The impact of process changes to a heat pump’s performance

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1. Deployment pathways & strategies
2. Case study: Biodiesel production
3. Take-aways
4. Future work
Deployment pathways & strategies

1. Brownfield approach
2. Greenfield approach
3. Expertise-based approach
Case study: Biodiesel production
Selected CO$_2$-mitigation options
(recap) Pinch analysis
GCC of the current biodiesel production process
Changes in the heat profile

(A) Layout 1 and 3: original

$Q_{req} = 2.4 \text{ MW}$

$Q_H = 1.9 \text{ MW}$

$Q_C = 1.4 \text{ MW}$

(B) Layout 2 and 4: HP

$Q_{req} = 0.6 \text{ MW}$
Changes in the heat profile

Layout 5: DWC

$Q_{\text{req}} = 1.8 \text{ MW}$

Layout 6: DWC + HP

$Q_{\text{req}} = 1.8 \text{ MW}$ (infeasible)
Changes in the heat profile

Layout 7: MR

\[ Q_{req} = 1.9 \text{ MW} \]

\[ Q_U = 1.5 \text{ MW} \]

\[ Q_C = 1.1 \text{ MW} \]

Layout 8: MR + HP

\[ Q_{req} = 0.5 \text{ MW} \]
Changes in the heat profile

Layout 9: MR + DWC

- \( Q_{\text{req}} = 1.7 \text{ MW} \)
- \( Q_H = 0.2 \text{ MW} \)
- \( Q_C = 0.1 \text{ MW} \)

Layout 10: MR + DWC + HP

- \( Q_{\text{req}} = 1.5 \text{ MW} \)
Combined CO$_2$ reduction: outside-in
Combined CO$_2$ reduction: inside-out
Combined CO₂ reduction: ideal combination
• Decarbonize from a heat integration perspective to avoid loss of capital or lock-ins

• Outer sections are more sensitive to the deployment of measures in the inner sections.

• Application of tools like MACC should only be applied under very stringent conditions.
Future work: Process Change Analysis

- Extracted process (heat pump connections)
- Background process (other processes)
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Specialization
- smart electrification
- heat integration
- heat storage
- applied research

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