



EVAPORATION TECHNOLOGY AS

MULTI-STAGE STEAM PRODUCING HEAT PUMPS BASED ON MVR
WoodWorks! Cluster, December 2021



AGENDA

- Short about EPCON
- MVR-HP characteristics
- Case studies
- References
- Summary



Who is EPCON



KEY FACTS

- Specialist in energy efficient MVR thermal separation / evaporation, more than 150 plants delivered since 1986, whereof more than 100 plants with MVR
- Supplies turnkey plants, both standardized or tailor made.
- Located in Trondheim, Norway
- 16 employees
- Turnover 2016-2020 average EUR 10 mill

Markets

Industries

Focused industries

- Process industry
- Biomarine industry
- Food industry
- Biofuel industry



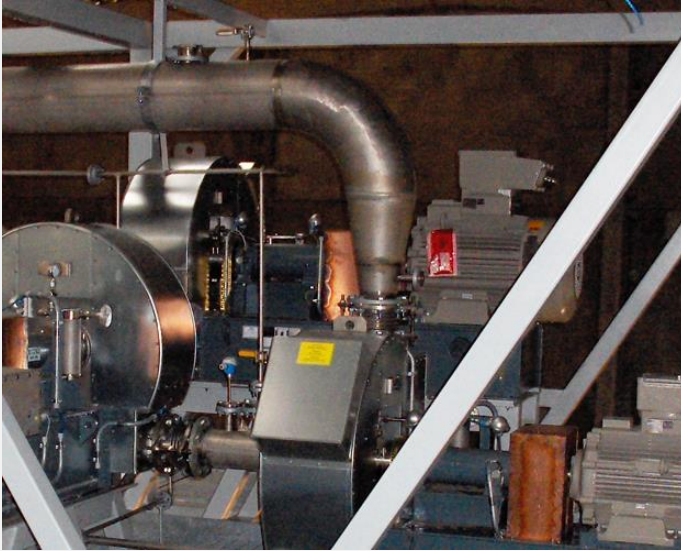
Products

EPCON products



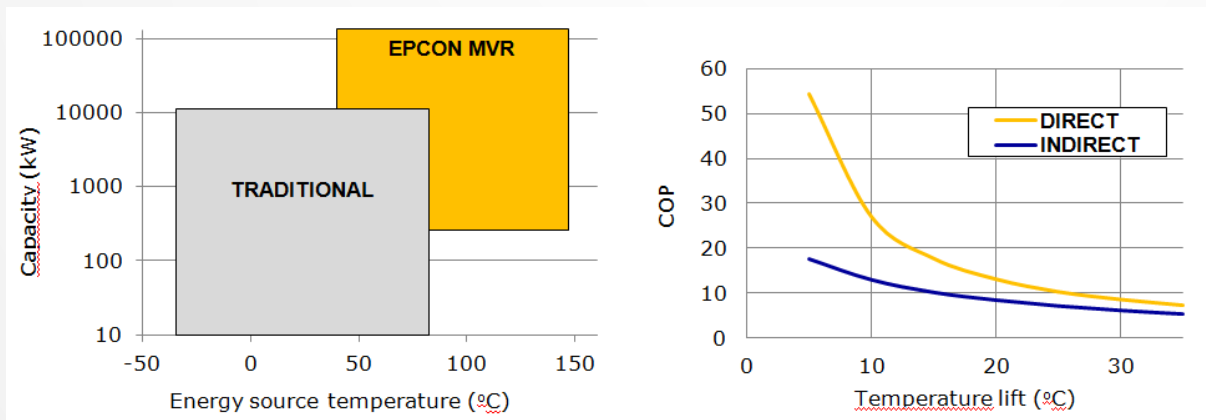
- Falling film evaporators
- Forced circulation evaporators
- Combined evaporators
- Compact evaporators
- Flash coolers
- Biogas reject water treatment plants
- Industrial MVR heat pump
- After sales services
- Test work in pilot plants

MVR HP



Characteristics of MVR-HP

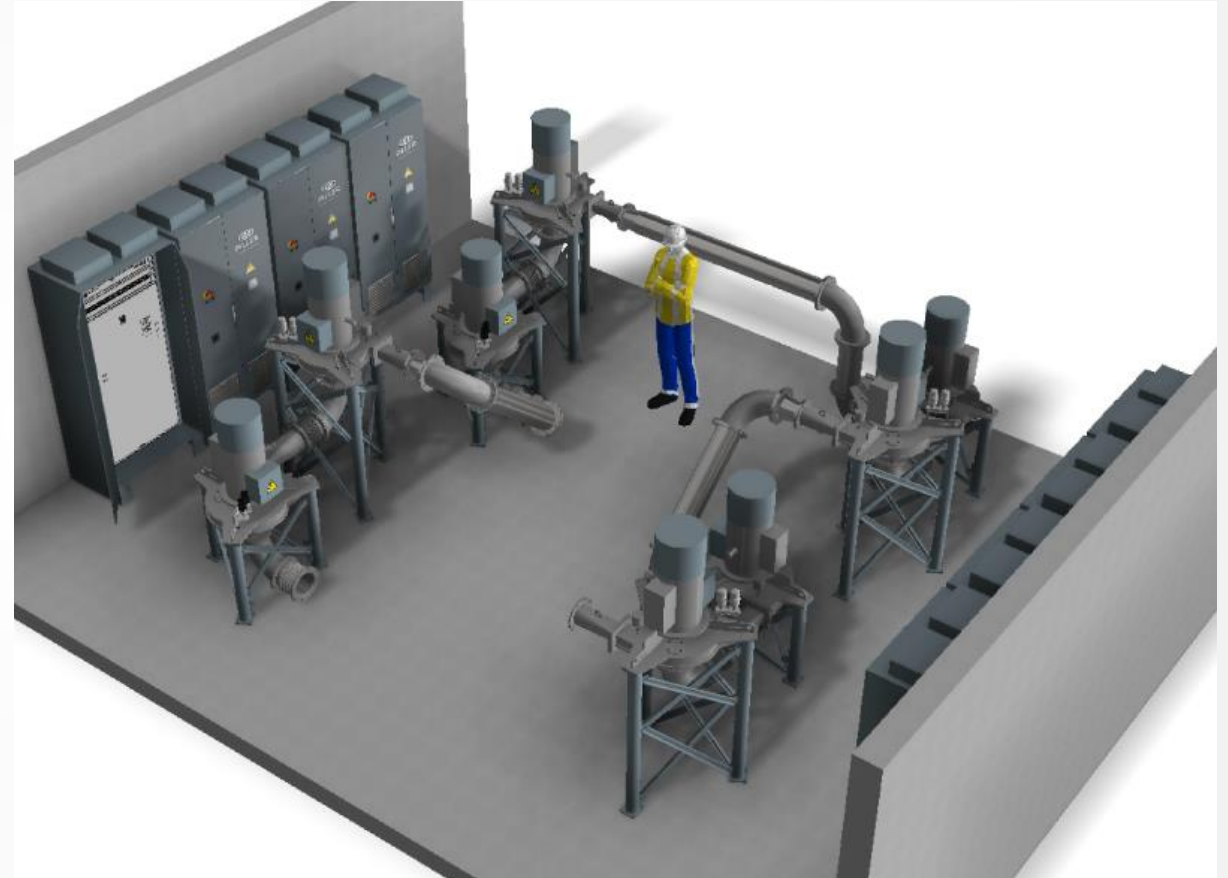
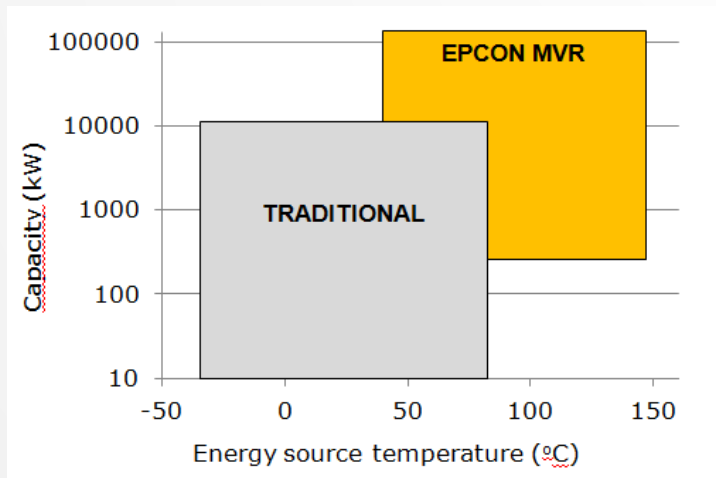
- Open / partly open circuit with water, alcohols or other solvents
- Closed circuit with water as working medium
- Energy sources: process vapour (water, alcohols, etc.) or hot liquid
- Energy sources return temperature: $>50^{\circ}\text{C}$
- Energy supply temperature range from 60°C to 150°C
- Steam can be supplied directly to energy sink
- De-superheating by direct water injection
- Multi-stage mean flexible vs heat sources / -sinks and optimized COP
- Heat output: 200 kW to >100 MW
- COP (Coefficient Of Performance): ~ 4 to >20



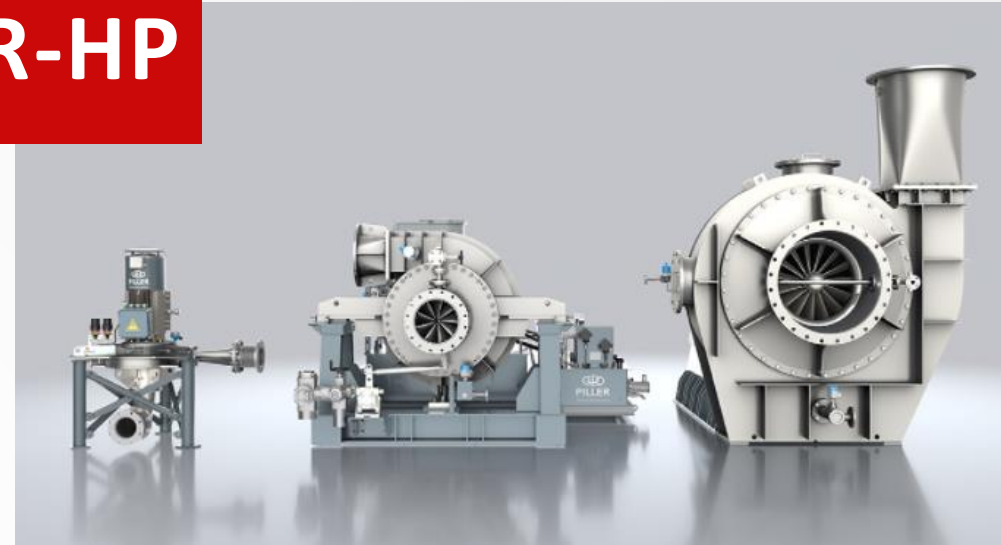
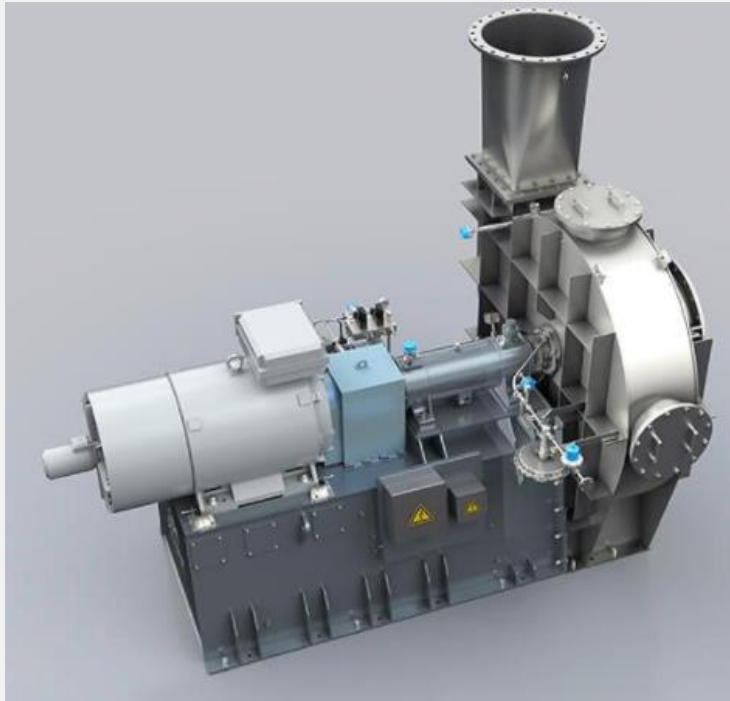
Applications

Typical applications well suited for MVR-HP

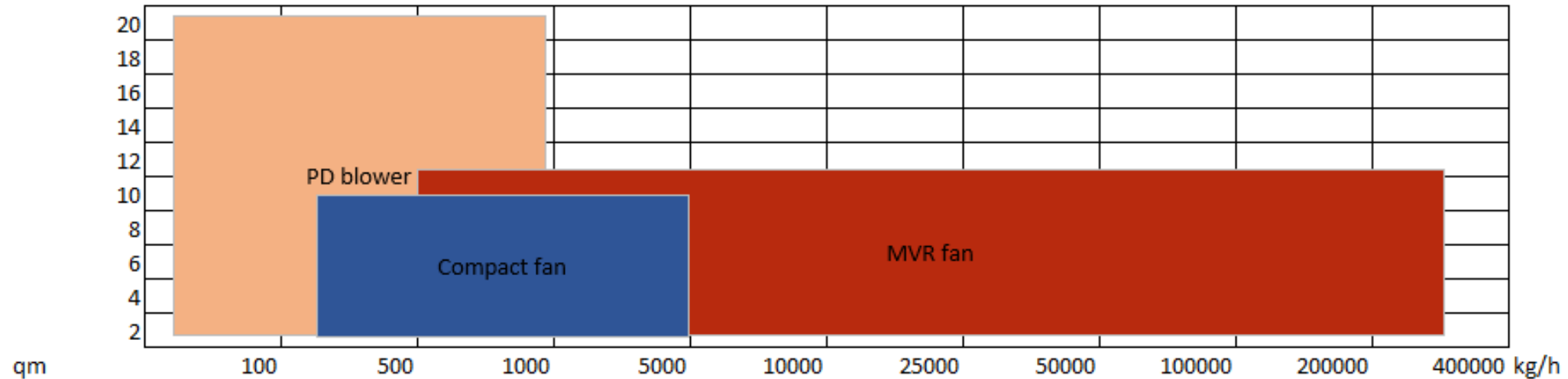
- Evaporators
- Multiple effect evaporators
- Distillation processes
- District heating
- Dryers
- Reactors / boilers
- Waste heat



MVR machinery in EPCON MVR-HP



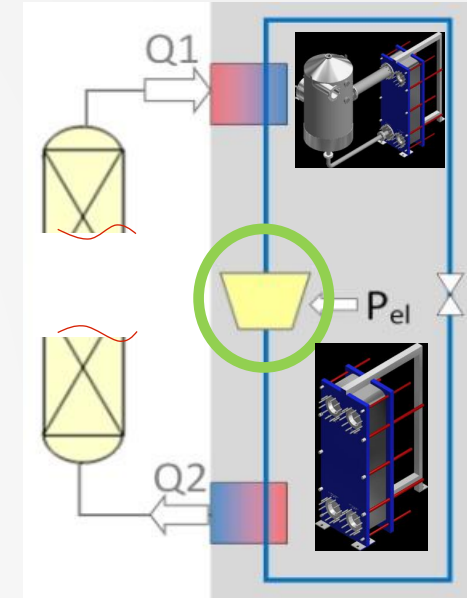
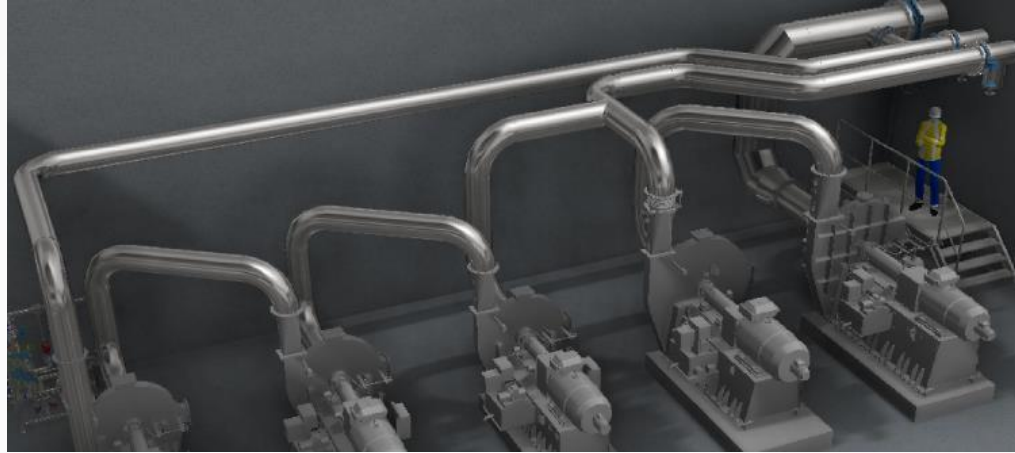
dT C



Case study

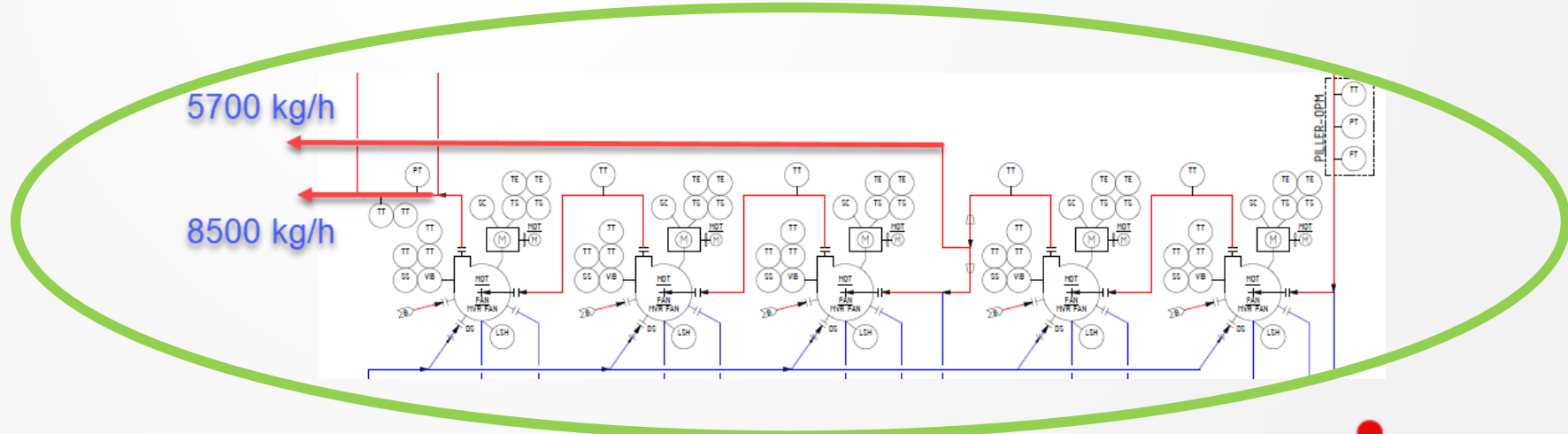
Closed MVR-HP circuit

MVR-HP in distillation process –
2x top solvent vapours latent
heat recovered and supplied as
water vapour to 2x reboilers



Main data:

- Medium: water vapour
- Temp. inlet MVR1: 103°C
- Temp. outlet MVR2: 123°C
- Temp. outlet MVR5: 148°C
- dT, total: 45°C
- Energy cons. (P_{el}): 1050 kW
- Energy supply: 8600 kW
- COP: 8.2



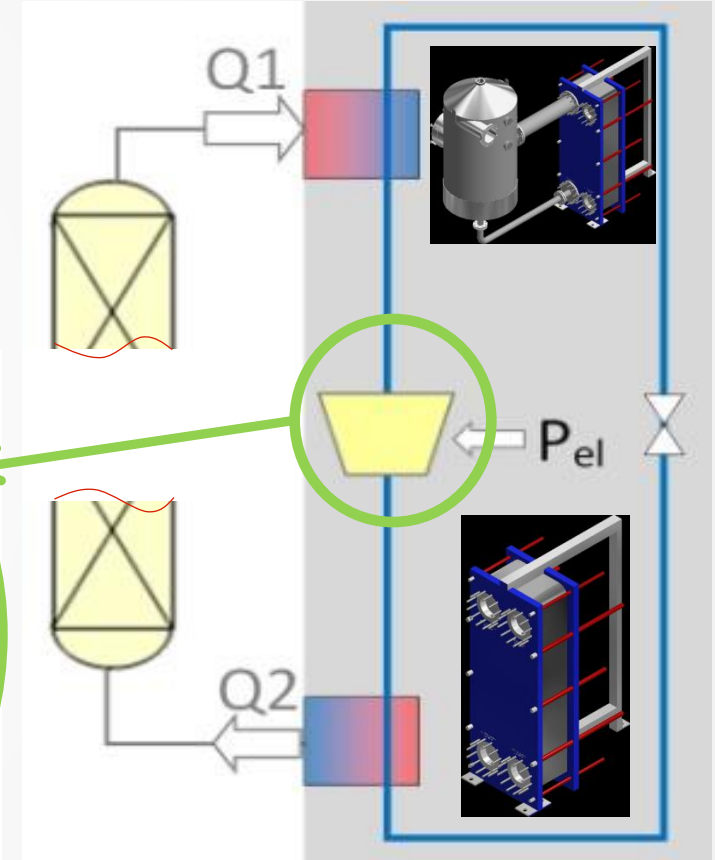
References

Closed MVR-HP circuit

MVR-HP in distillation process - top vapour latent heat recovered and supplied as water vapour to reboiler

Main data:

- Temp. source (Q1): 80°C
- Supply steam (sat.): 90°C
- Energy cons. (P_{el}): 50 kW
- Energy supply (Q2): 650 kW
- COP: approx. 13



Summary

- EPCON`s MVR Heat Pumps cover a wide range of applications within a number of industries, either standardized units or tailor made systems.
- Water as working medium has many advantages, among others:
 - Environmentally friendly working medium
 - Water based heat source could be directly used as working medium
 - Multi-stage mean flexible design versus heat sources / -sinks, giving also optimized COP
 - Recovered energy can be supplied as direct water steam to energy sinks
- The MVR machinery used is robust and well proven technology from European leading suppliers, which EPCON has used since 1986 in more than 100 MVR projects.
- EPCON is close to ongoing development work, which will widen up the future applications- and MVR compressor range even further.