Your Success, Our Pride.

Decarbonization by Innovative Energy Conservation Technologies *SUPERHIDIC*™ & HERO

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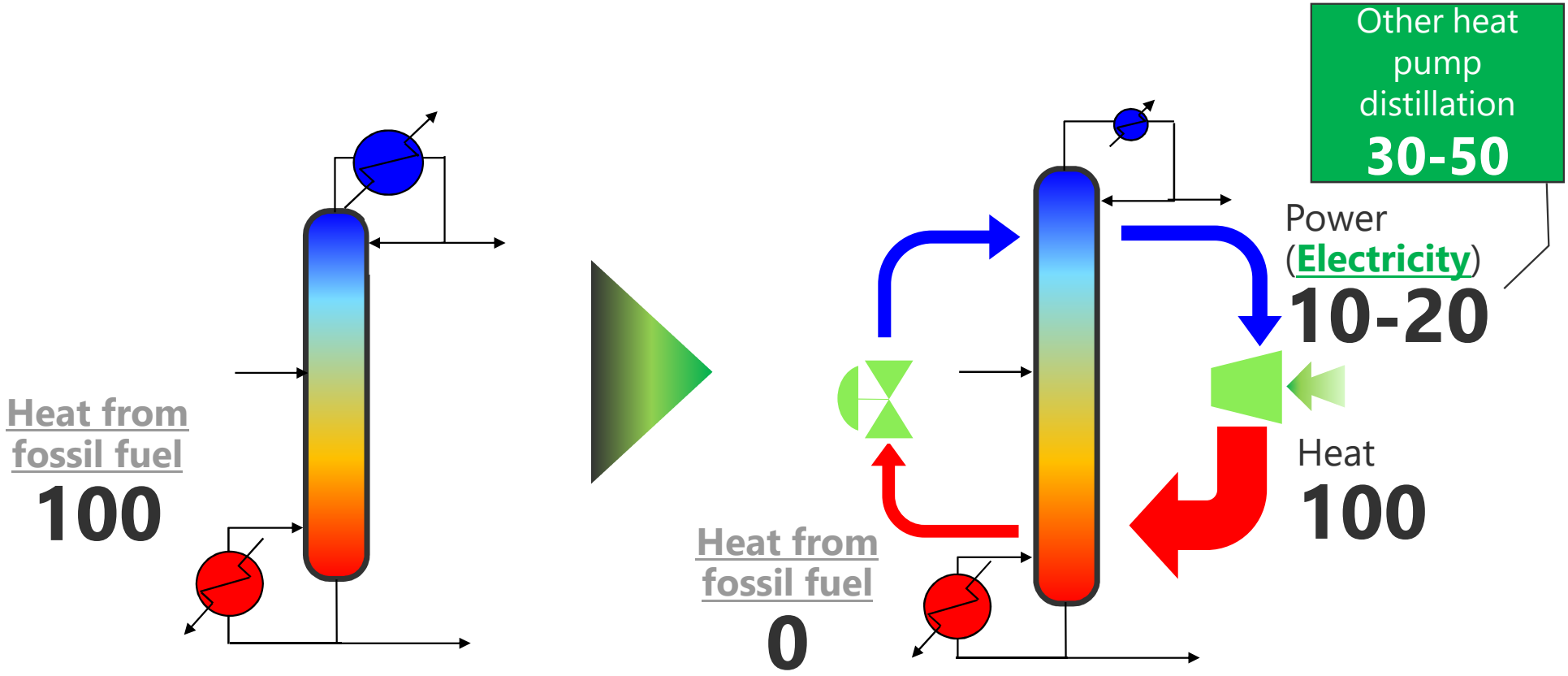
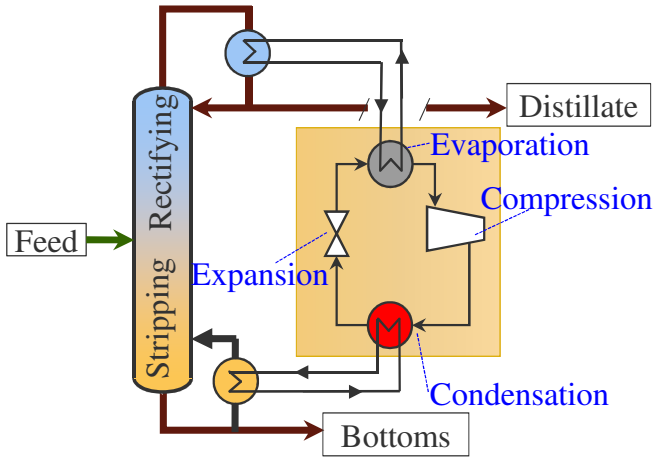
SUPERHIDIC™ Introduction
- What is *SUPERHIDIC*™ ? -

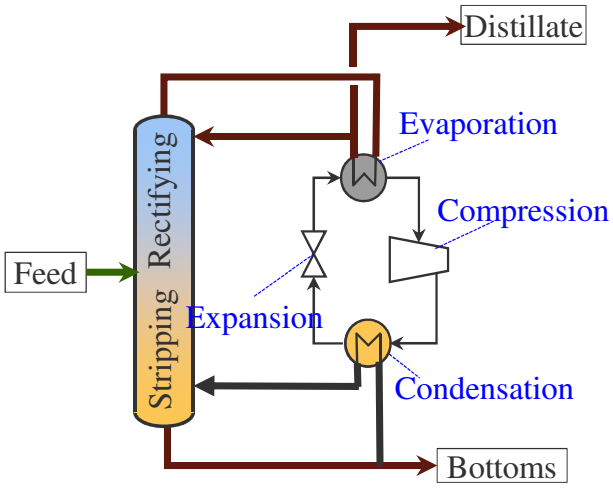


SUPERHIDIC™ Introduction
- Advantage of *SUPERHIDIC*™ to other heat pump -



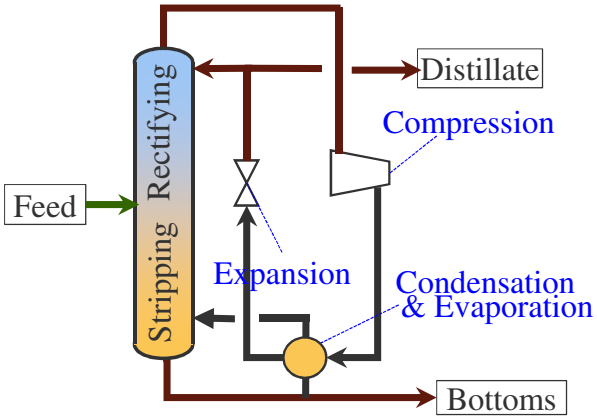
$\Delta T_{top\text{-}btm} + 4 \times \Delta T_{hex}$

Indirect Industrial Heat Pump Distillation



$\Delta T_{top\text{-}btm} + 2 \times \Delta T_{hex}$

Indirect Heat Pump Distillation



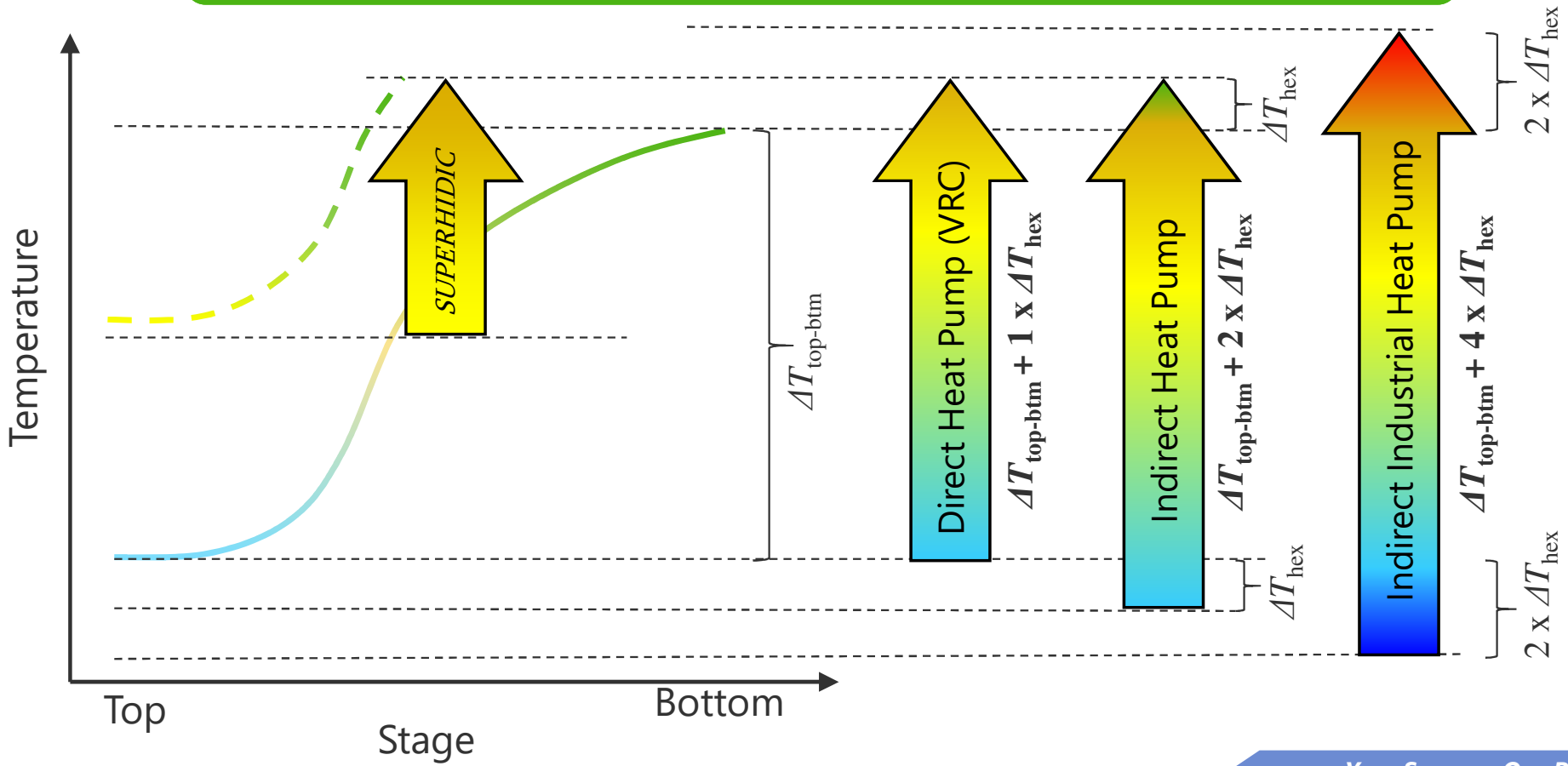
$\Delta T_{top\text{-}btm} + 1 \times \Delta T_{hex}$

Direct Heat Pump Distillation

- Acceptable temperature rise in heat pump system = "Less than 30 deg C"
- ΔT_{hex} : 5～10 deg C → 2 x ΔT_{hex} : 10～20 deg C, 4 x ΔT_{hex} : 20～40 deg C
- Almost no chance to apply these technologies in industrial application
  Allowable $\Delta T_{top\text{-}btm}$ → 20～25 deg C even in direct heat pump distillation

SUPERHIDIC™ Introduction
- Advantage of *SUPERHIDIC*™ to other heat pump -

Compression Ratio
SUPERHIDIC ≪ Other Heat Pump Distillation System



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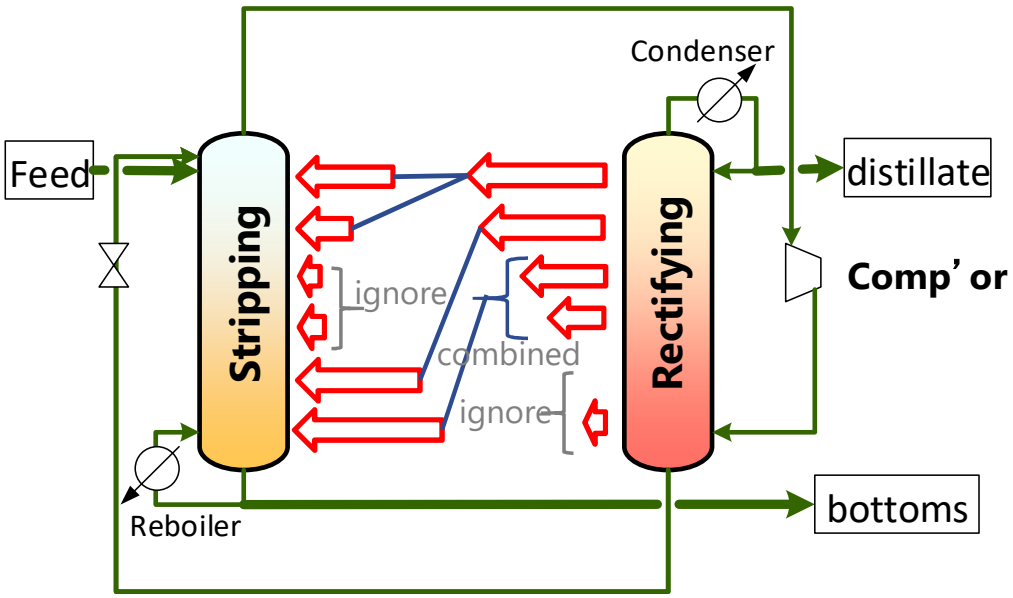
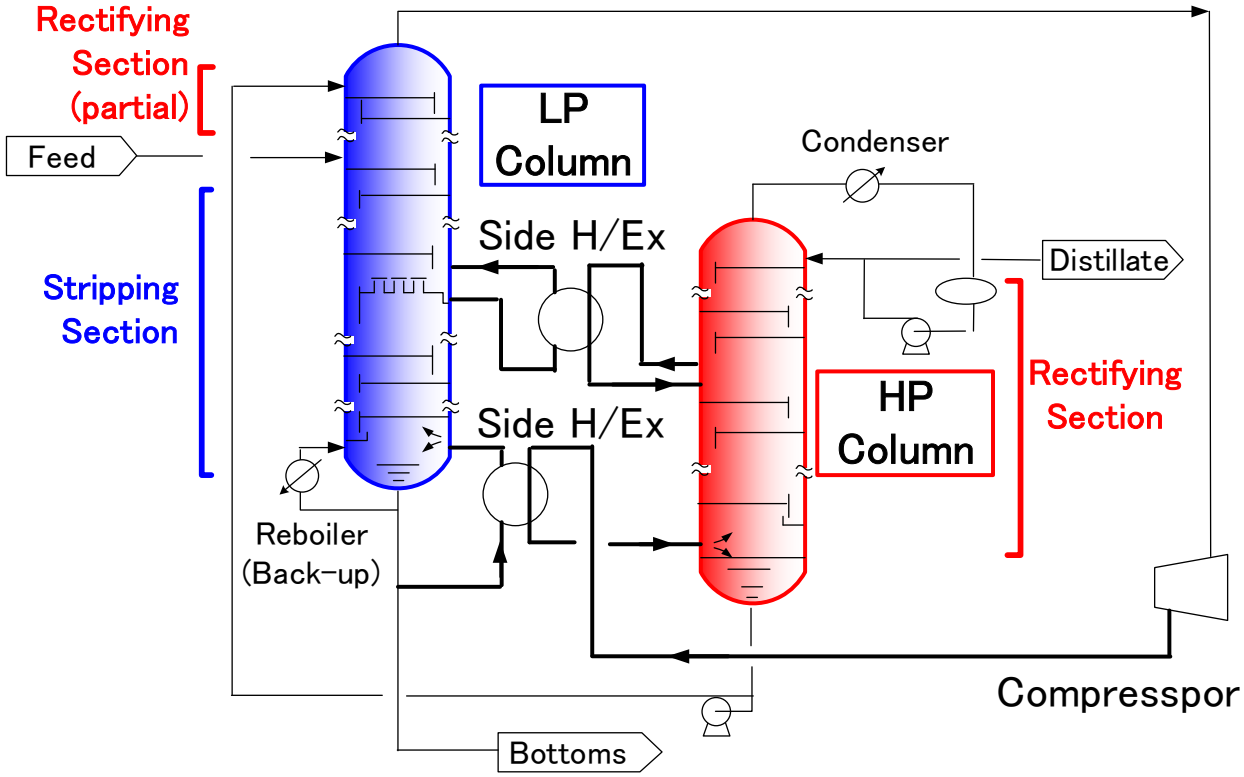


- Findings through intensive thermodynamics study
  - Ideal heat duty is dependent on the composition (stage).
    - ✓ Some composition may require heat while some others may not.
  - Heat at neighboring stages can be combined.
  - Minor heat can be ignored.
  - Stage(s) having similar demand for heat duty should be paired in heat-exchange.

SUPERHIDIC™ Introduction
- Feature of *SUPERHIDIC*™ -



- Side exchangers
  - Normal S/T type H/Ex
    - Externally installed S/T H/Ex
    - Stabbed-in H/Ex
  - Installed at the desired composition
    - → Freedom in pairing of stages
  - Heat transfer area is variable
  - Limited number (around 1-4)
- Column
  - Normal tray or packing

Existing column/HEx/drum/pump can be reused

Patent registered

SUPERHIDIC™ Introduction
- Reference -

In operation

- Methyl-ethyl-ketone Fractionator (Japan)

Licensor design package (under EPC bidding phase)

- C5 Super-fractionator (confidential)
- Alcohol fractionator (confidential)

Under negotiation for Licensing

- Isomerization Unit (confidential)
- LPG Fractionation Unit (confidential)
- Sour Water Stripper Unit (confidential)

SUPERHIDIC™ Introduction
- Reference -

Process Unit	Service Name	Energy Saving	Conv. Dist.	*SUPERHIDIC*®	
			Reb Duty	Reb Duty	Comp Power
		[%]	[MW]	[MW]	[MW]
MEK	MEK Fractionator	56	6.0	0	0.9
C5	C5 Super-Fractionator	47	12.9	0	2.45
Alcohol	Confidential	44	82.3	0	17.0
Isomerization	Confidential	58	36.8	0	5.2
LPG	Confidential	68	15.2	0	1.75
SWS	Sour Water Stripper	37	14.6	0.8	3.09

$$\text{Energy Saving } [\%] = \left(1 - \frac{Q_{\text{r-SH}} + W_{\text{SH}}/0.366}{Q_{\text{r-conv}} + W_{\text{conv}}/0.366}\right) \times 100$$

$Q_{\text{r-SH}}$: Reboiler duty in *SUPERHIDIC*® [MW]
$Q_{\text{r-conv}}$: Reboiler duty in current operation [MW]
W_{SH} : Compressor & pumps & AFC power in *SUPERHIDIC*® [MW]
W_{conv} : Compressor & pumps & AFC power in current operation [MW]

Synergy of *SUPERHIDIC*™ & HERO

① Focusing on Process Units

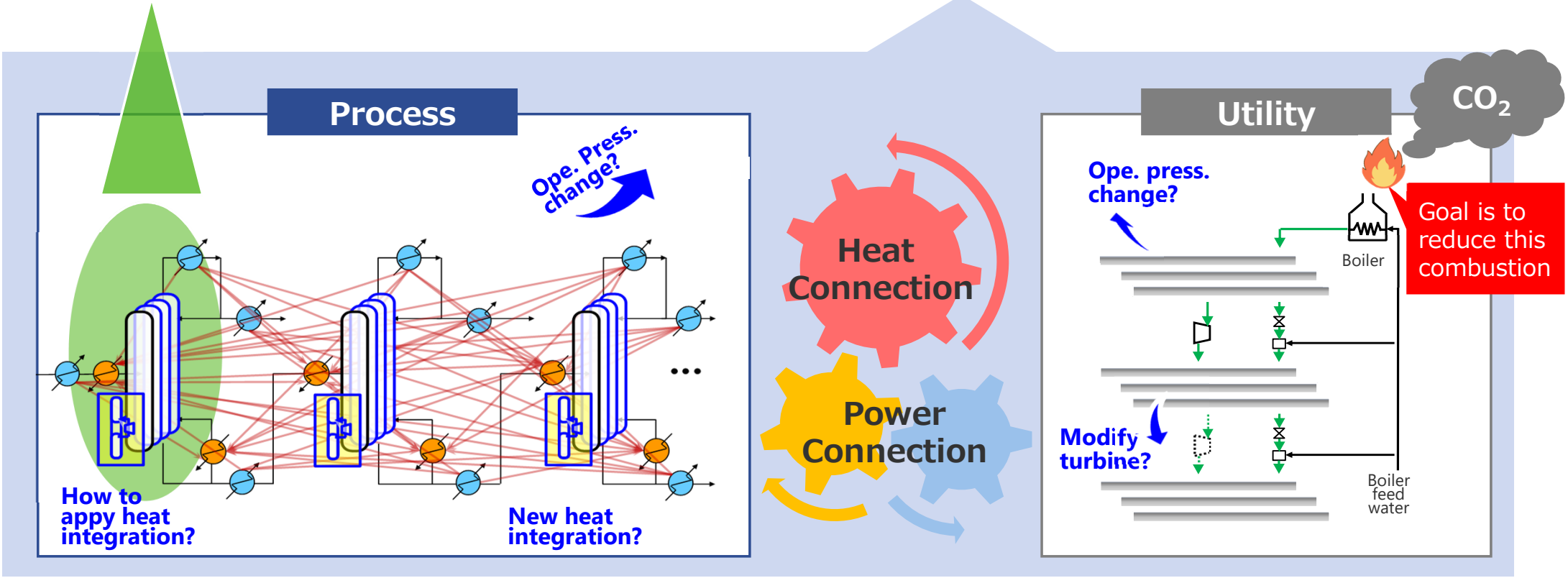
SUPERHIDIC ™

Innovative Energy Saving Distillation System

② Comprehensive Approach

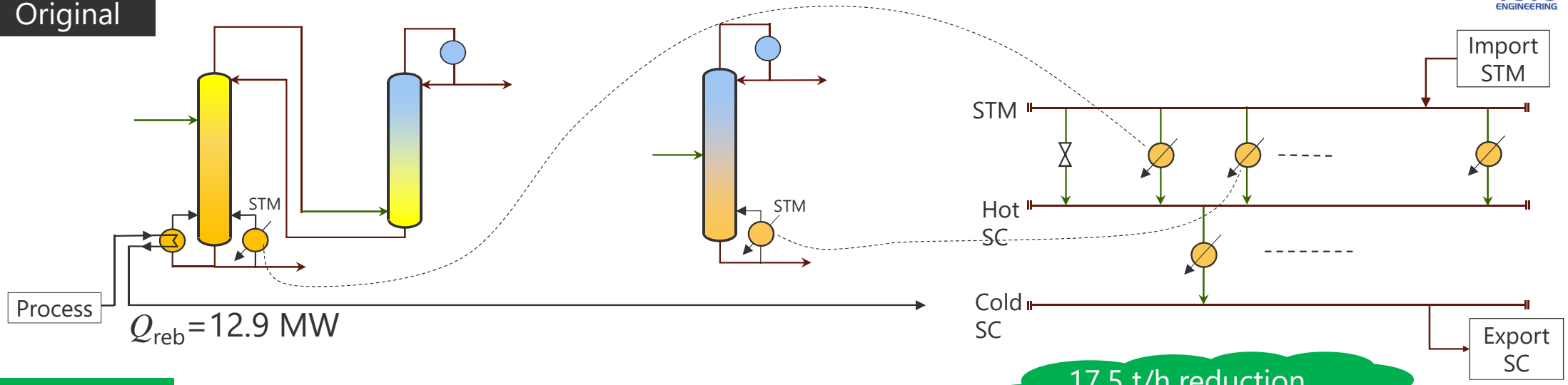
HERO

Mathematical Optimization Technology
to study astronomical number of PFD & UFD



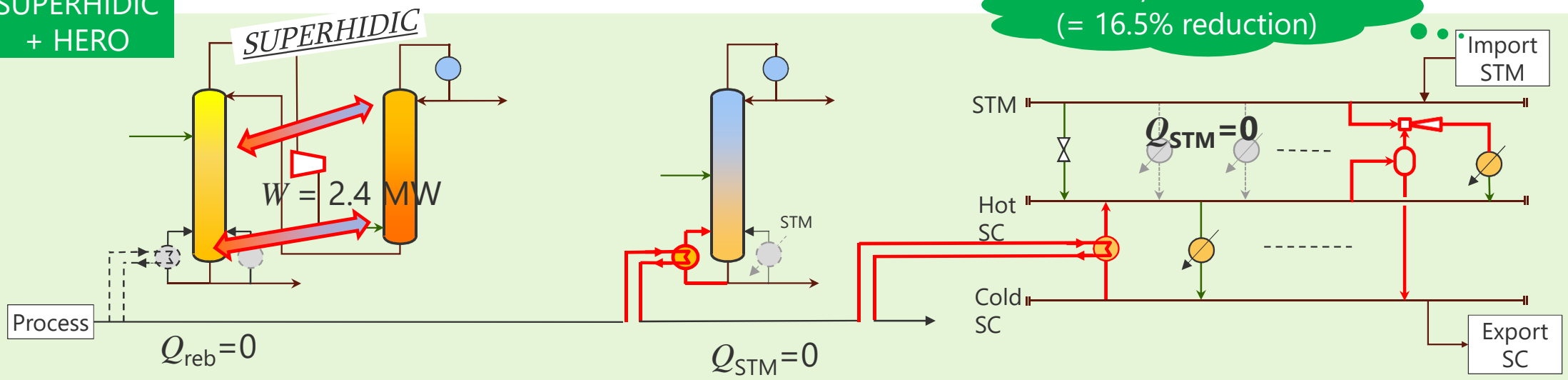
Synergy of *SUPERHIDIC*™ & HERO / Example

Original



SUPERHIDIC + HERO

17.5 t/h reduction
(= 16.5% reduction)



Conclusion

- *SUPERHIDIC*™ offers huge reduction of energy and chance of huge decarbonization

- Complicated usage of heat can be conquered by synergy of *SUPERHIDIC*™ and HERO

Thank you for your attention!!