UNIVERSITÀ DEGLI STUDI FIRENZE
DIEF
Dipartimento di Ingegneria Industriale

Process Simulation using UNISIM Design

(Training Course - Basic level II)

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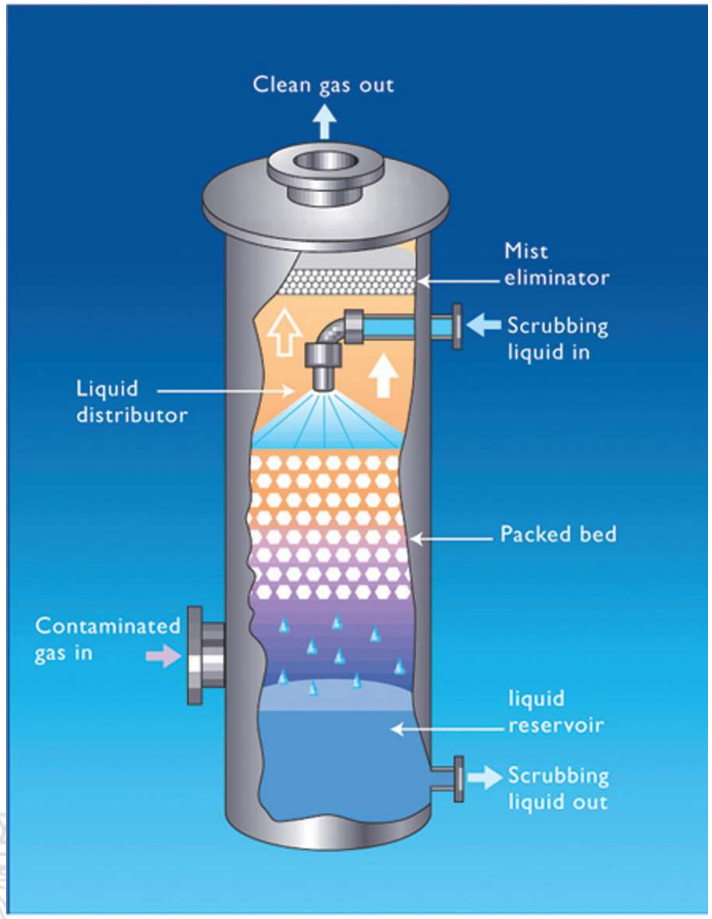
Table of content

Example #2.1: absorber (Scrubber)

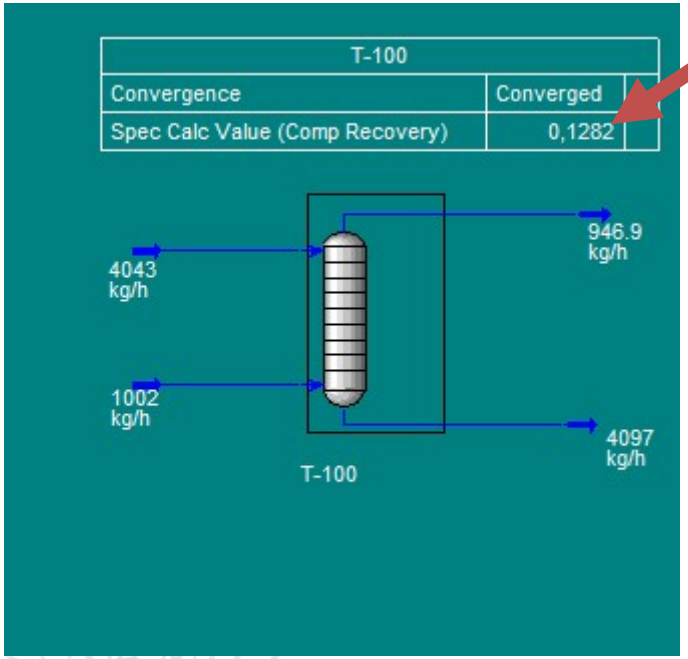
- scrubber
- Objective: CO2 elimination

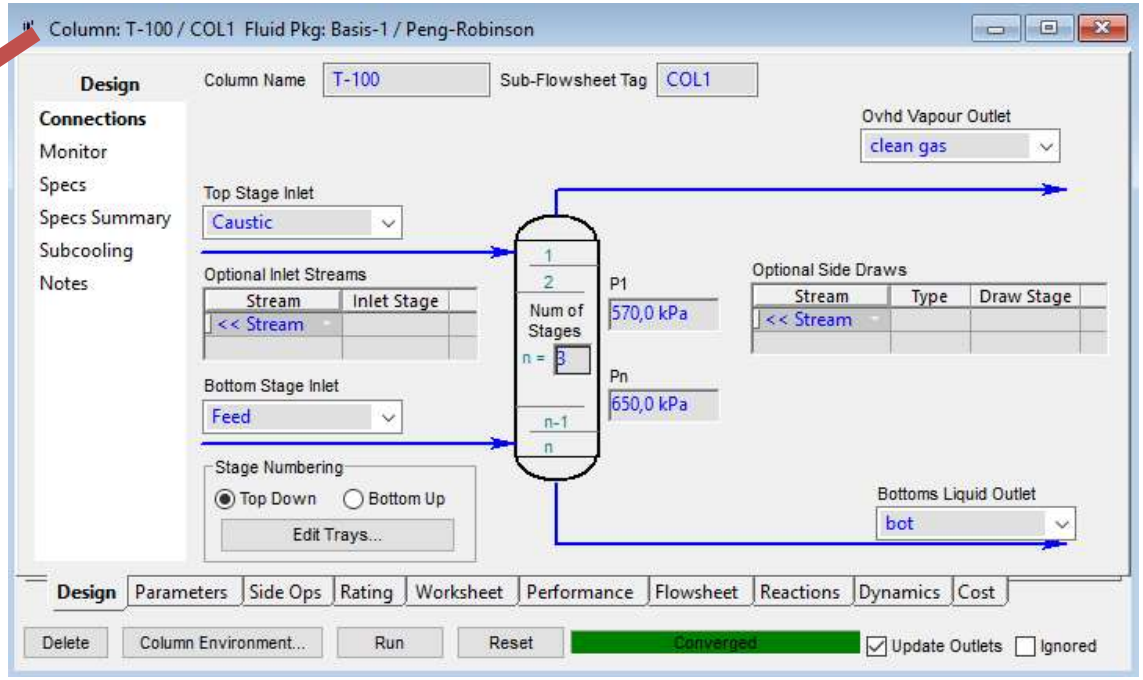


Example #2.1: absorber (Scrubber)

- Absorber

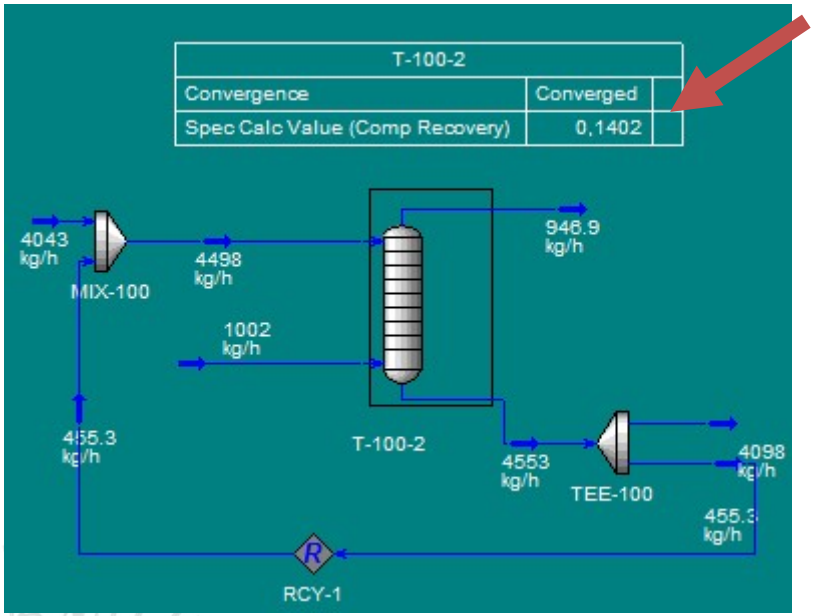
- Objective: CO2 elimination
- Gas Feed2 : CO2 30% + CH4 70% 9,2bar 50C 40kgmol/hr
- Liq. Feed1 : NaOH 10% + water 90% 6,5bar 54C 200 kgmol/hr





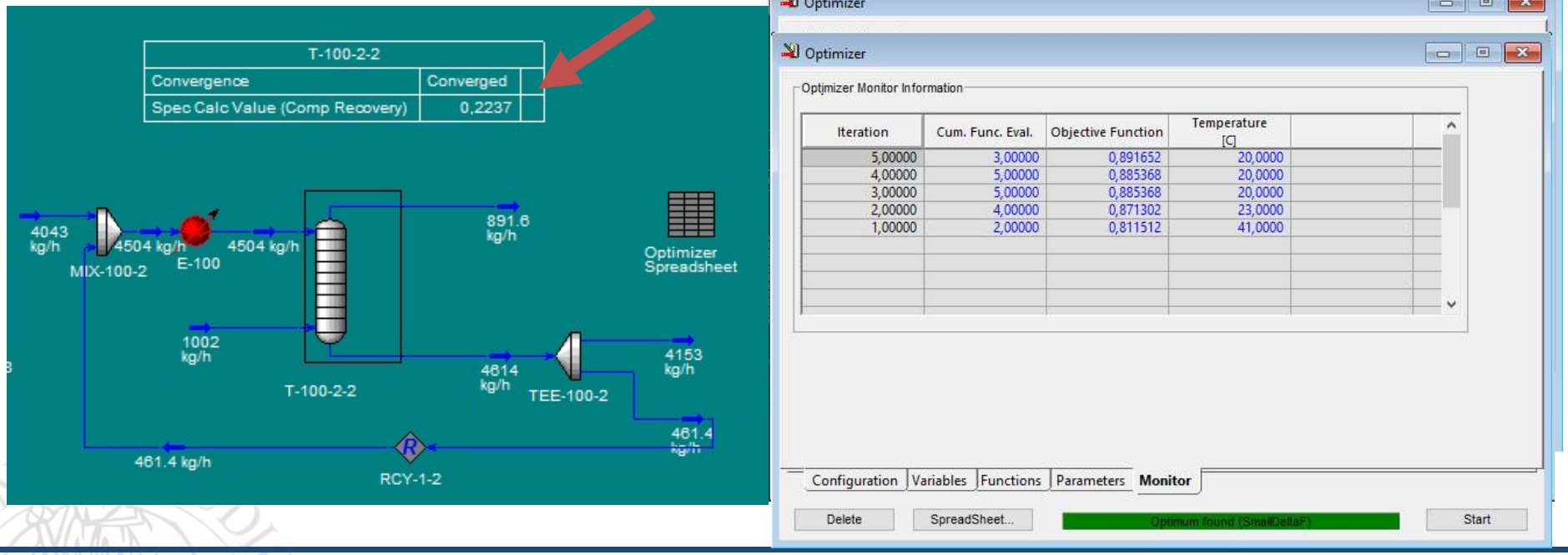
Example #2.2: absorber (Scrubber)

- Absorber with Recycle
- Objective: CO2 elimination
- Gas Feed1 : CO2 30% + CH4 70% 9,2bar 50C 40kgmol/hr
- Liq. Feed2 : NaOH 10% + water 90% 6,5bar 54C 200 kgmol/hr



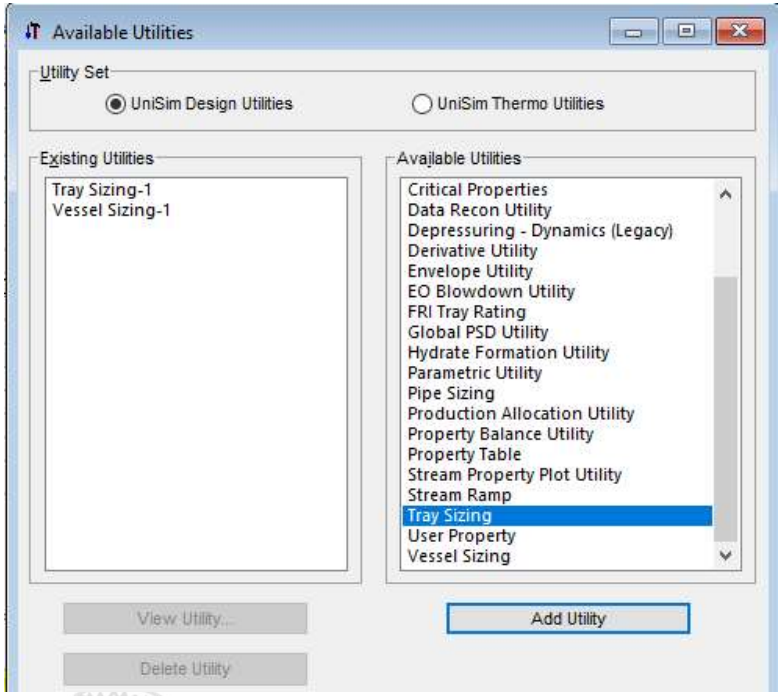
Example #2.3: absorber (Scrubber)

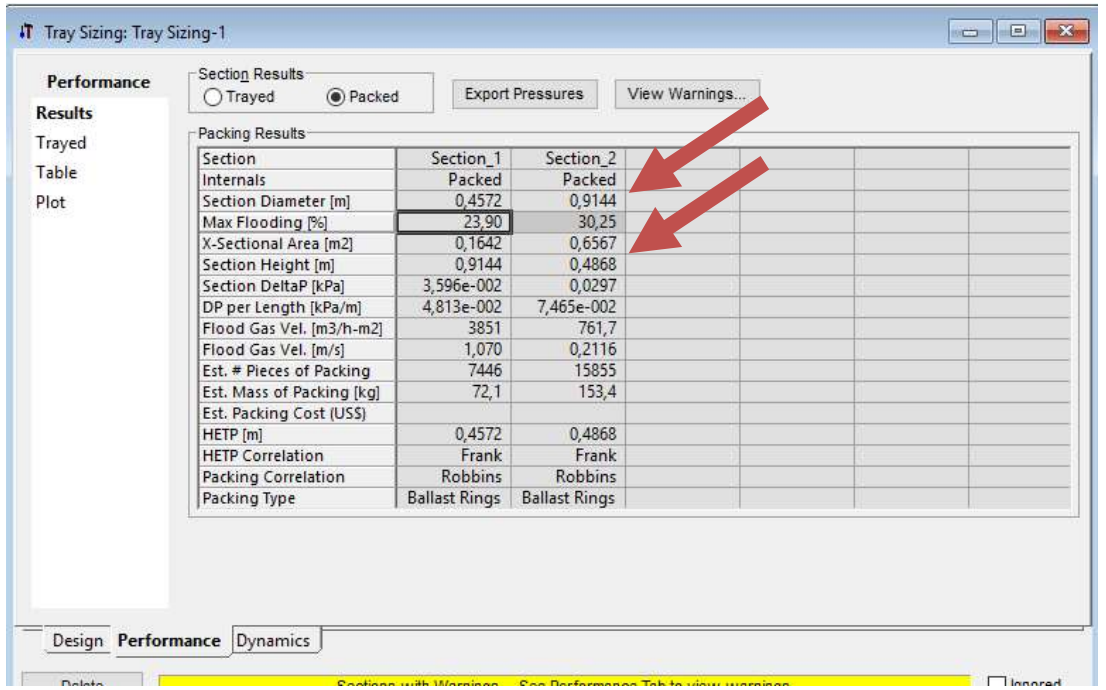
- Absorber with Recycle + Caustic cooler
- Objective: CO2 elimination
- Gas Feed1 : CO2 30% + CH4 70% 9,2bar 50C 40kgmol/hr
- Liq. Feed2 : NaOH 10% + water 90% 6,5bar 54C 200 kgmol/hr



Example #2.4: absorber (Scrubber)

- Sizing of final column



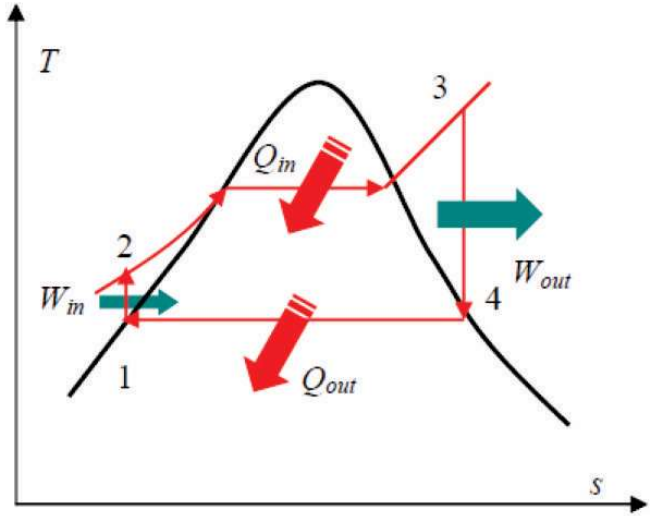


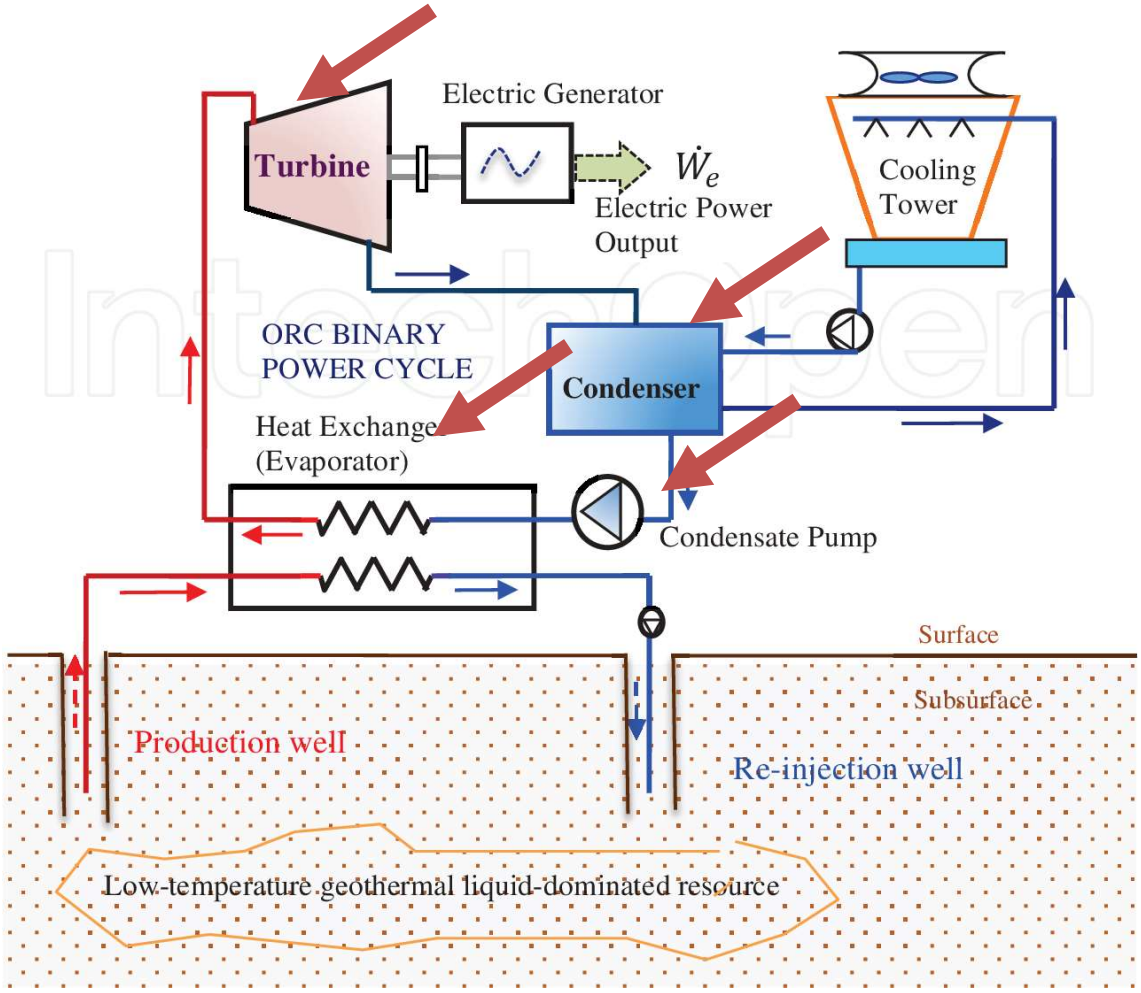
Section	Section_1	Section_2
Internals	Packed	Packed
Section Diameter [m]	0,4572	0,9144
Max Flooding [%]	23,90	30,25
X-Sectional Area [m2]	0,1642	0,6567
Section Height [m]	0,9144	0,4868
Section DeltaP [kPa]	3,596e-002	0,0297
DP per Length [kPa/m]	4,813e-002	7,465e-002
Flood Gas Vel. [m3/h-m2]	3851	761,7
Flood Gas Vel. [m/s]	1,070	0,2116
Est. # Pieces of Packing	7446	15855
Est. Mass of Packing [kg]	72,1	153,4
Est. Packing Cost (US$)		
HETP [m]	0,4572	0,4868
HETP Correlation	Frank	Frank
Packing Correlation	Robbins	Robbins
Packing Type	Ballast Rings	Ballast Rings

Break time

Ex. #2.5: ORC cycle

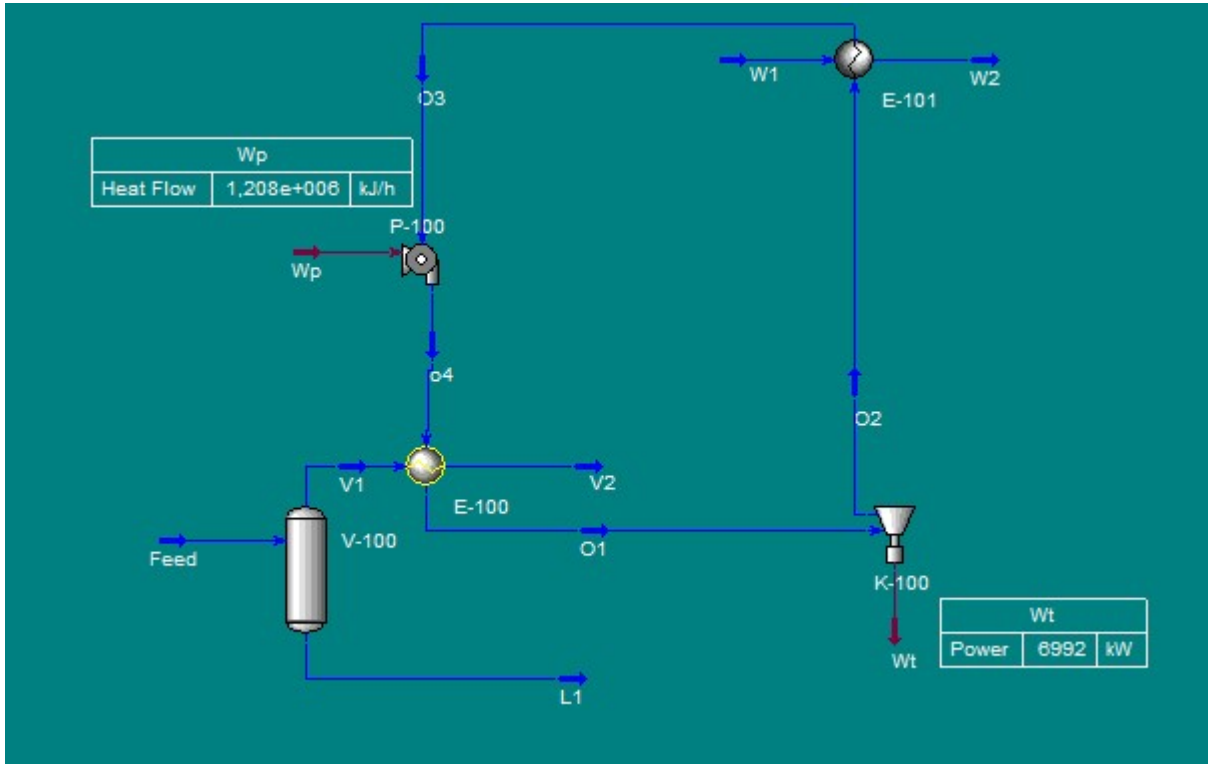
- ORC cycle-Basic





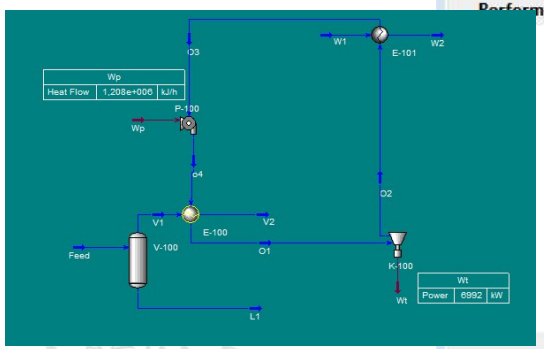
Ex. #2.5: ORC cycle

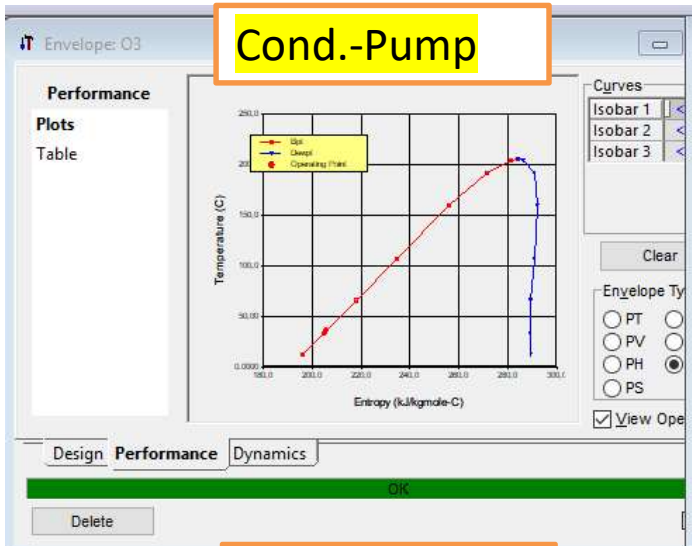
- Simulating ORC
- Feed: superheated steam: H2O:92% + CO2:8% 10bar 180C
  - After evaporator : 10bar 89C
- ORC cycle composition : R141b 100%
  - After evaporator: 170C
  - Pump output pressure: 2300 kPa
  - Turbine output : 200 kPa
  - Turbine efficiency: 88%
  - Condenser output: 35C
  - Condenser $\Delta Ptube = 0$
  - Condenser $\Delta Pshell = 0$
  - Evap. $\Delta Ptube = 0$
  - Evap. $\Delta Pshell = 0$

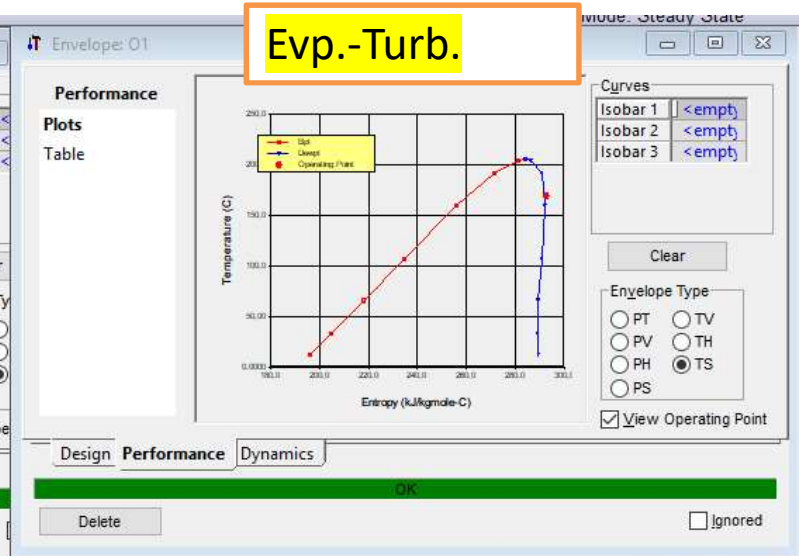


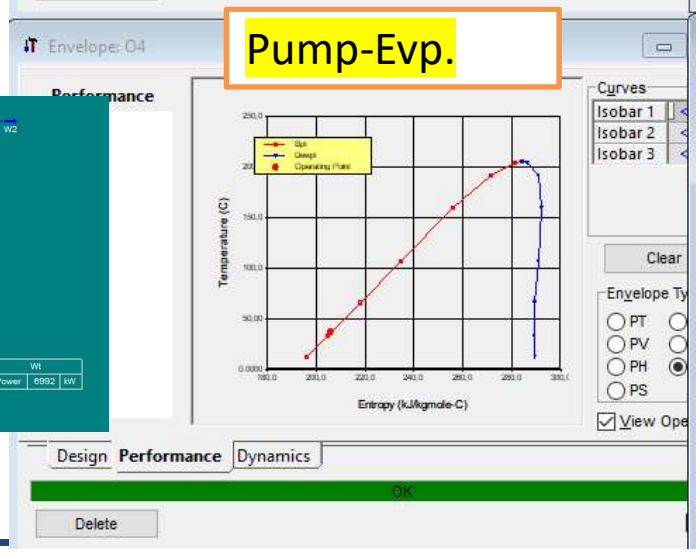
Ex. #2.5: ORC cycle

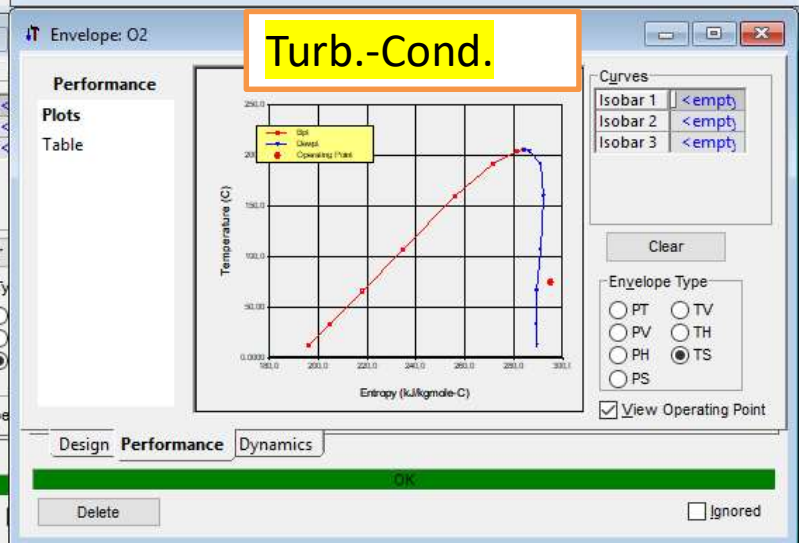
- Simulating ORC





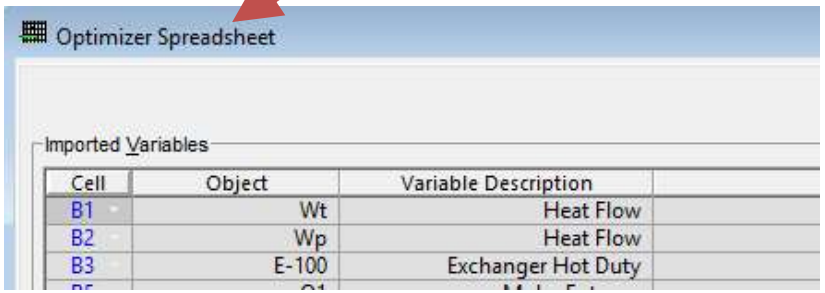


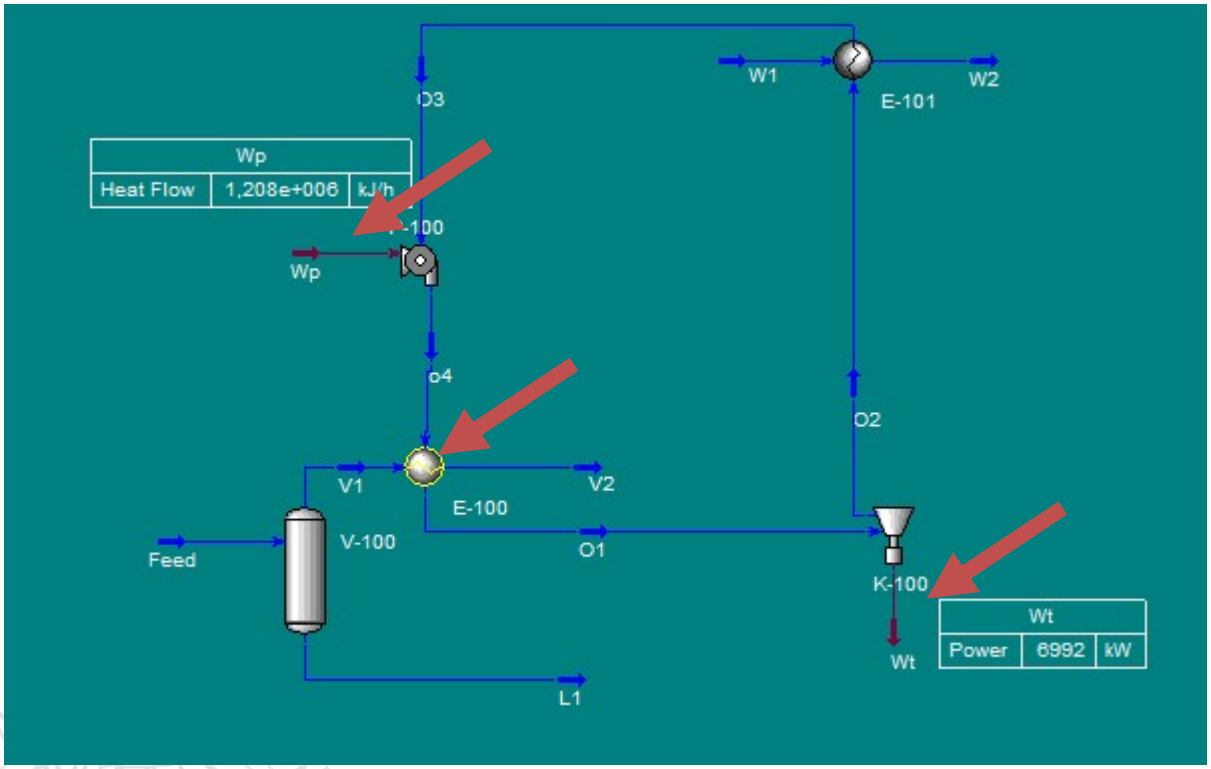


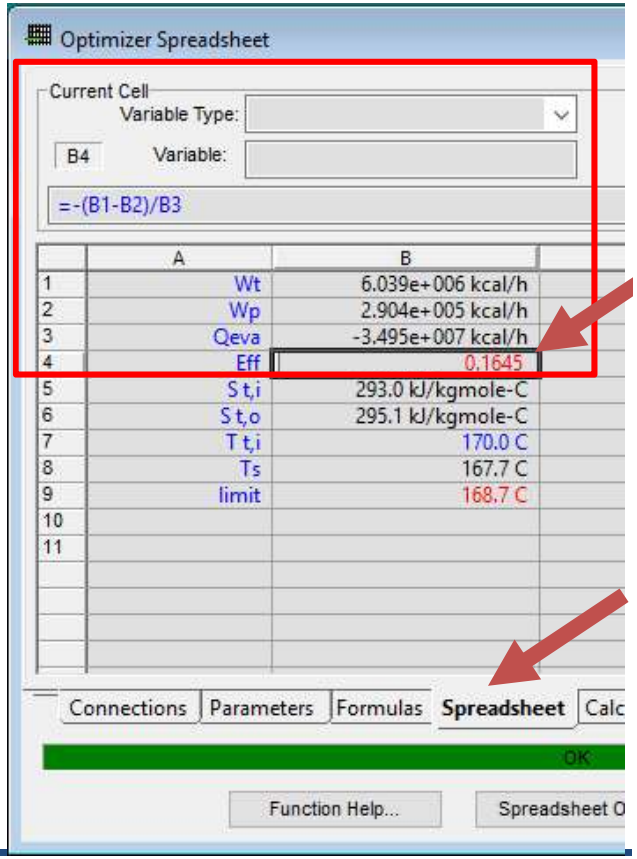


Ex. #2.6: ORC optimization

- Calculate efficiency of ORC
- Optimizing the cycle

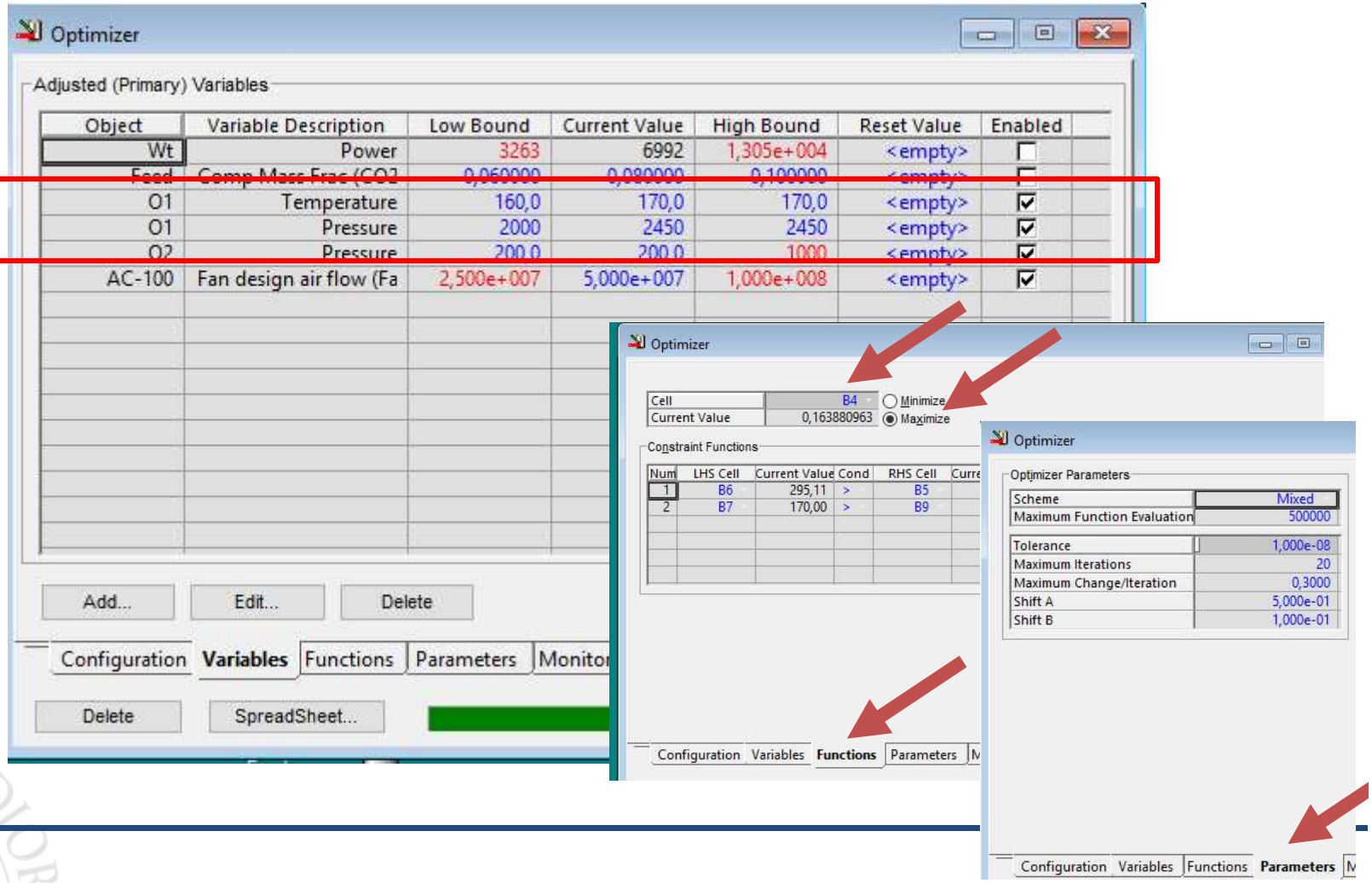






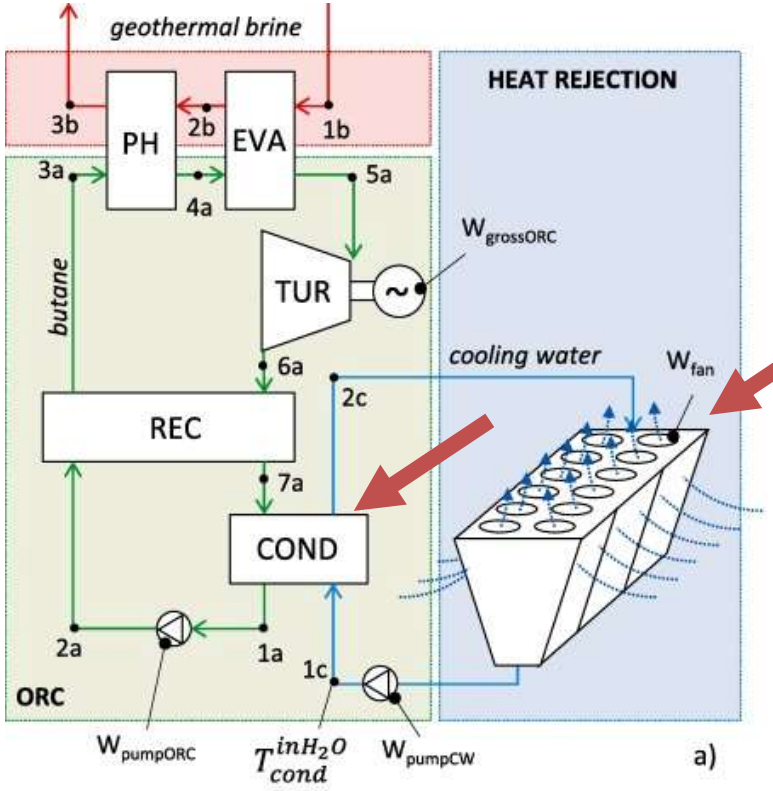
Ex. #2.6: ORC optimization

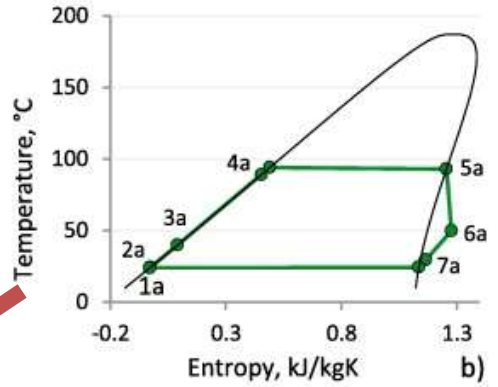
- Calculate efficiency of ORC
- Optimizing the cycle

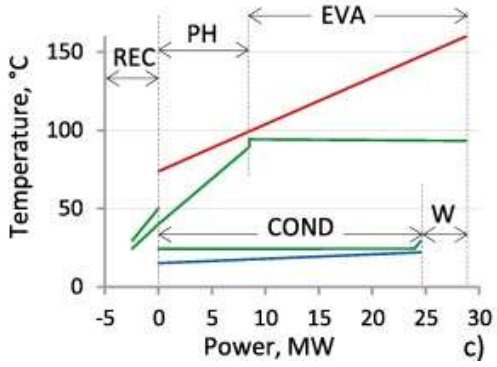


Ex. #2.2: ORC cycle

- Adding air cooler
- Adjust the air flow

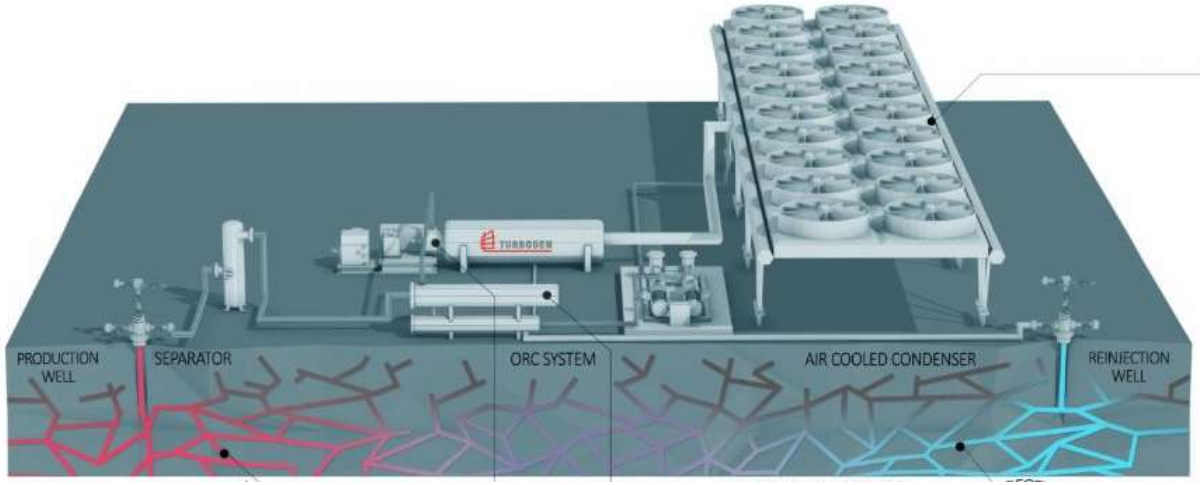






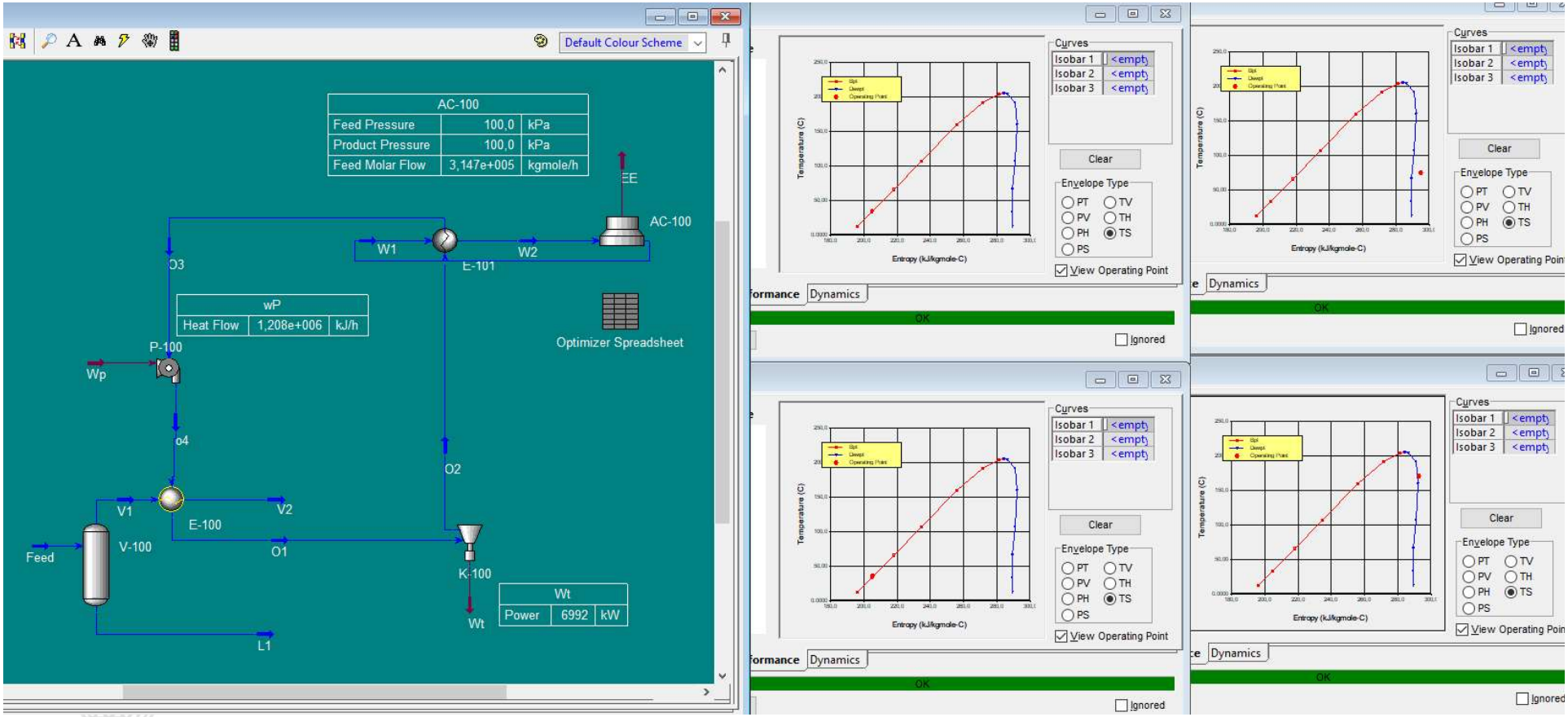
Ex. #1.5: Refrigeration Cycle

- Adding air cooler
- Adjust the air flow



INTRODUCTION

- Also we can optimize the air flow of air coolers…



- http://tiny.cc/0dokgz
- or
- https://bit.ly/2r9KUiR