# Sustainable Integration of Trigeneration Systems with Heat Exchanger Networks

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## Problem Statement

The problem addressed in this work can be stated as follows.

Given are:

- A set of hot process streams (*HPS*) and a set of cold process streams (*CPS*) required to be cooled/heated from their supply to their target temperatures (some *HPSs* require refrigeration).
- A single effect absorption refrigeration (*AR*) cycle to supply the cooling requirement (cold utility below the ambient temperature) for the (*HPS*).
- An organic Rankine cycle (*ORC*) to produce electricity that can be sold.
- A steam Rankine cycle (*SRC*) available for power production, which can be driven by different primary energy sources (solar energy, biofuels and fossil fuels). The waste heat from the *SRC* can be used as hot utility in the heat exchanger network (*HEN*), in the *AR* cycle to generate the process cooling requirement and in the *ORC* for producing electricity.
- A solar collector to provide a heat source to drive the *SRC*. The number of jobs that can be generated per kJ produced by each solar collector must be also given.
- A set of available fossil fuels *F* to provide external energy to the integrated system. For each fossil fuel available are also given the overall specific greenhouse gas emissions (*GHGE*) and number of jobs that can be generated per kJ produced.
- A set of available biofuels *B* to supply heat to the *SRC* to run it, including their entire life cycle unit *GHGE* and number of jobs that can be generated.
- Also, it is given the minimum temperature difference ($\Delta T_{min}$) for heat transfer.

Then, the problem to be addressed involves the design and integration of a *HEN*, a *SRC*, an *ORC* and an *AR* cycle into an industrial facility and the selection of multiple primary energy sources in order to simultaneously maximize the total annual profit (*TAP*), minimize the overall *GHGE* and maximize the number of jobs (*NJOBS*) created by the project.