

POLITECNICO
MILANO 1863

LAB6: Computation of the EP4

Assessing the economic potential of level-4

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The economic potential of level-4 (EP_4) is defined as:

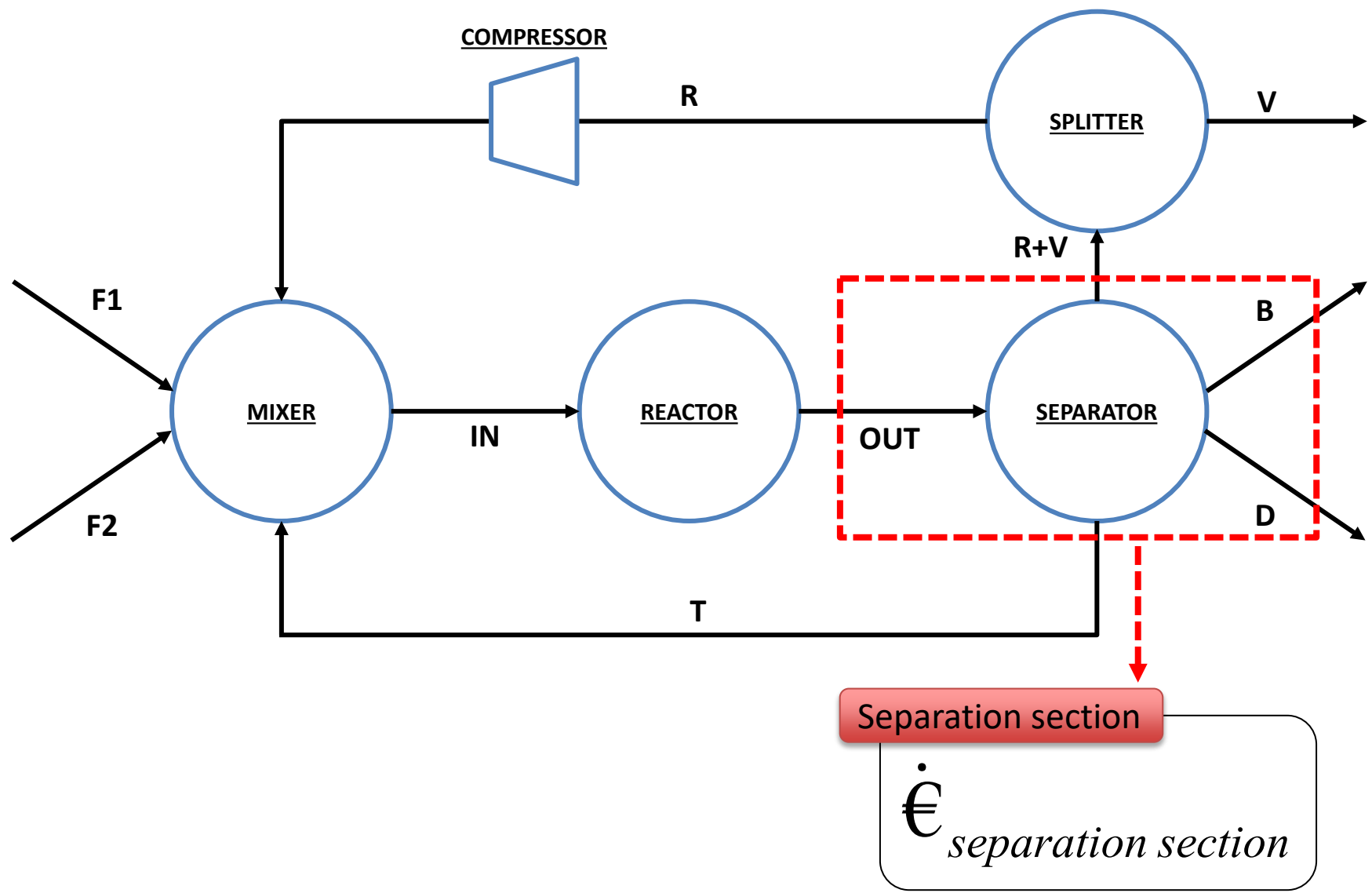
$$EP_4 = EP_3 - \dot{\text{€}}_{\text{separation section}}$$

with EP_4 in [M€/y].

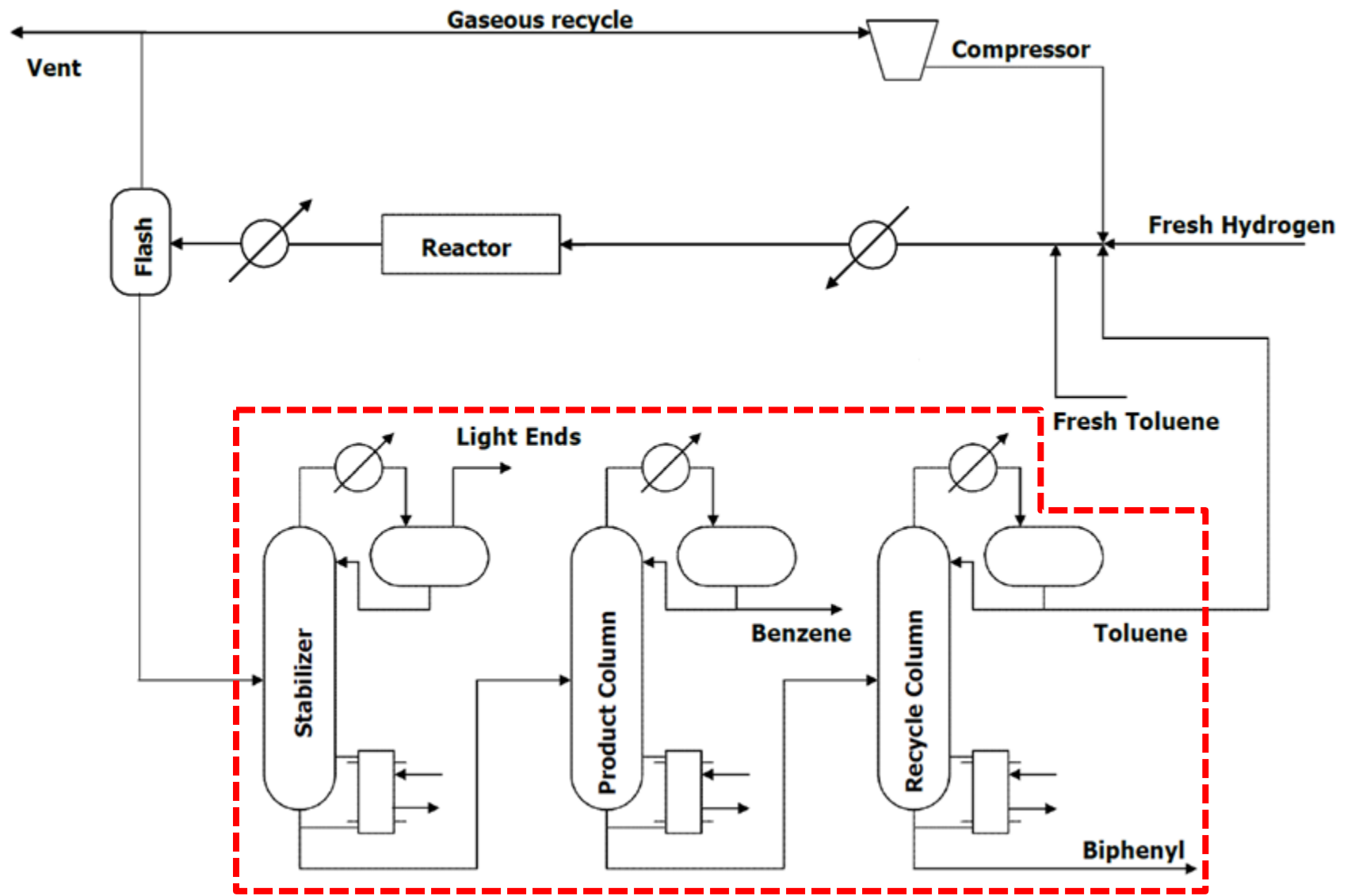
If the EP_4 is greater than zero, the process may be economically attractive; vice versa, the process is not economically interesting.

It is then necessary to design all the equipment for the separation.

Remark: A flash has a negligible cost over that of a distillation column.



The separation section (after using the process simulator)





The equipment costs must account for:

- Capital expenditure (CapEx);
- Operative expenditure (OpEx).

The **CapEx** term is the sum of the costs of the materials used to manufacture and install the equipment (*e.g.*, vessels and welds).

The **OpEx** term depends on the equipment's operating requirements, such as electricity consumption and other utilities (*e.g.*, steam and cooling water).

For the sake of simplicity, we will again assume a **depreciation period of 5 years** (*i.e.*, the one assumed for the EP₃ evaluation) for all the units.

CapEx:

⇒ **Guthrie's formulae** for installing (i) the **vessel** and (ii) the **trays**.

OpEx:

⇒ **null**, because such equipment can be schematized as **pressure tanks** (as already done for the reactor during the calculation of the EP_3).

PS: the OpEx associated with the **condenser and reboiler duties** will be considered in the analysis of **heat exchangers** cost!

PPS: the only column that works with a relatively high hydrogen concentration is the **stabilizer**: the suggested building material for such a column is **stainless steel**; on the other hand, **carbon steel** (cheaper!) is used for the other columns.

CapEx:

⇒ **Guthrie's formula** (installed cost) related to heat exchangers.

To use such a correlation, evaluate the **heat exchange area** of each unit.

OpEx:

⇒ **Utility flows** needed by condensers (**water**) and reboilers (**steam**).

The prices of such utilities are:

- Steam @ 30 bar = 1.65€/1000lb
- Steam @ 70 bar = 2.25€/1000lb
- Cooling water = 0.06€/1000USgal