1 Pinch technology

Pinch technology is a methodology aimed to optimize a process scheme from an energetical point of view, i.e. to define the optimal heat exchanger network configuration in order to minimize the external duty requirement. In general external duties cost decreases by approaching the ambient temperature as shown in Figure 1.1, therefore the fundamental idea this method is based on is to take advantage of the heat exchange at the higher cost of the energy. Capital costs, proportional to the heat exchanger areas, are limited by fixing a ΔT_{min}, that will determine the so called "pinch condition" or "pinch point".

The optimal network resulting from the analysis usually includes a big number of heat exchangers. This means that whether the operating cost is minimized the total cost is not, therefore an a posteriori analysis should take into account all the cost items.

Further improvements can be obtained by "shifting" some streams or coupling small exchangers involving the same streams.

Since pinch technology was introduced the network design is performed following the analysis only if it shows an optimal condition far from the real one.

Good rules of thumb are:

- Do not transfer heat across the pinch point;
- Add heat above the pinch point;
- Remove heat below the pinch point;
- Add heat at the higher possible temperature with respect to the pinch point;
- Remove heat at the lower possible temperature with respect to the pinch point.

1.1 Optimization of a heat exchanger network

The minimum energy consumption condition of the process scheme shown in Figure 1.2 needs to be evaluated. Streams data are listed in Table 1.1. Moreover, the suggestion of an alternative heat exchanger network is requested.

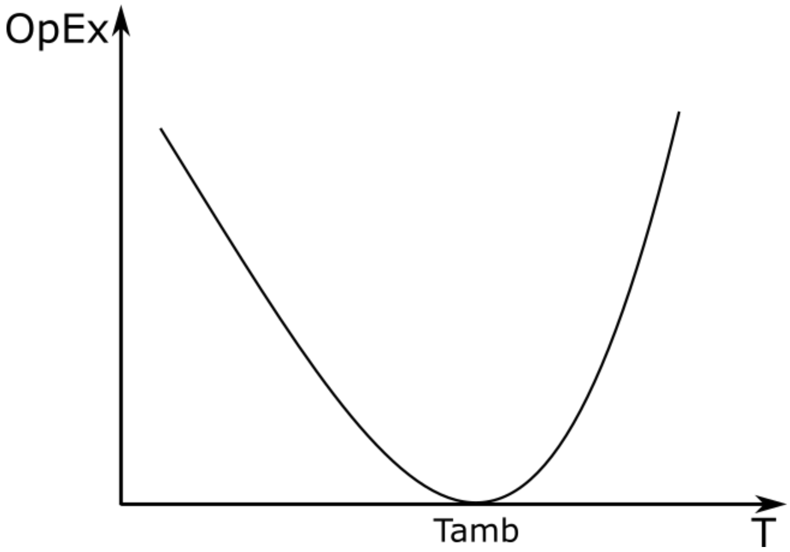

Figure 1.1: Heating cost

Stream	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**
Heat capacity [$MW/$**°C**]	0.3	0.3	0.2	0.2	0.15	0.15	0.25	0.25
T [**°C**]	160	250	40	200	270	60	220	100

Table 1.1: Chemico-physical properties

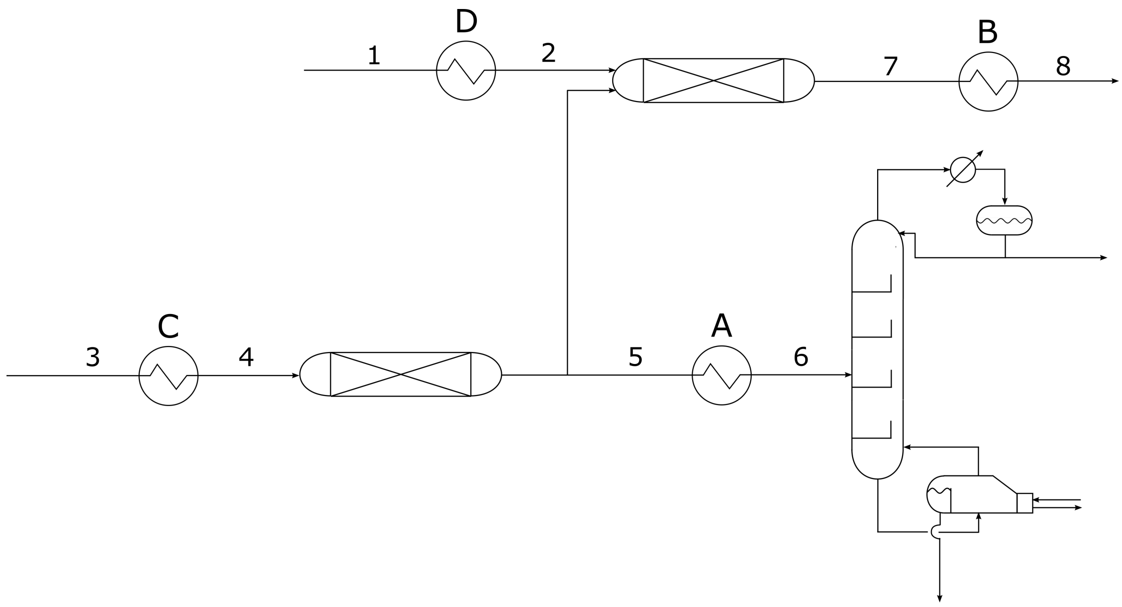

Figure 1.2: Process Flowsheet Diagram