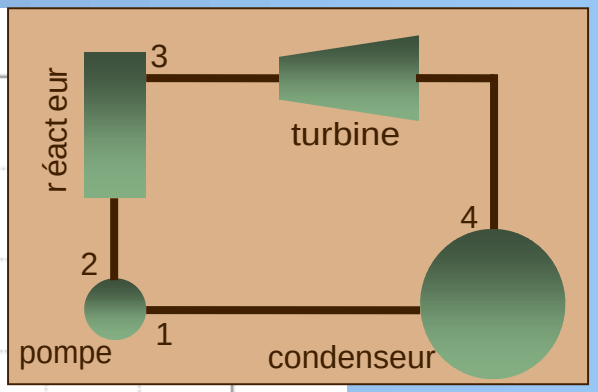


Ce signe tient compte du fait qu 'il s 'agit de travail fourni

$$w_{1\to2} + w_{3\to4} = -(q_{2\to3} + q_{4\to1})$$

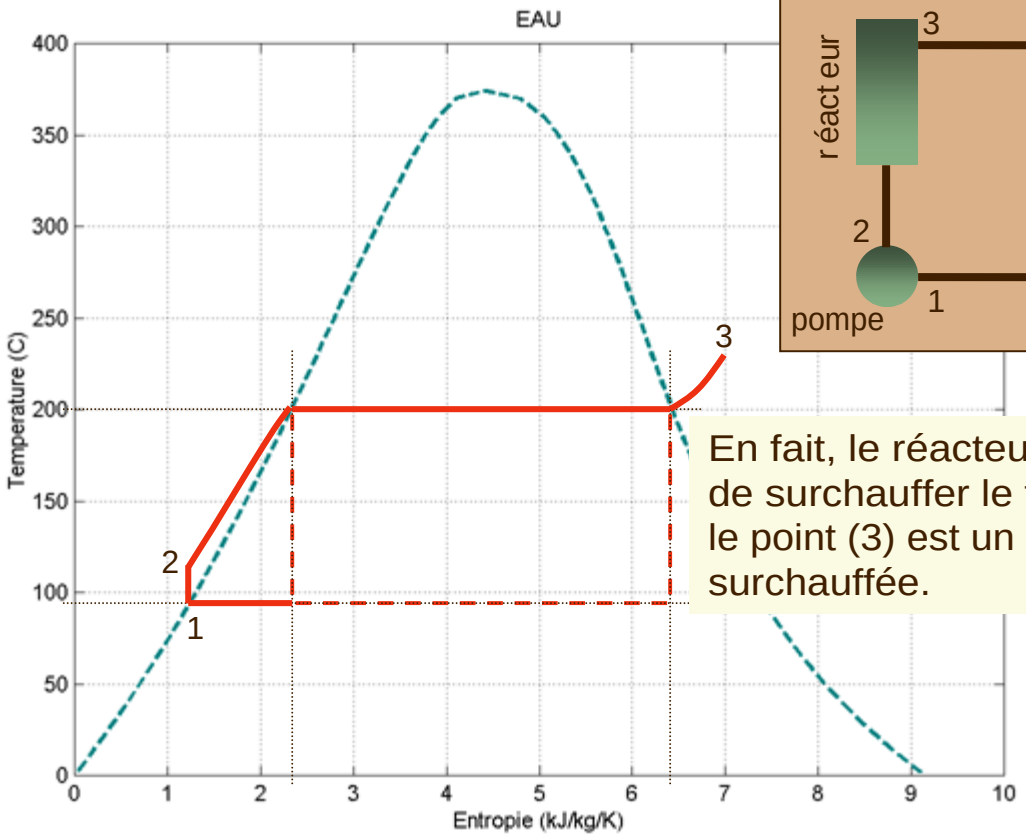
$$\eta = \frac{-(w_{1\to2} + w_{3\to4})}{q_{2\to3}}$$

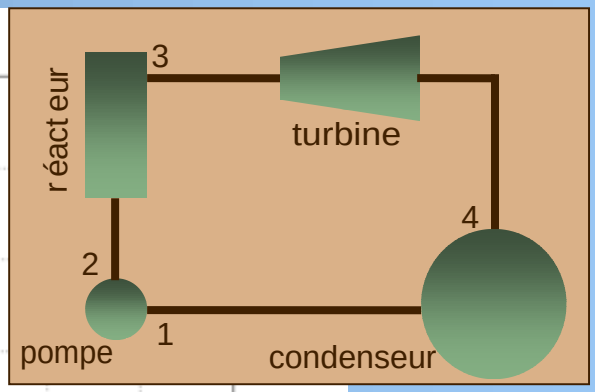




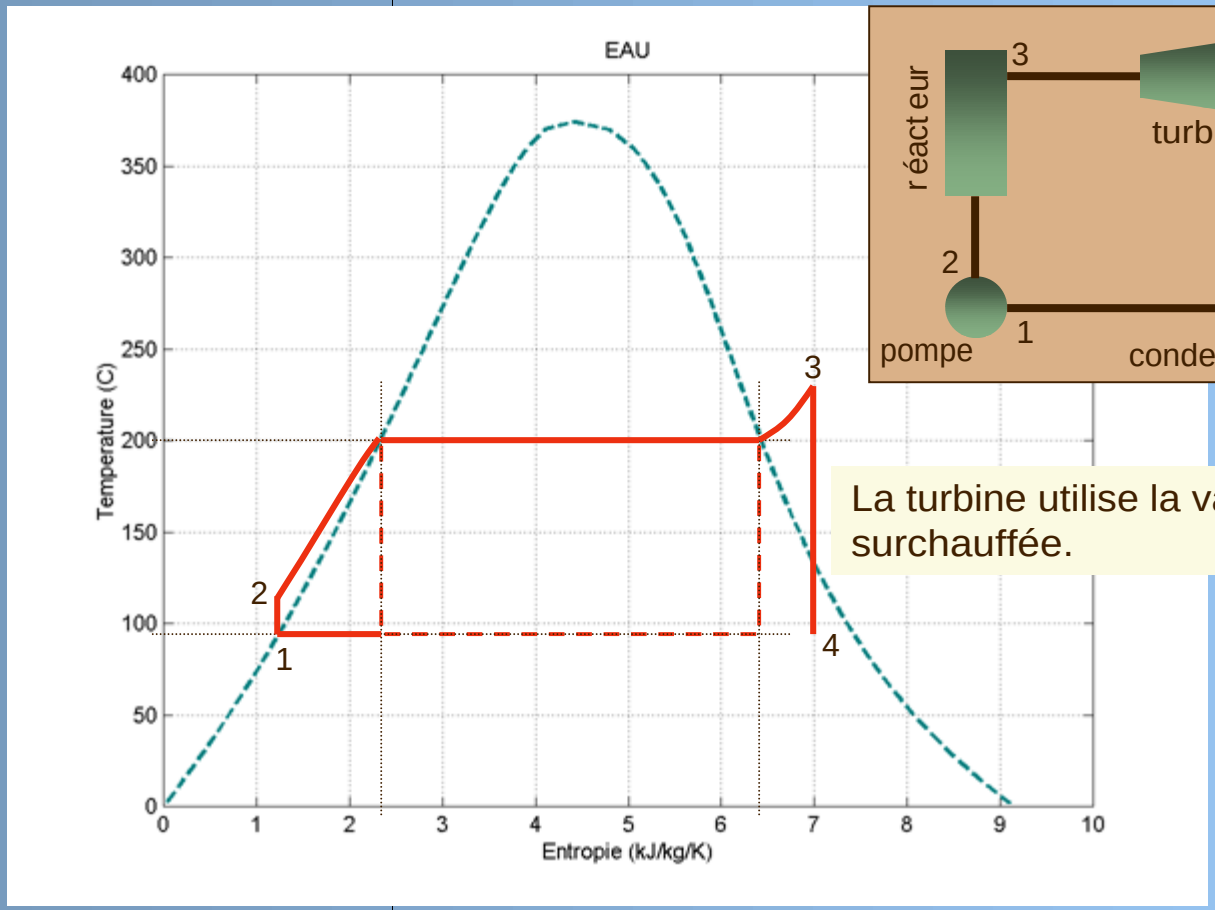
$$\eta = \frac{q_{2\to3} + q_{4\to1}}{q_{2\to3}}$$

Il s 'agit du rapport des deux surfaces

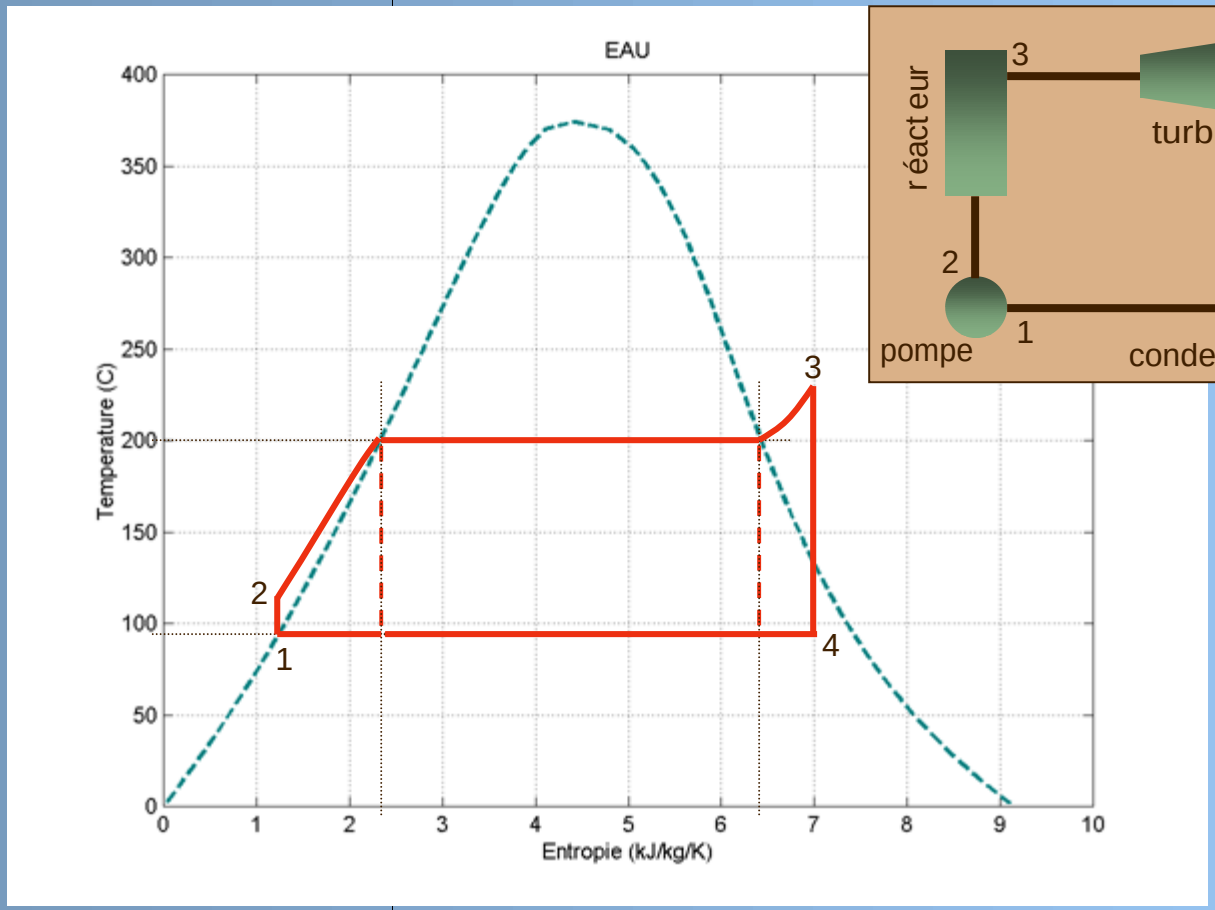




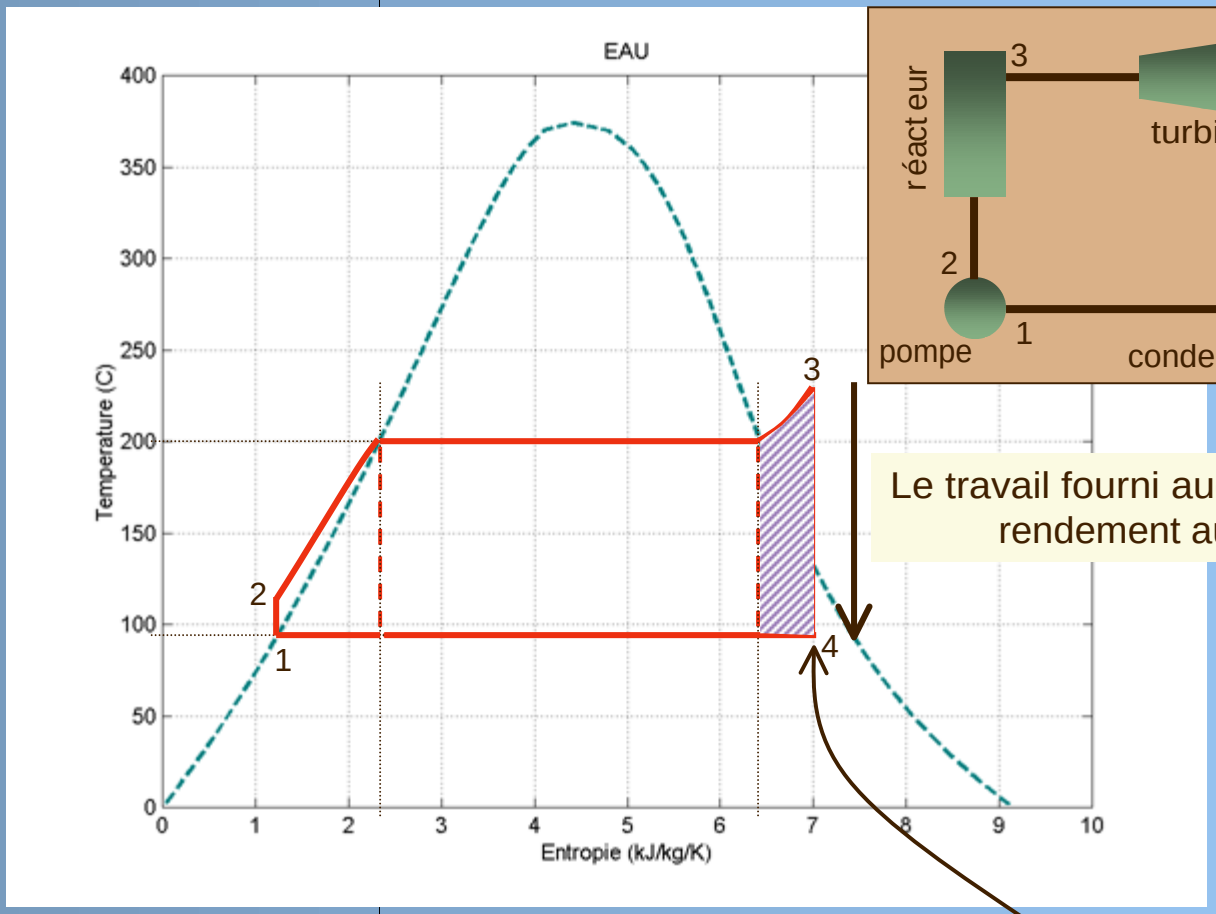
En fait, le réacteur peut permettre de surchauffer le fluide caloporteur: le point (3) est un état de vapeur surchauffée.



La turbine utilise la vapeur surchauffée.

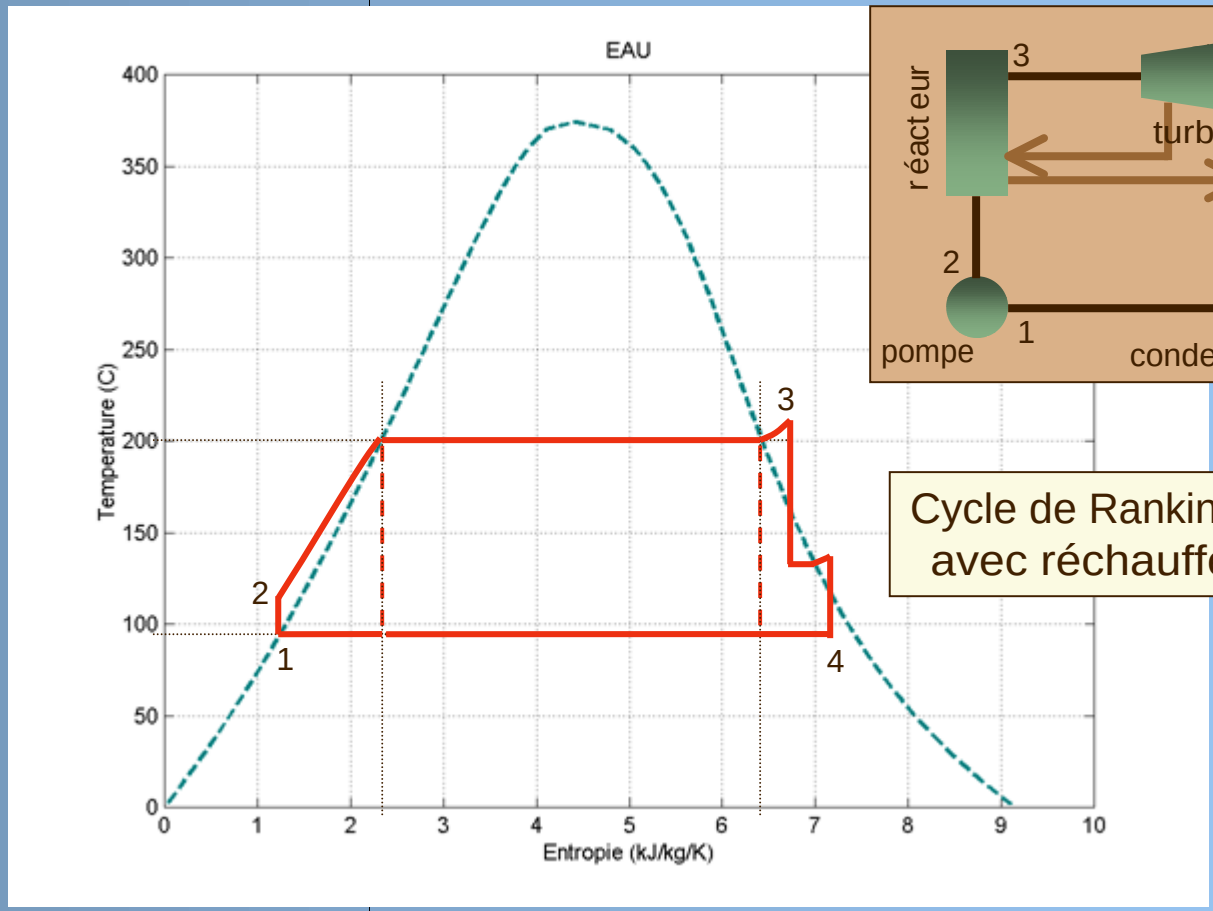


Cycle de Rankine avec surchauffe



Le travail fourni augmente, le rendement aussi.

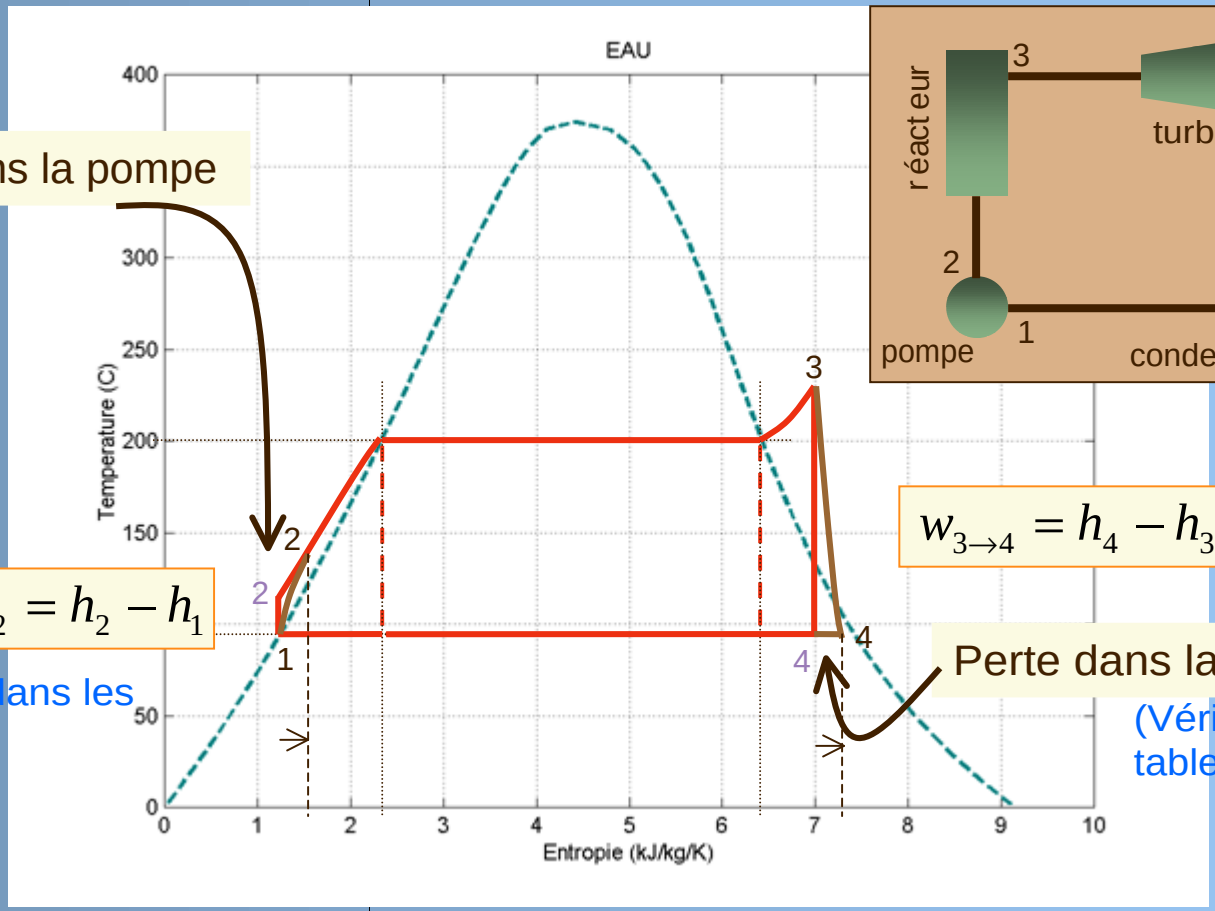
Le titre augmente:
il y a un intérêt pratique (corrosion dans la turbine) pour l 'amener proche de 1



Cycle de Rankine avec réchauffe

Cycle de Hirn

Perte dans la pompe



$w_{1\to 2} = h_2 - h_1$

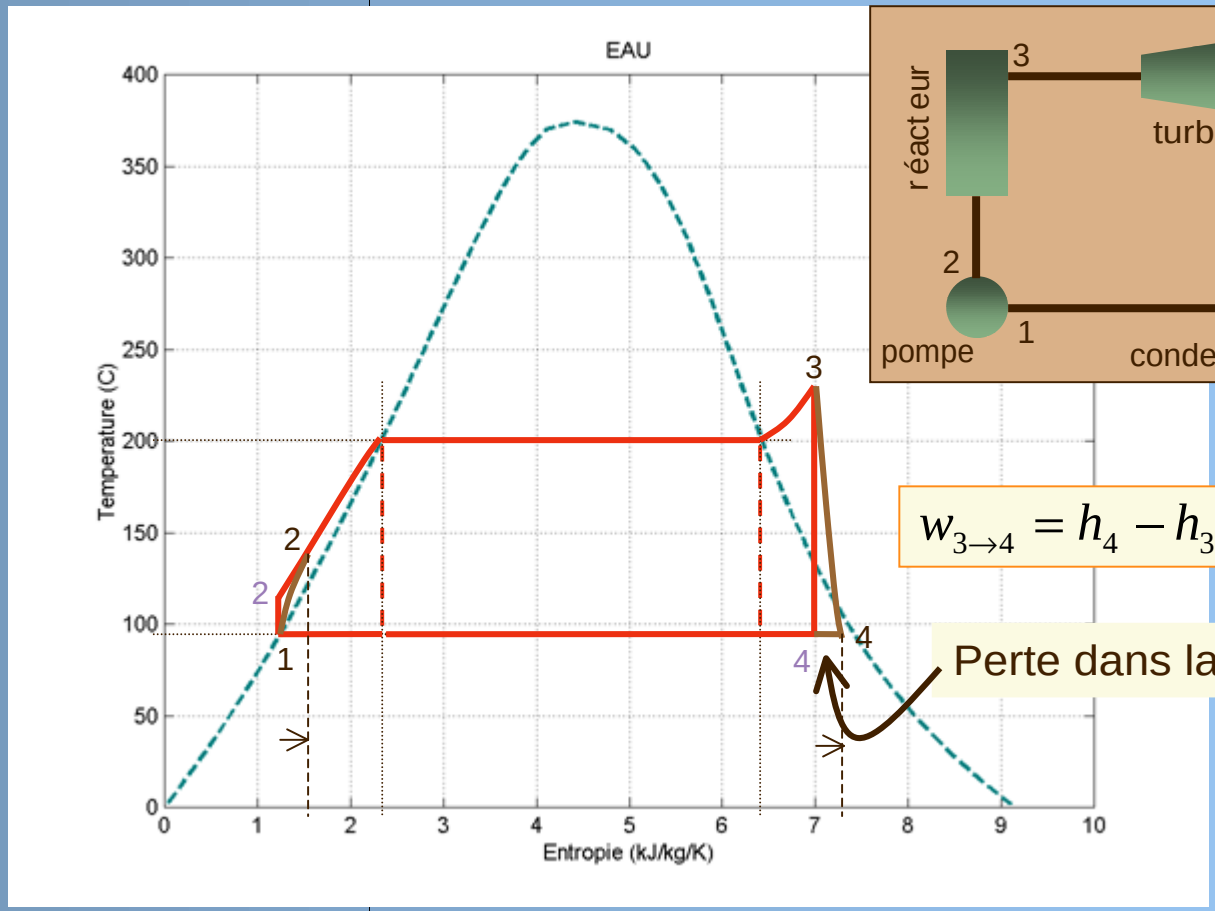
(Vérifier dans les tables.)

$w_{3\to 4} = h_4 - h_3$

Perte dans la turbine

(Vérifier dans les tables.)

Les pertes -->Accroissement de l ’entropie.



$w_{3\to4} = h_4 - h_3$

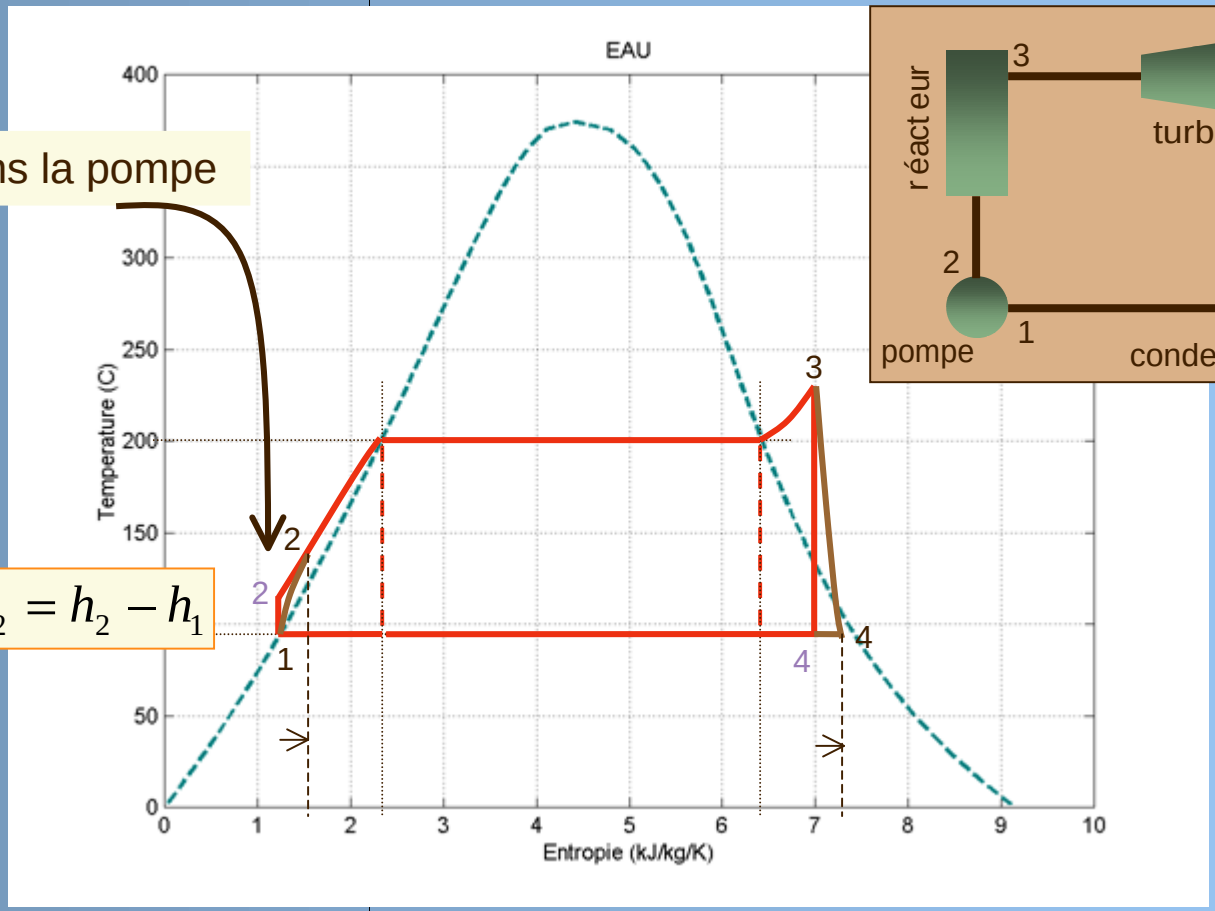
Perte dans la turbine

$$w_{turbine} = h_4 - h_3$$

$$\eta_{turbine} = \frac{h_4 - h_3}{h_{4esp} - h_3}$$

$$w_{turbine} = \eta_{turbine}\left(h_{4esp} - h_3\right)$$

Perte dans la pompe



$$w_{1\to 2} = h_2 - h_1$$

$$dh = T\,ds - p\,dv + p\,dv + v\,dp = T\,ds + v\,dp$$

$$h_{2esp} - h_1 = v\left(P_2 - P_1\right)$$

$$\eta_{pompe} = \frac{h_{2esp} - h_1}{h_2 - h_1}$$

$$w_{pompe} = v\,\frac{P_2 - P_1}{\eta_{pompe}}$$