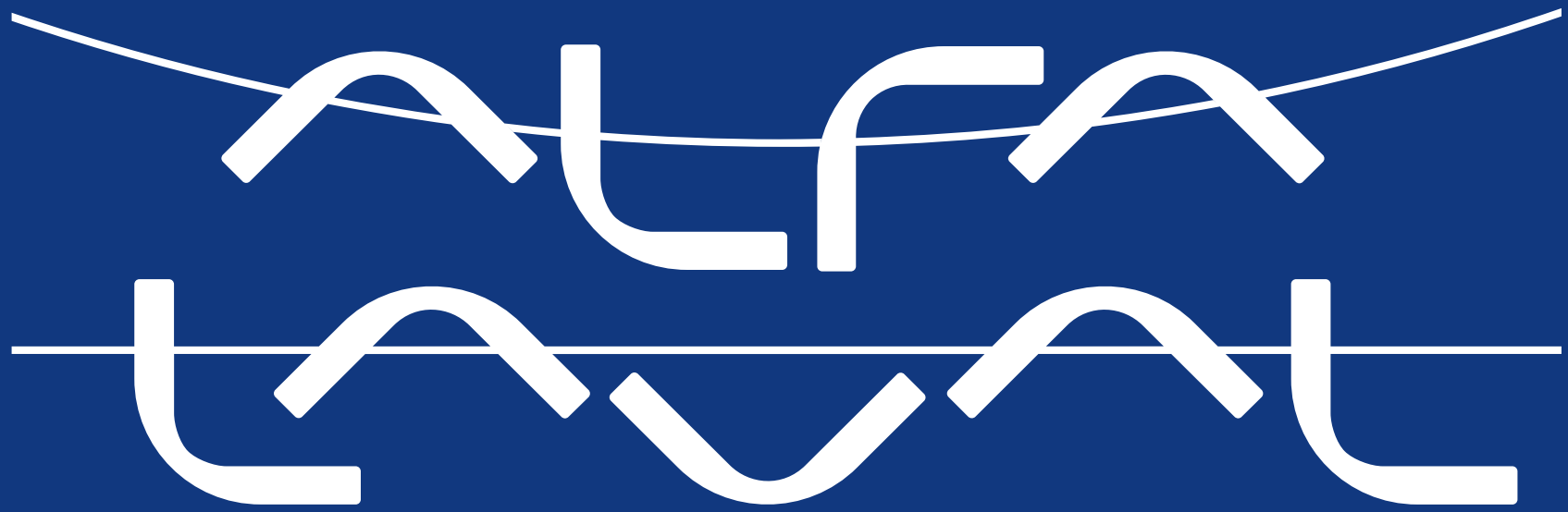
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Heat pump

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Lets talk about Industrial Ammonia Heat Pumps

Superior Energy Efficiency with Alfa Laval Plate heat exchangers

Tommy Angback
Sales Director Refrigeration at Alfa Laval

October 14th , 2020

Low value heat sources

– Reason for using Heat Pumps

Heat pump

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Why Heat Pumps?

Industrial Heat pumps makes it possible to use waste or natural low temperature heat for space or industrial process heating.

Typical heat sources are sea water, ground water or waste heat from industries, refrigeration plants and data centers mainly used for:

Industrial Process

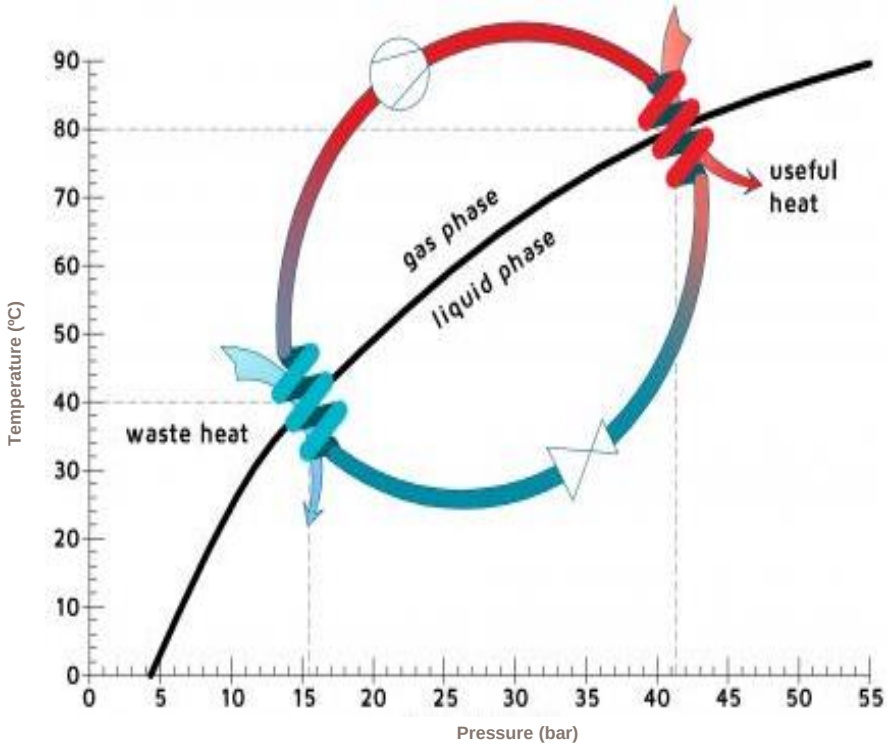
They are connected to dehumidification, distillation and evaporation processes, but also for water heating and combined heating and cooling.

District heating

Heat pumps are successfully connected to district heating systems or in combined district heating and cooling systems.

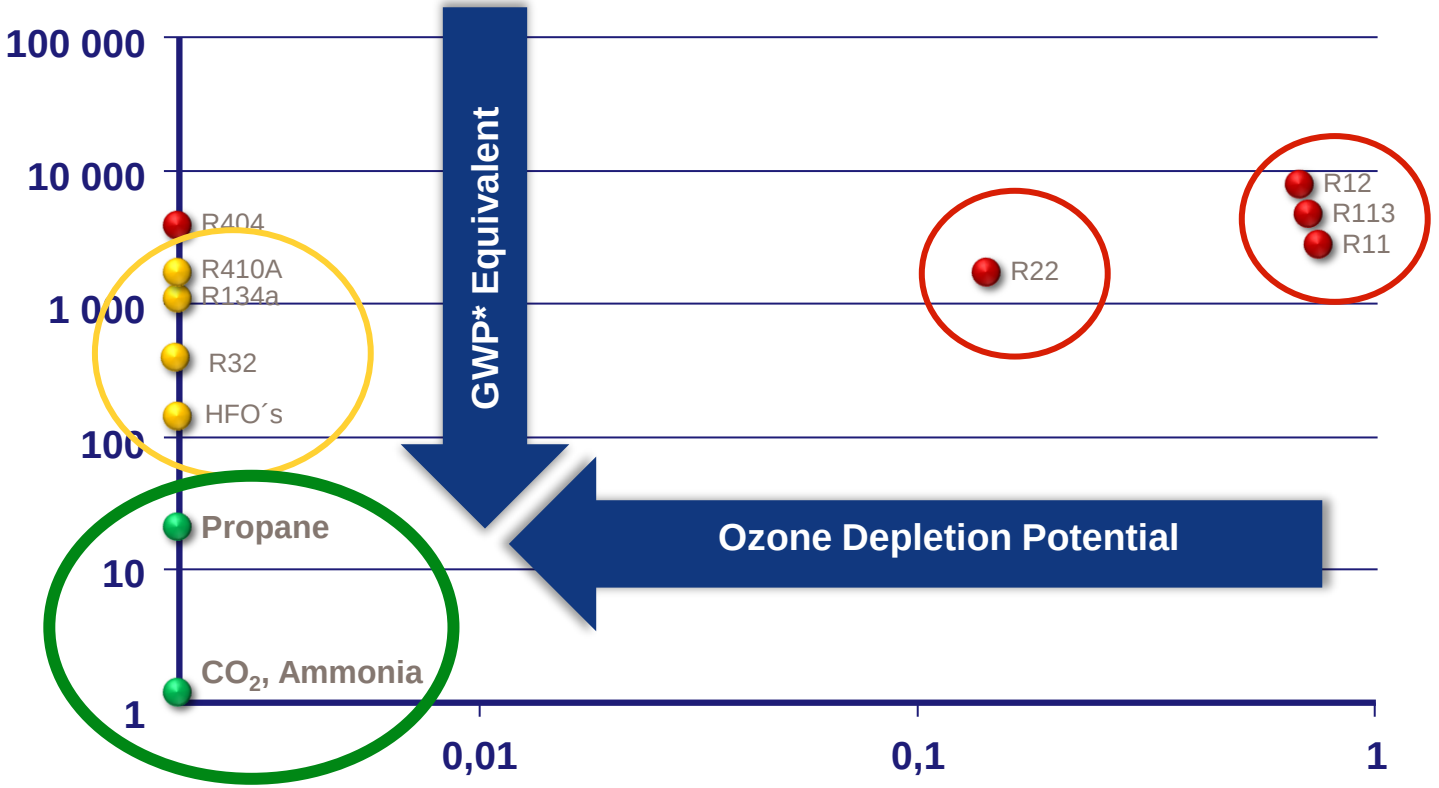
Commercial buildings

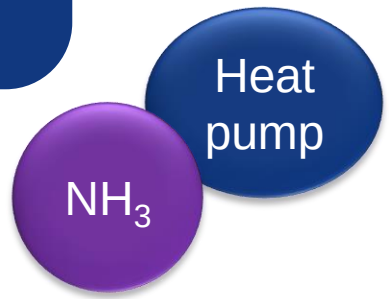
Heat pumps are connected to water loops (hydronic) for heat and cold distribution.



Why Ammonia

– Highly efficient future proof refrigerant





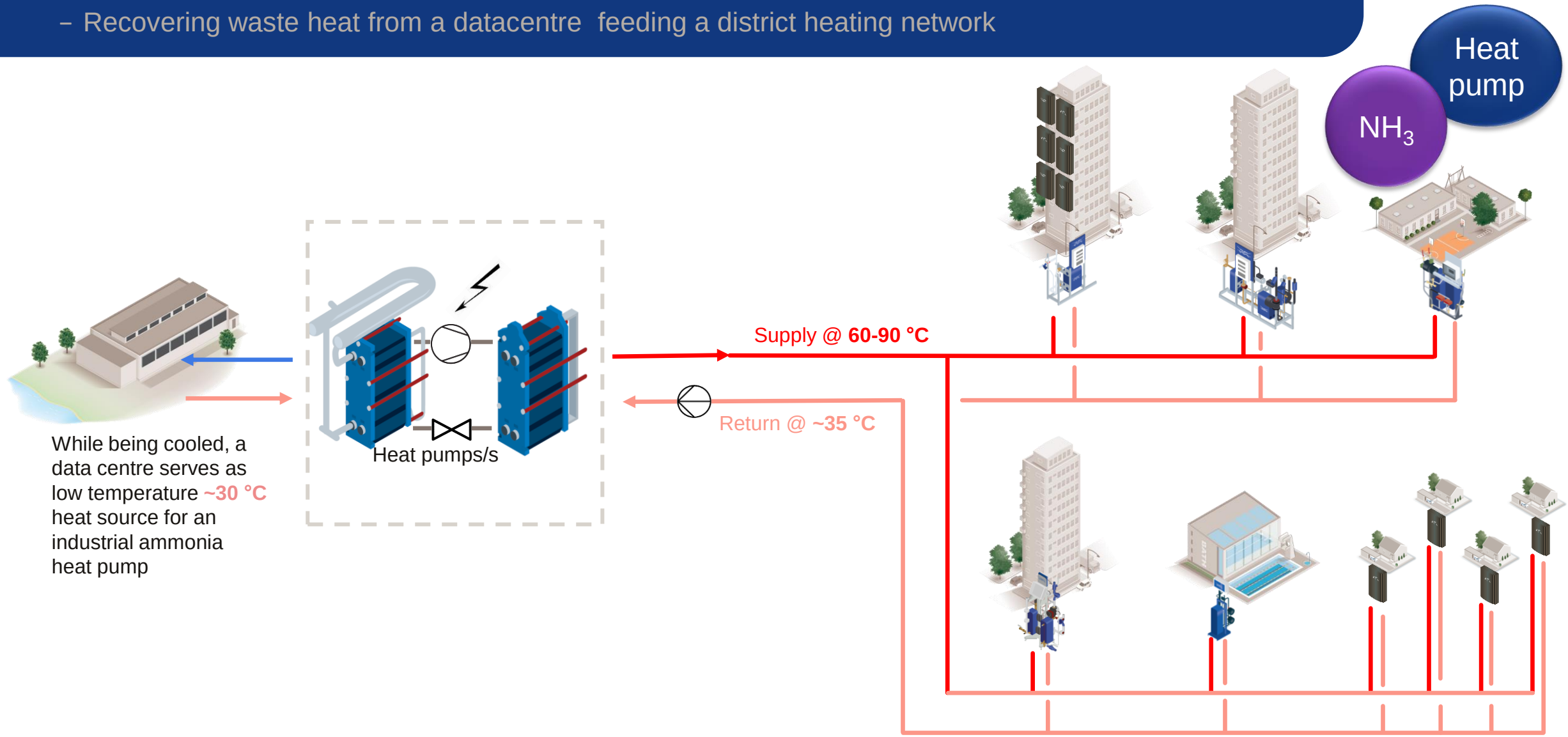
- GWP=0
- ODP=0
- High volumetric capacity
- More effective and cheaper than synthetic alternatives
- Lowest total lifetime cost
- Known for centuries as a refrigerant and will stay

Remember

- Classified as Fluid Group 1 in PED (toxic, corrosive, and moderately flammable), so special legal requirements may apply
- No ATEX requirements for normal ammonia plants except for machine-room ventilation in special cases
- Copper and its alloys are not allowed as material
- Oil draining required

Industrial Heat Pump-example of application

– Recovering waste heat from a datacentre feeding a district heating network



Heat Pump Impact – How Alfa Laval semi welded plate heat exchanger increases the COP

Efficiency (COP) of the Heatpump

Heat pump

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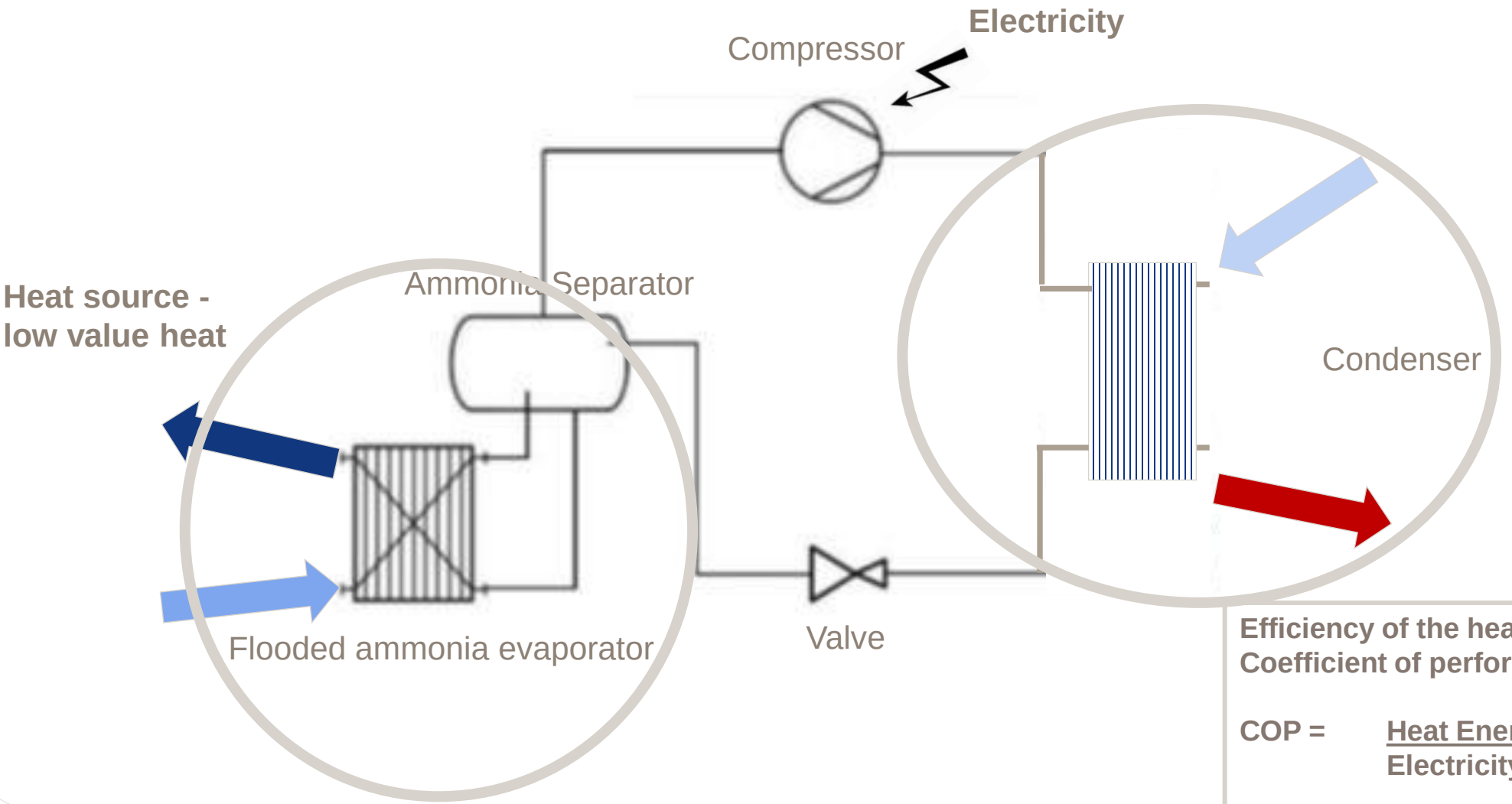
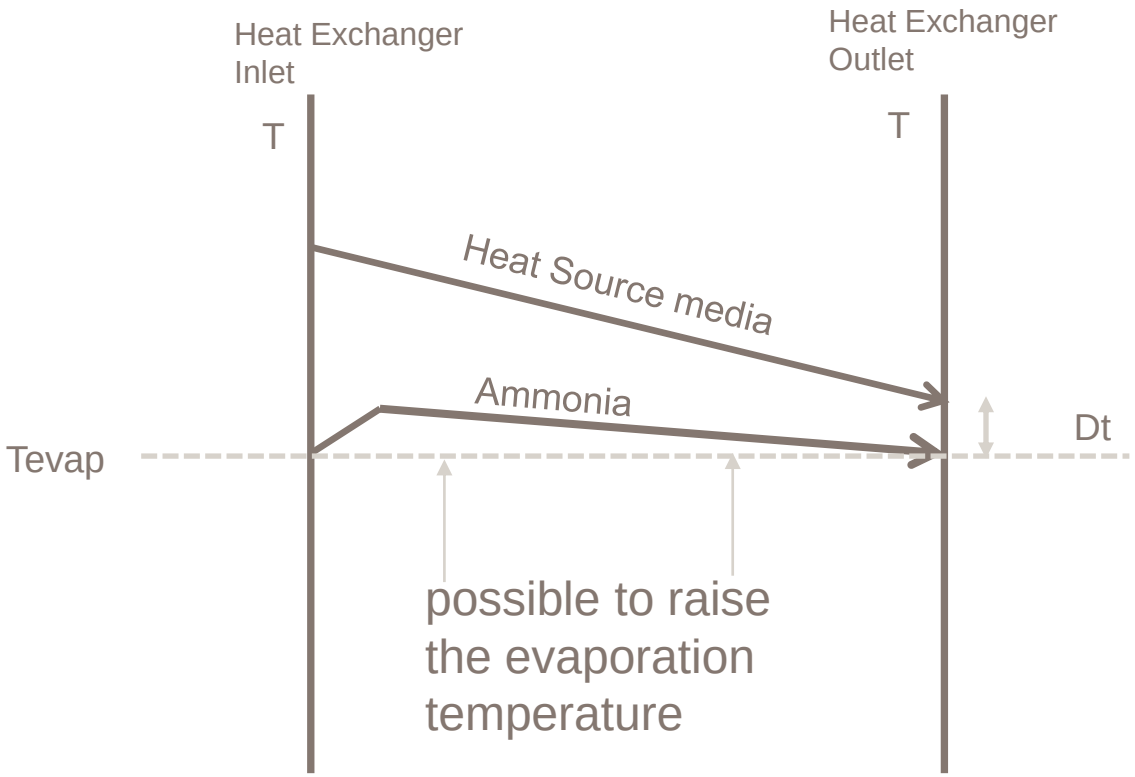


Efficiency of the heat pump = COP
Coefficient of performance

COP = Heat Energy supplied (kW) / Electricity Power Consumed (kW)

Flooded Ammonia Evaporator

– Plate Heat exchangers Enables higher energy efficiency



Heat pump

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In general it is possible to obtain 2K closer approach than with other heat exchanger technologies at comparable size and cost

- every K higher Tevap (evaporation temperature) saves 3-6% of the heat pump power consumption.

Condenser with integrated Subcooling

– SWPHE with Subcoolcondense™ is compact and efficient

Heat pump

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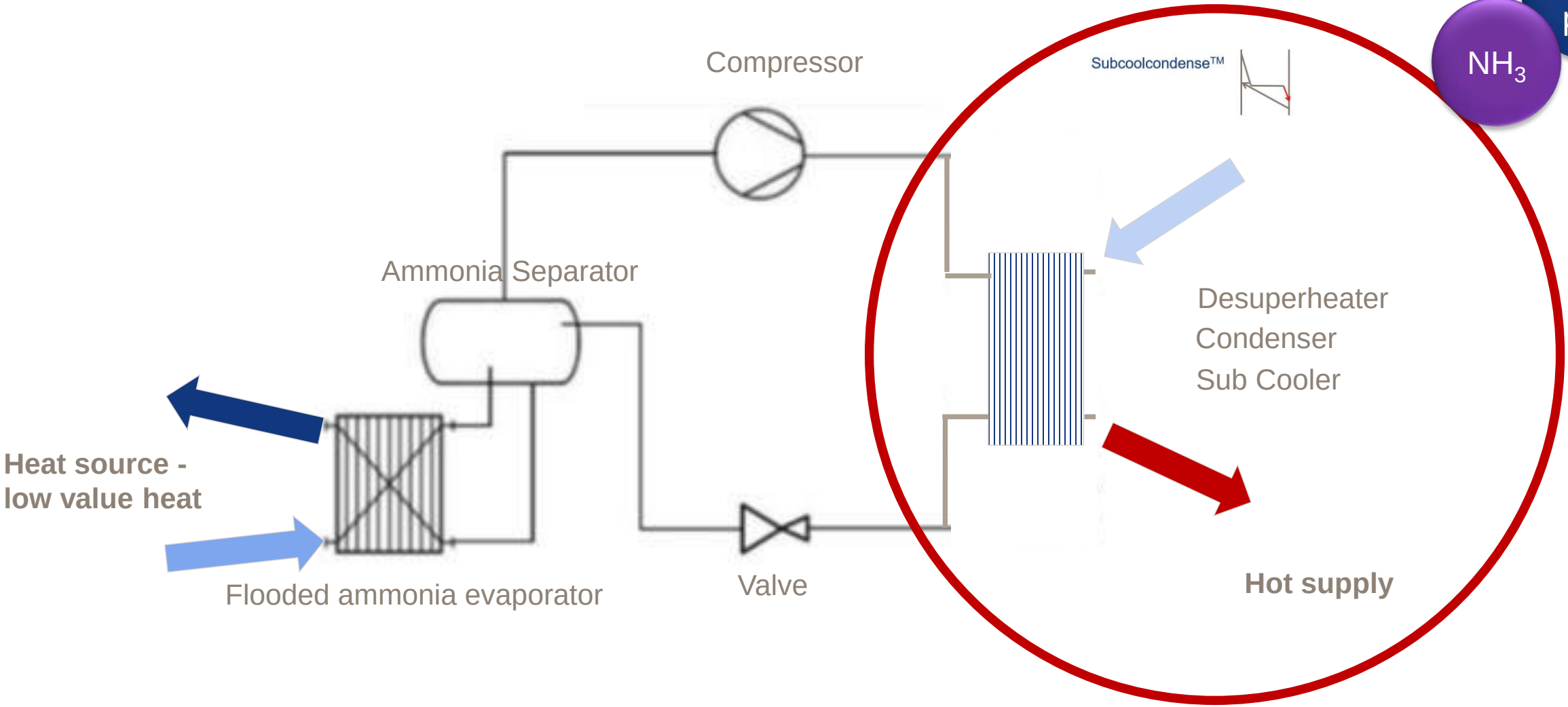

T10 EW Condenser with integrated Subcooling

– Enables high energy efficiency and a compact installation

Heat pump

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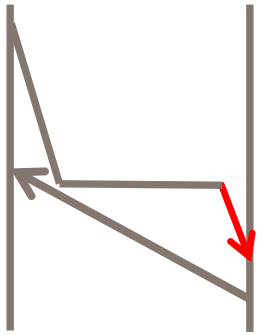
Subcoolcondense™



- T10- EW with this feature allows Condensing, Desuperheating, and Subcooling in same plate heat exchanger with the benefits of :
  - Enabling high efficiency (COP) of the Heat Pump
  - Avoiding the use multiple heat exchangers on hot side

New features to increase efficiency

Heat pump

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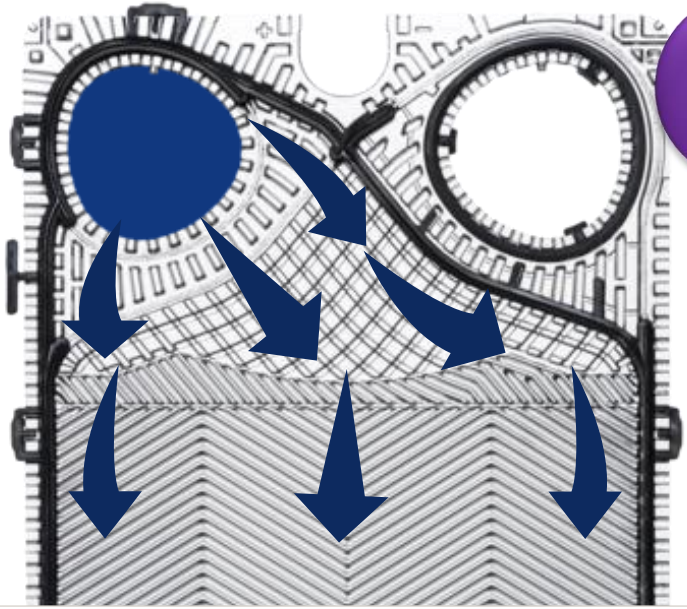
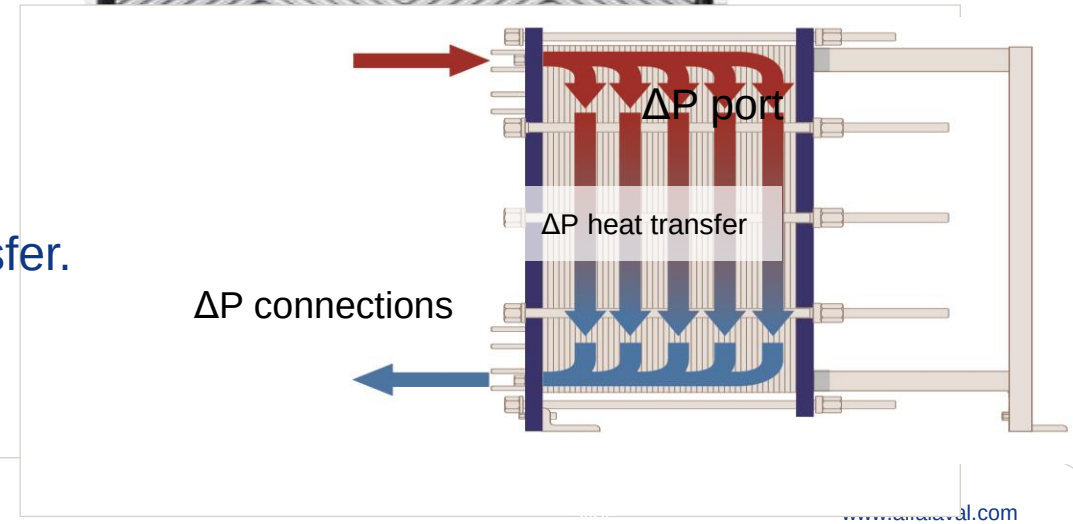
CurveFlow™ distribution area

- ✓ Fully utilizes available surface area.
- ✓ Provides perfect distribution inside channel for best heat transfer and surface stays cleaner



OmegaPort™ noncircular port holes

- ✓ Better distribution of media
- ✓ Pressure drop better utilized for heat transfer.



References

District heating - heat recovered from sea and wastewater

– Joint venture of HOFOR, CTR and VEKS for Copenhagen City

Heat pump

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Inaugurated in April 2019

5 MW full scale ammonia heat pump test

Servicing 1100 households

Heat sources: seawater and wastewater

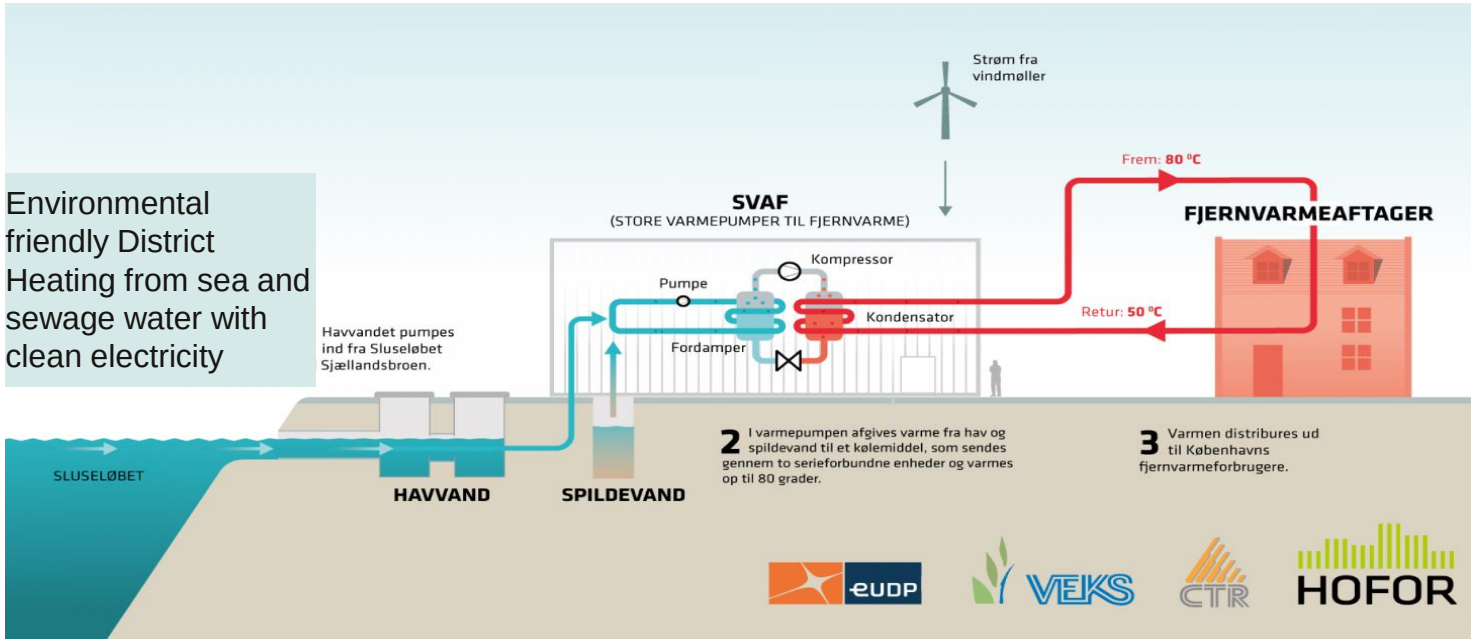
Power source: wind mills at sea

COP = 3.2

Alfa Laval supplied:

- Flooded Ammonia Evaporators for heat recovery from sea-/wastewater 4°C → 0.5°C: **Alfa Laval semi-welded TK20-BWFG**
- Condensers delivering hot water from 50°C → 80°C: **Alfa Laval semi-welded MK15-BWFT** and **Alfa Laval semi-welded TK20-BWFX**
- Sub-cooling duties: **Alfa Laval ANH76** and **Alfa Laval ANXP52**

Environmental friendly District Heating from sea and sewage water with clean electricity



District heating in Broager DK

4 MW Ground water heat pump started operation end 2016

End User: Broager District heating company

System builder: ICS - Industrial Cooling system a/s Consultant: PlanEnergi

Purpose: Useng 250 m deep ground water **at 9 C** as heat source delivering district heating supply of hot water at 70 C. The total capacity of 4 MW covers approximately ¾ of the heating need for Broager or about 18.000 MWh/year.

Refrigerant: Ammonia

Alfa Laval supplied: Semi Welded Plate Heat exchangers as evaporators cooling/recovering the ground water heat from 9° C to 2 C evaporating ammonia of the heat pump at 0° C

COP Heat pump = 4,1

Semi Welded Plate Heat Exchangers

– For Ammonia Heat pumps

Major benefits

- High efficiency.
- Space saving
- Minimizes Ammonia charge
- Reliable operation

Heat pump

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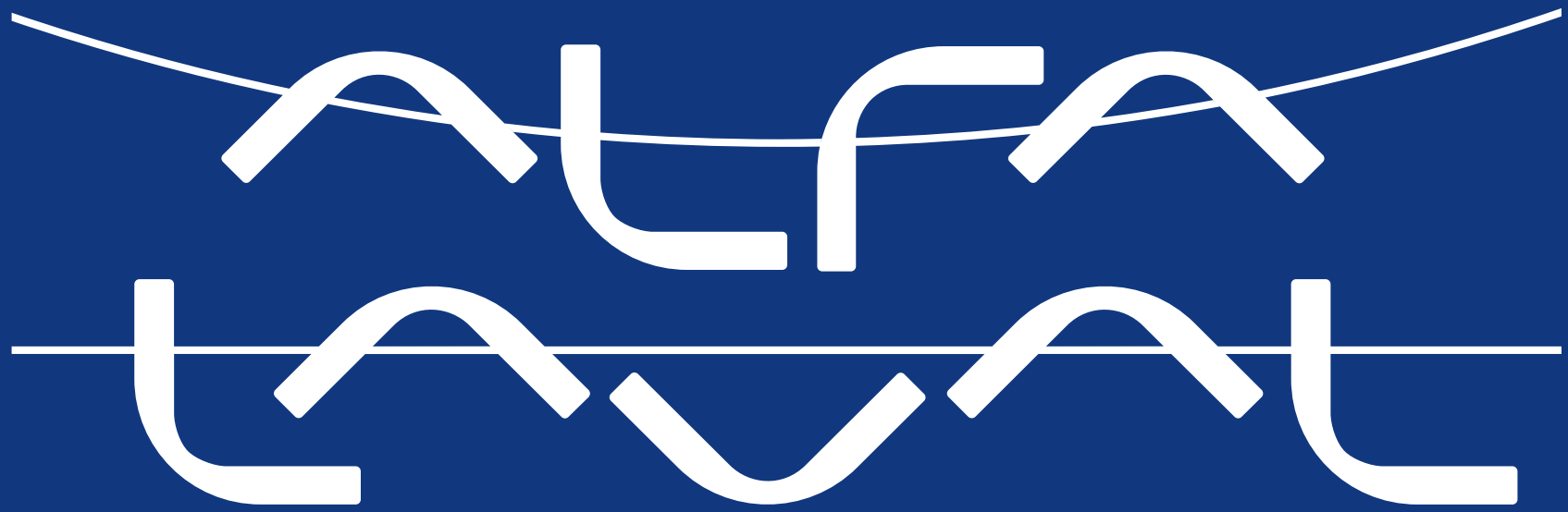
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