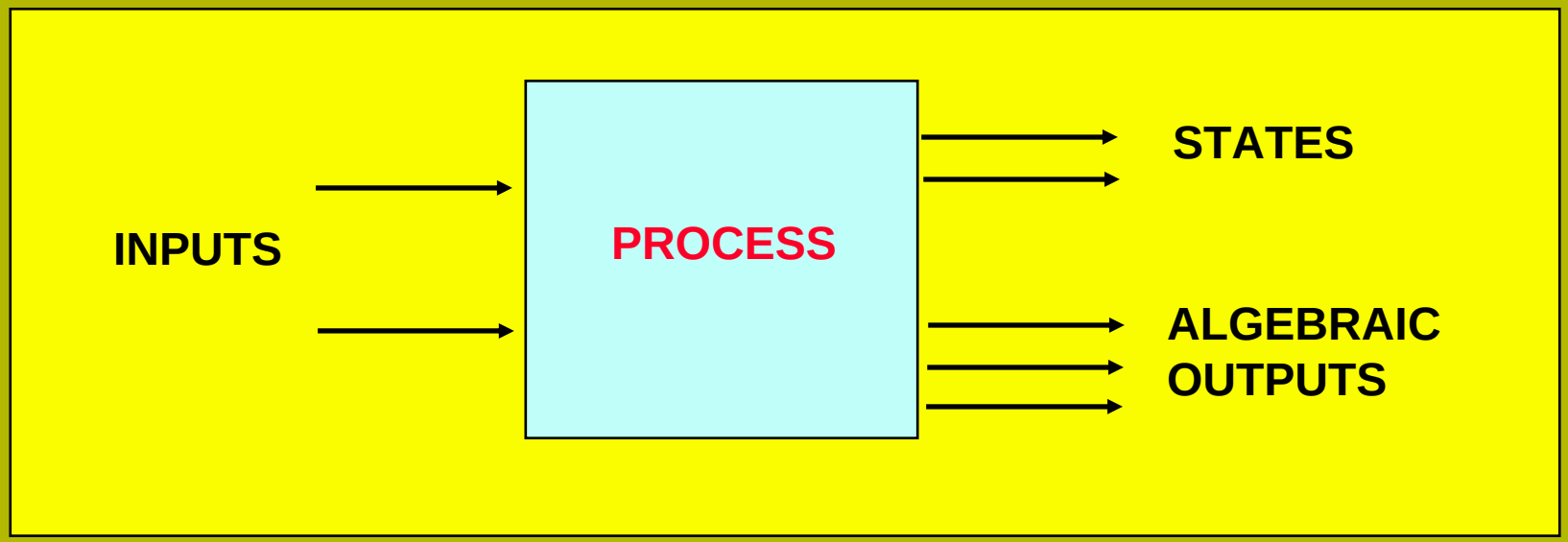
Building a model with LEGOCAD

- **First the system to be modelized must be defined. One should put the following questions:**
  - **what is the model to be used for?**
  - **which systems does it interact with?**
  - **what are the boundary conditions?**
  - **are they enough to characterize correctly the process?**
- **These questions are very important at every stages of the model construction**

Process scheme as a system



- **One should always verify the phisical consistency of the created model**

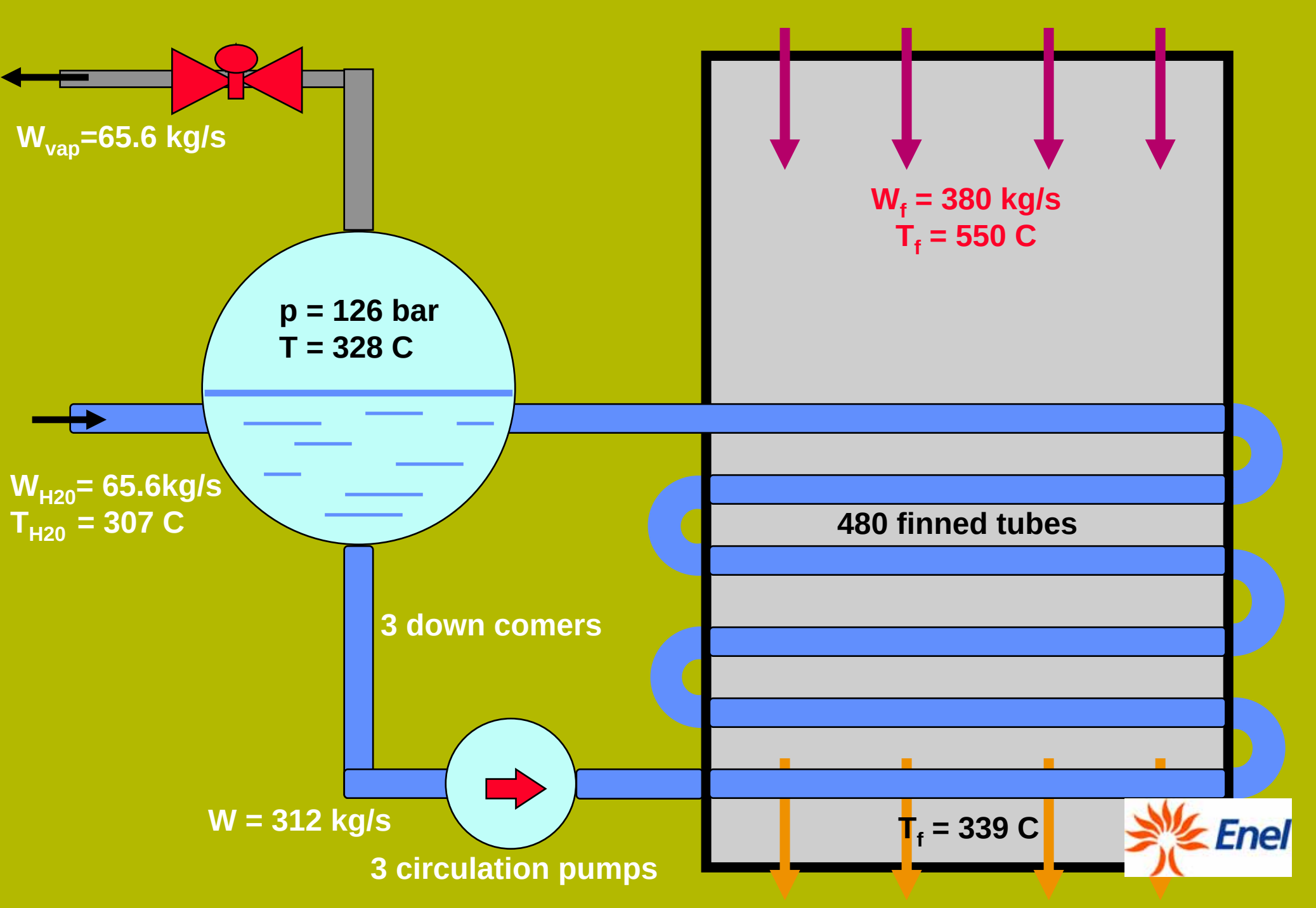
Process and regulation PIDs (fluograms) must be examined

A simplified scheme is drawn, taking into account only what be treated in the model

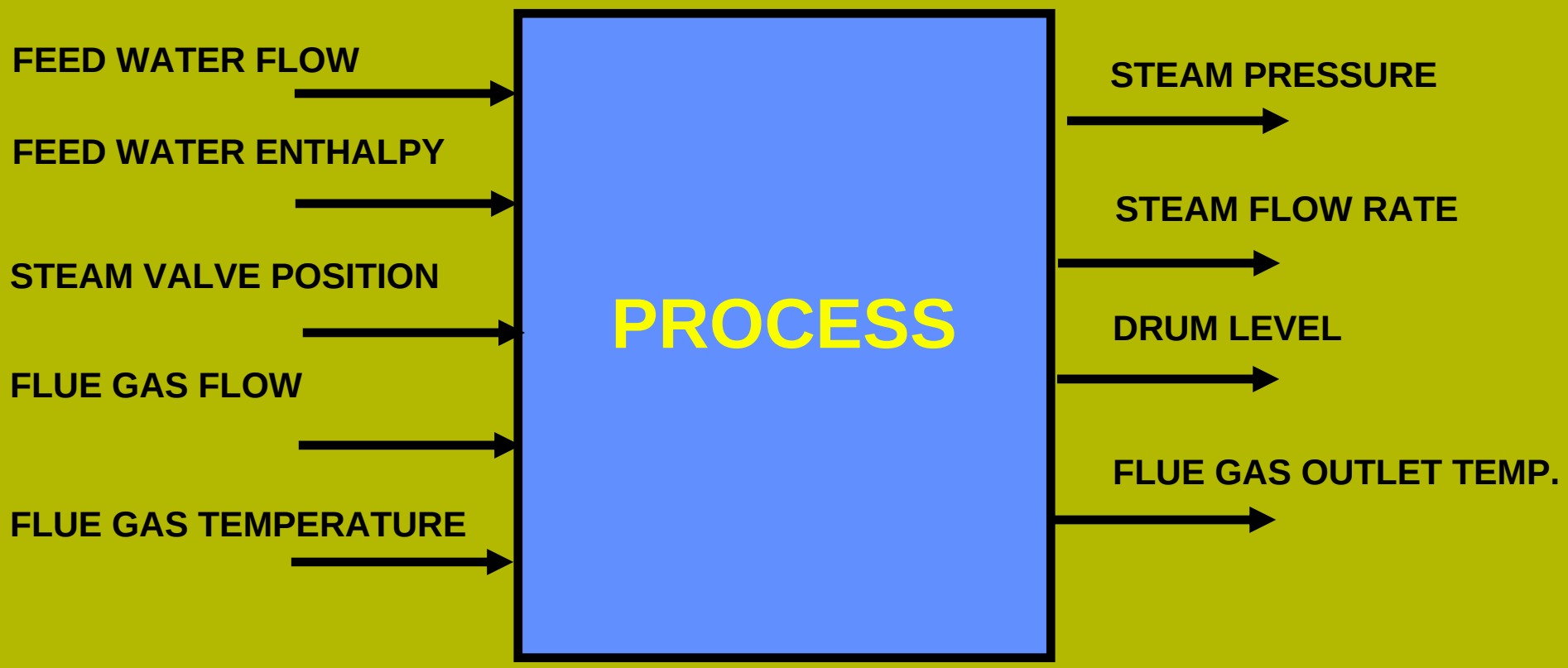
A block scheme using LEGO modules is drawn, searching for the best suited modules on the base of model and process considerations

Which modules to use?

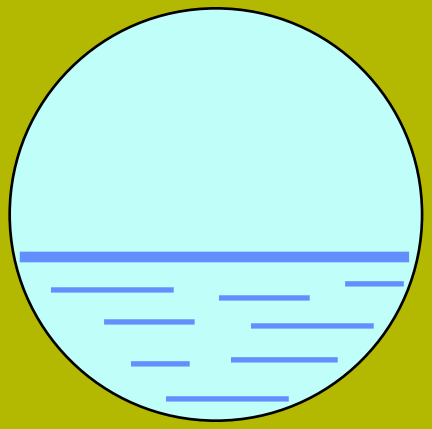
- One must consider the following points:
  - simplification level of each existing module
  - how suited a module is to describe a certain phenomenon
  - is the advantage of creating a new module worth the extra effort required?


W_{vap}=65.6 kg/s
p = 126 bar
T = 328 C
W_{H20}= 65.6kg/s
T_{H20} = 307 C
W_f = 380 kg/s
T_f = 550 C
480 finned tubes
3 down comers
W = 312 kg/s
3 circulation pumps
T_f = 339 C
Enel

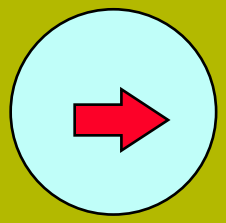
Process scheme



LEGO modules choice



DRUM
module CLAV

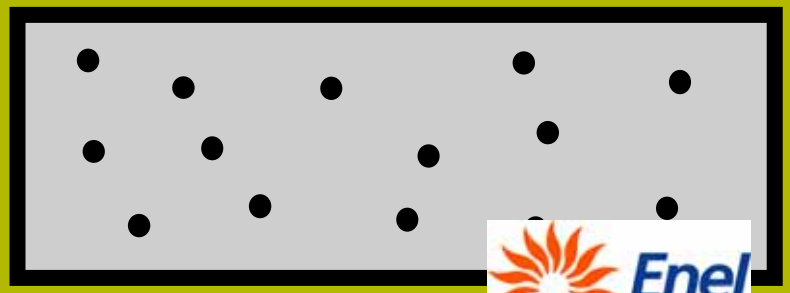


PUMP
module CPOM

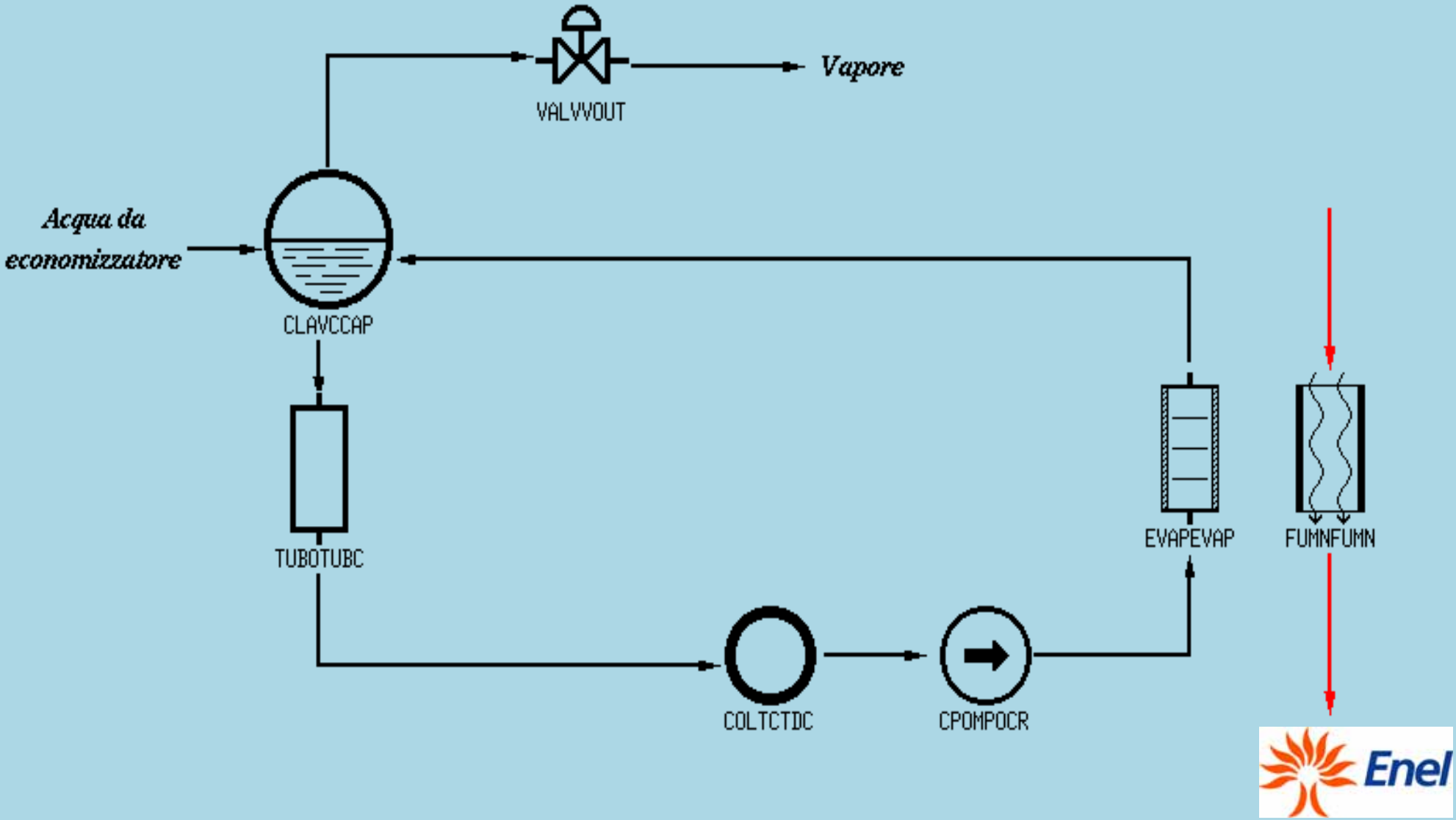
DOWN-COMERS
modules TUBO, COLT

RISERS
module EVAP

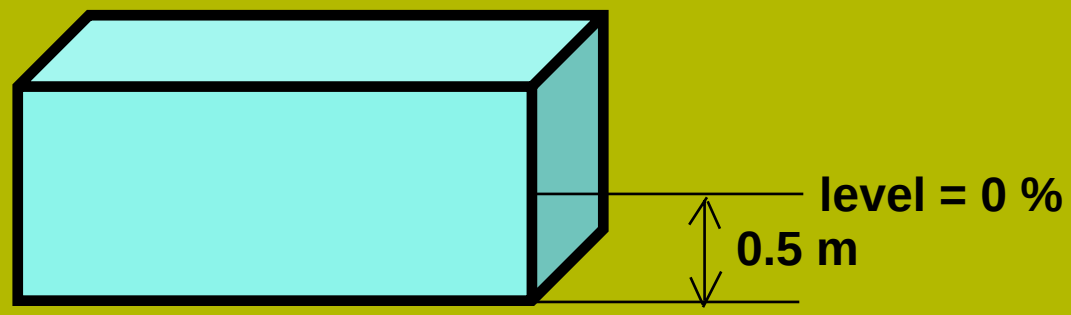
FLUEGAS
module FUMN



Model topology scheme



DRUM (CLAVCCAP)



- **Geometrical - physical data:**
  - volume = 32 m^3
  - height = 3 m
  - horizontal section = 10.667 m^2
  - measure range = 1 m
- **Operating conditions:**
  - pressure = 126 bar
  - temperature = 328 C

DOWN COMERS (TUBOTUBC - COLTCTDC)

- **Geometrical - physical data:**
  - number of pipes = 3
  - outside diameter = 323 mm
  - thickness = 7 mm
  - lenght = 10 m
  - difference of level = 4 m
  - pipe weight = 55 kg/m
  - metal c_p = 630 J/(kg C)
  - metal conductivity = 35 W/(m C)
- **Operating conditions**
  - flow rate = 320 kg/s
  - inlet water temperaure = 328 C

CIRCULATION PUMPS (CPOMPOCR)

- number of pumps = 3
- Operating conditions (for each pump):
  - water flow rate = 106.67 kg/s
  - angular velocity = 750 RPM
  - differential pressure = 0.7 bar

RISERS (EVAPEVAP - FUMNFUMN)

- **Geometrical - physical data:**
  - number of pipes = 480
  - outside diameter = 50.8 mm
  - thickness = 4.2 mm
  - pipe lenght = 30.870 m
  - fins size (height * thickness) = 19.05 * 1.27 mm
  - number of fins = 236 fins/m
  - total heat-exchange surface = 31350 m^2
  - metal density = 7800 kg/m^3
  - metal c_p = 630 J/(kg C)
  - metal conductivity = 35 W/(m C)
  - transversal pipes pitch = 114 mm
  - longitudinal pipes pitch = 120 mm
  - gas duct section = 105 m^2

STEAM VALVE (VALVVOUT)

- **Operating conditions:**
  - **steam flow rate = 64 kg/s**
  - **inlet pressure = 126 bar**
  - **outlet pressure = 1 bar**
  - **inlet temperature = 328 C**