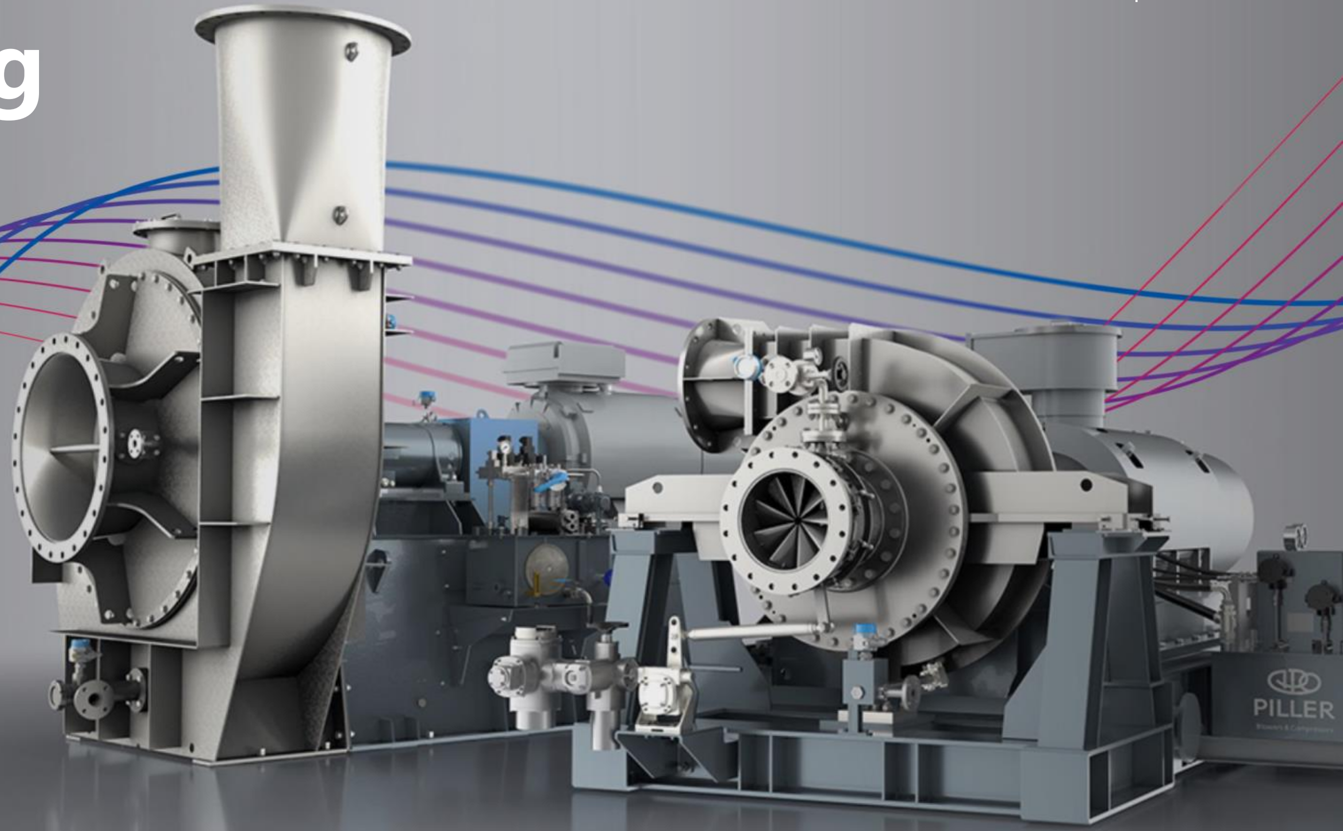
# Energy Efficiency in Petrochemical Processing

## MVR Application Profile



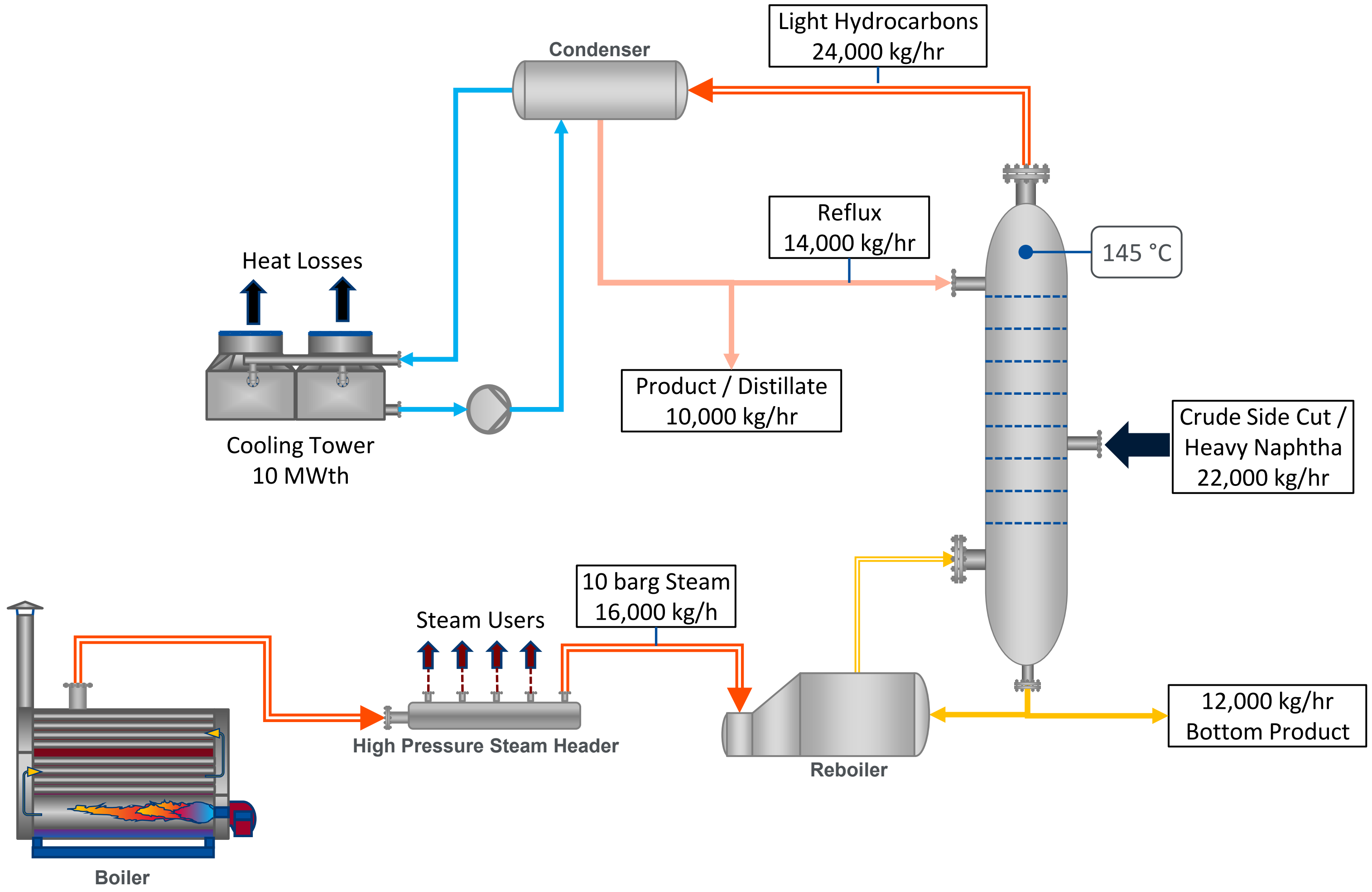
APPLICATION PROFILE

# MVR for high temperature condenser heat recovery

- In high-temperature separations like gas sweetening or petrochemical processing, distillation columns' reflux condensers can operate at >100°C.
- Specialized fractionation units (e.g., deethanizer or debutanizer columns) often have condensers designed to handle process vapor temperatures between 100–200°C.
- This heat is usually rejected to the atmosphere which can be profitably reused with Mechanical Vapor Compression.

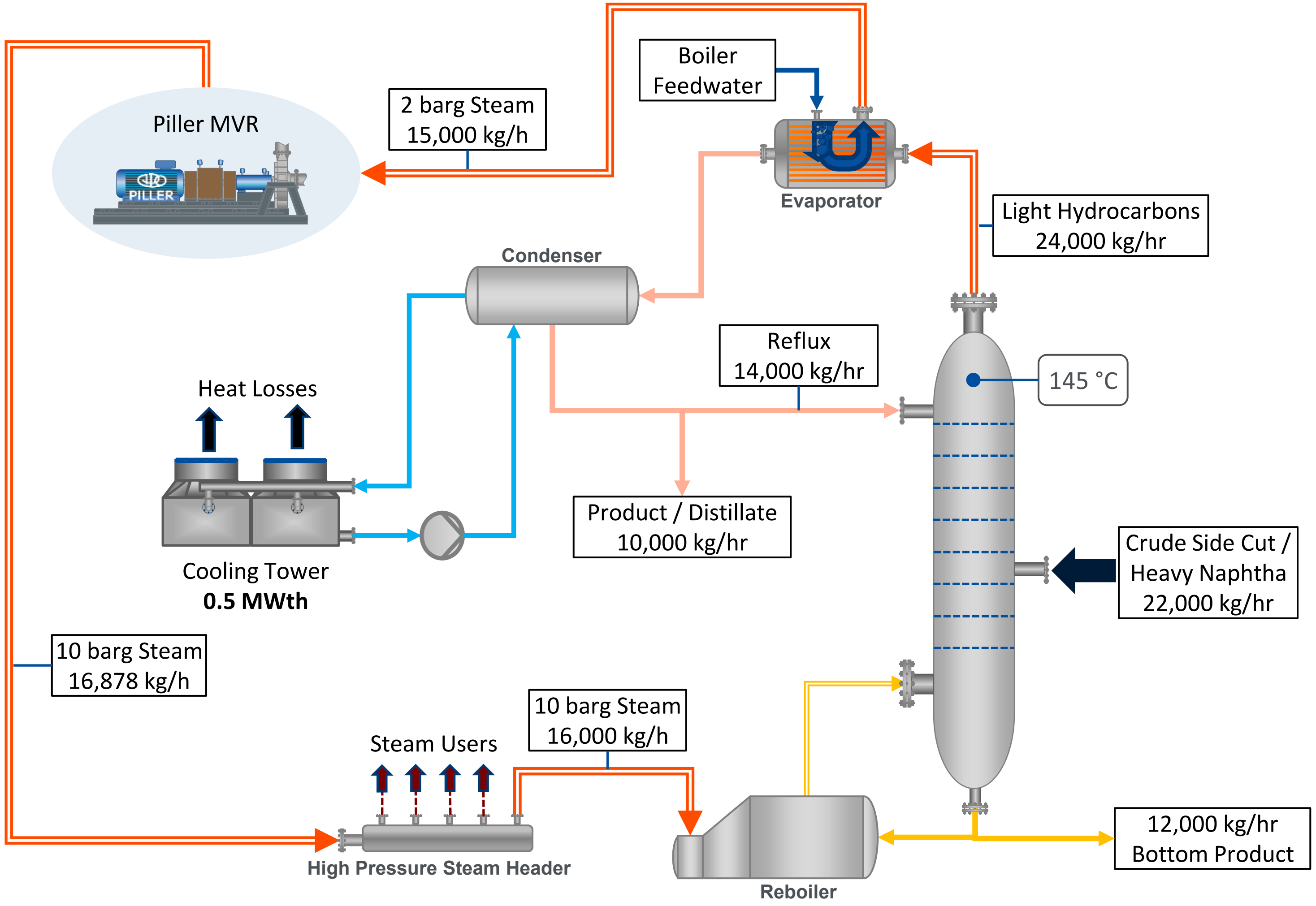
# Before: Heat Available in Reflux Condenser is Wasted

- The condenser removes the overhead vapor's latent heat so the vapor can turn into liquid reflux and distillate, which is essential for maintaining separation in the column.
- Most of that heat is not reused directly in the process, so it is rejected to cooling water or air and becomes wasted energy.
- The larger the condenser duty, the more utility power is consumed upstream and the more heat the cooling system must carry away, which increases operating cost.



# After: Latent Heat Recovered with MVR

- An evaporator recovers heat from overhead vapors to deliver 2 barg steam.
- To make the recovered steam usable, a multi-stage MVR system is installed which compresses steam to 10 barg, the same pressure required by reboiler.
- This eliminates need for boiler steam except at startup.
- In this example, the heating **COP is 5.8**. For every unit of electricity consumed by the compression system, 5.8 units of useable thermal energy is delivered to the process.



# Payback

## OPEX Before MVR

| Steam and Generation with Natural Gas Boiler | | |
|---|---|---|
| Steam Generation | kg/h | 16,878 |
| Steam Pressure | bar(g) | 10 |
| Steam enthalpy | kJ/kg | 2000 |
| | $MW_{th}$ | 9.5 |
| **Annual NG cost** | **$/yr** | **1,695,768** |

| Cooling with Cooling tower water | | |
|---|---|---|
| Cooling Demand | MWth | 10 |
| CT flowrate | $m^3/h$ | 860 |
| Evaporation Loss | million $m^3$/year | 0.14 |
| **Annual Water cost** | **$/yr** | **57,024** |

## OPEX After MVR

| Heat Recovery with MVR | | |
|---|---|---|
| MVR Electricity consumption | MWh | 1.49 |
| **MVR COP** | | **5.8** |
| **Annual Elec cost** | **$/yr** | **875,532** |

| Water Cost with MVR | | |
|---|---|---|
| Cooling Demand | MWth | 0.5 |
| CT flowrate | $m^3/h$ | 43 |
| Evaporation Loss | million $m^3$/year | 0.007 |
| **Annual Water cost** | **$/yr** | **2,851** |

| Savings | | |
|---|---|---|
| Annual Energy | $/yr | **820,236** |
| Annual Water | $/yr | **54,173** |
| Carbon | tCO2/yr | **19,581** |

| Utility Capacity Unloaded | | |
|---|---|---|
| Cooling Tower | MWth | **9.5** |
| Boiler Steam | kg/hr | **16,878** |

| Assumptions | | |
|---|---|---|
| Boiler eff | % | 80% |
| Operation Hour | hour/year | 8,400 |
| Water Cost | ¢/$m^3$ | 40 |
| Elec cost | $/MWh | 70 |
| NG cost | $/MWh | 17 |
| **NG/Elec cost** | | **4.1** |

# Typical Payback 4-6 Years

# Your Contact

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# Thank You!

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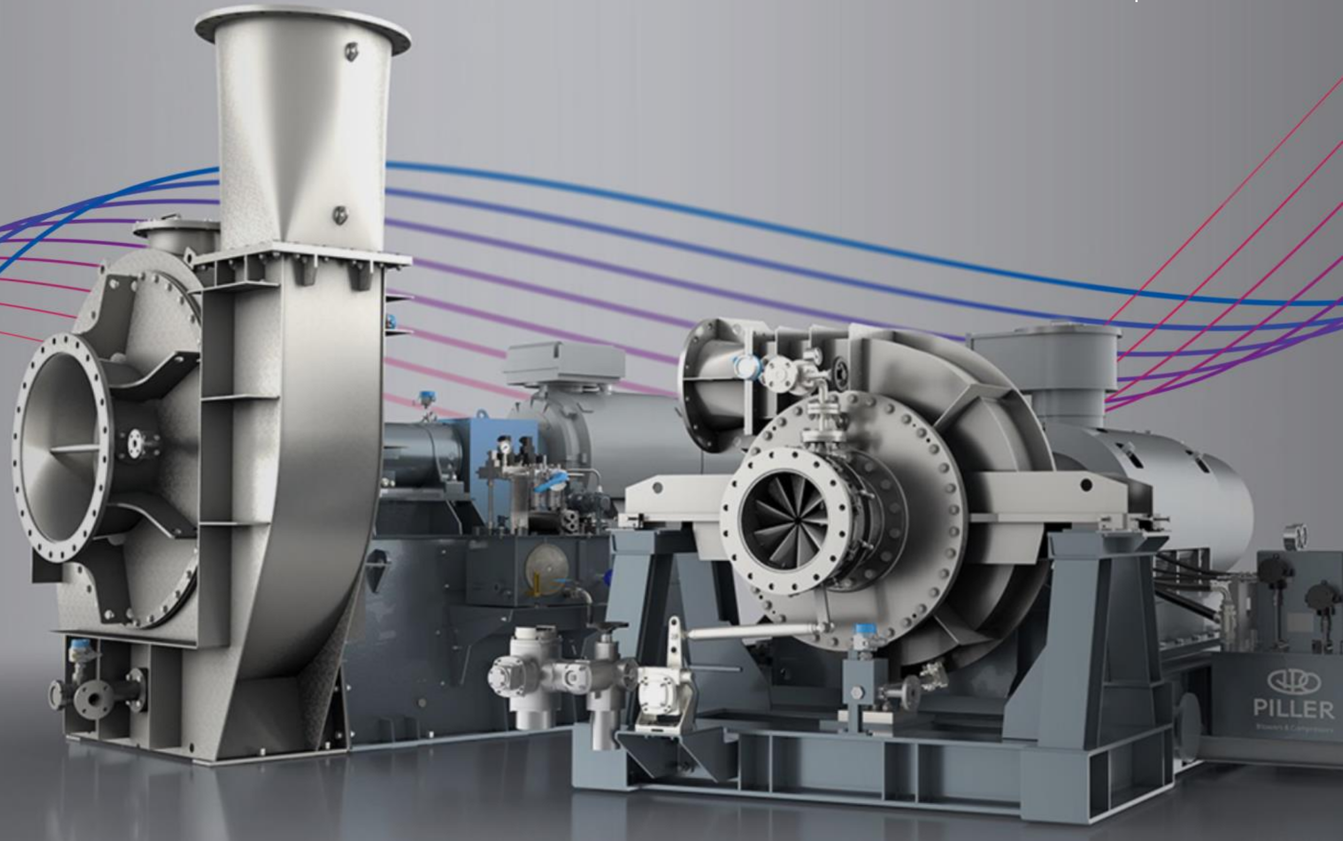


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