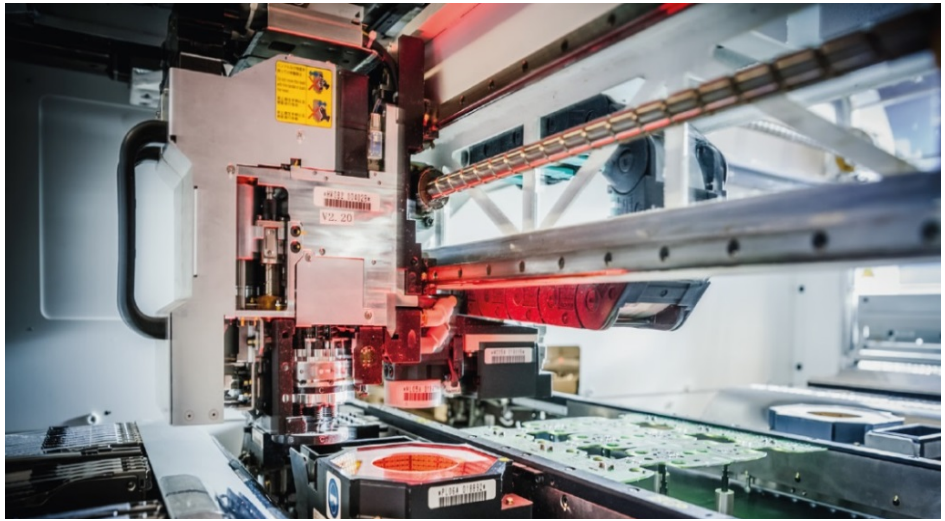
WURM

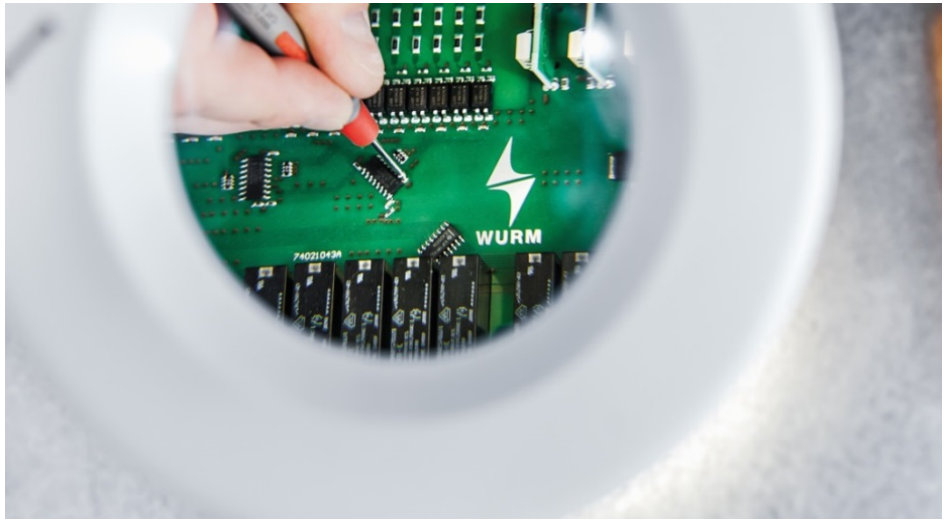
PERFORMANCE COMPARISON OF MODERN CO_2 INSTALLATIONS IN OPERATION

ATMOsphere Europe 2017 – Berlin - 25 – 27 September 2017

Wurm GmbH & Co. KG – Elektronische Systeme
Dr Lukas Patryarcha – Section Leader Research

COMPANY PRESENTATION

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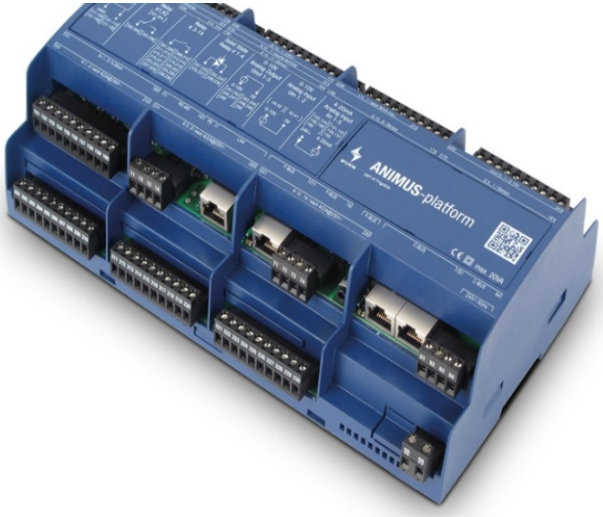
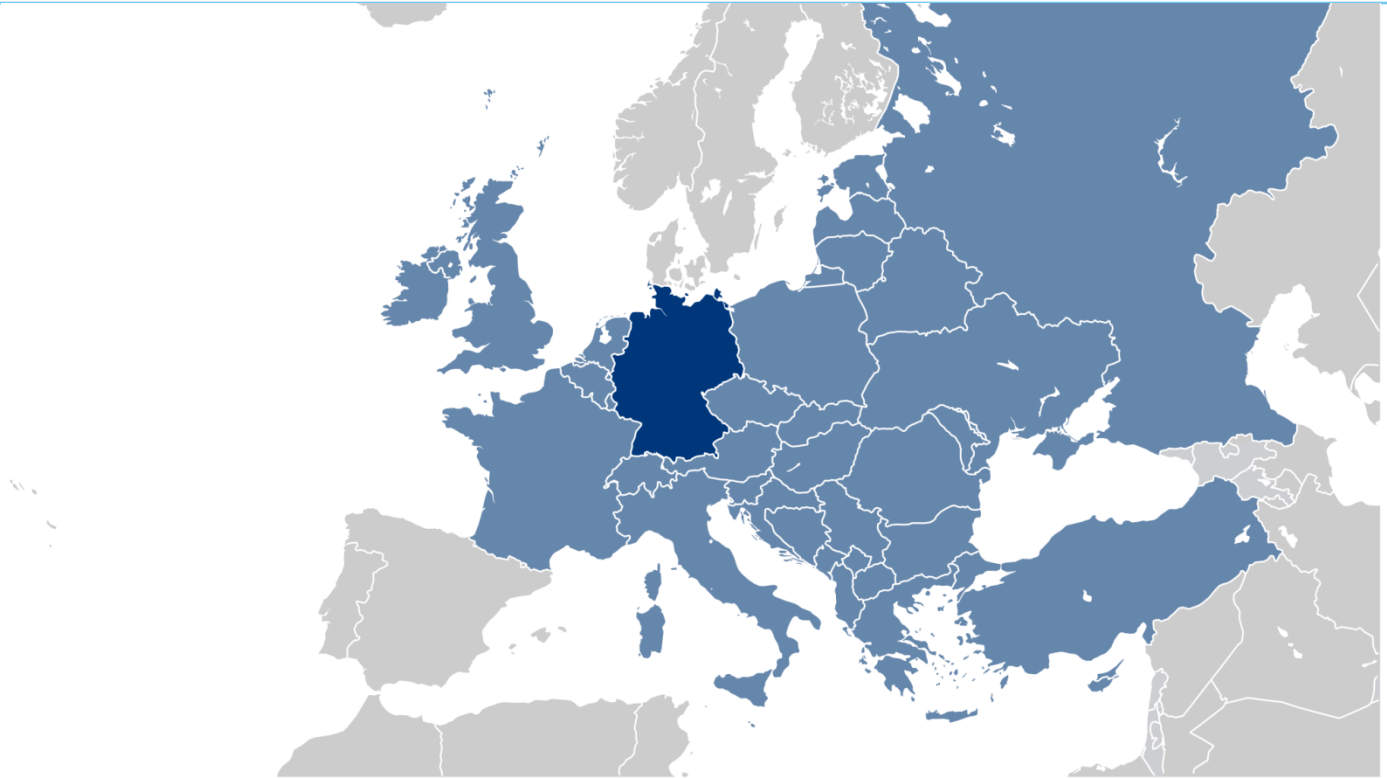

ANIMUS-platform


CO2-EMISSION
2014
21,0 t CO2
2015
19,2 t CO2
Anlagenschemen
Verbrauch 1. Quartal 2014
Verbrauch 1. Quartal 2015
Verbesserung
33225 kWh
32589 kWh
-2,0%
10864 kWh
10585 kWh
-2,6%

COMPANY PRESENTATION



WURM: HQ in Germany – Group: 250 employees – € 50m turnover
Focus: HVAC&R for food retailing in Central Europe

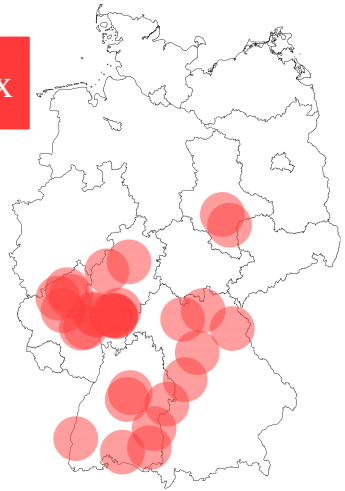
WURM

PERFORMANCE COMPARISON

MARKET COMPARISON

R134a

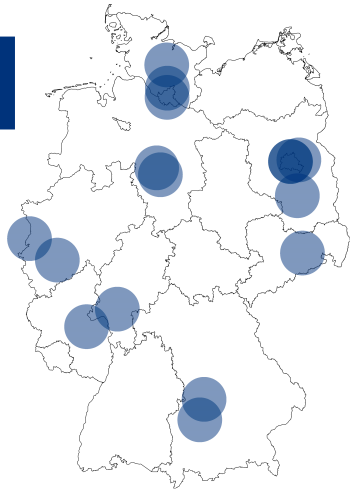
29x



heat recovery

R744

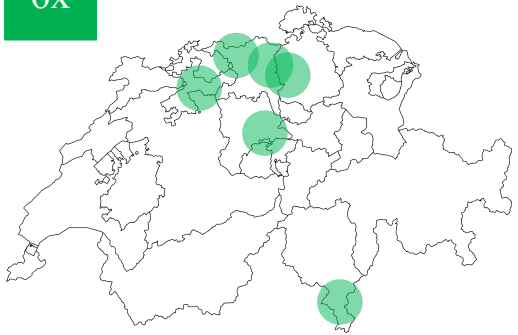
16x



heat recovery

R744++

6x

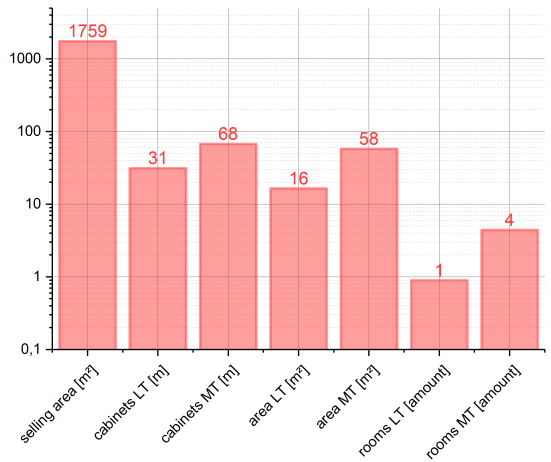


EJEC, SF-

All markets opened in 2015 / 2016, heat recovery, equal building concepts, data logging,

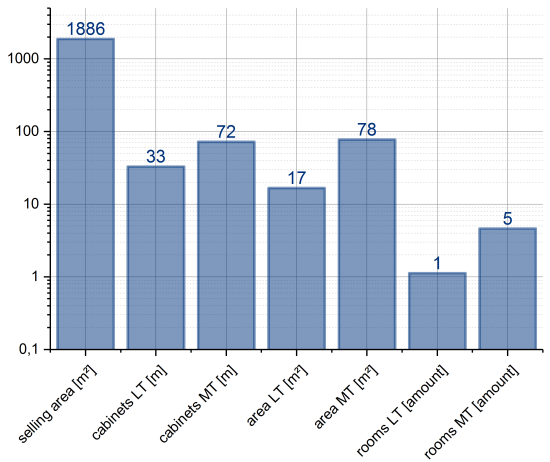
MARKET COMPARISON

R134a



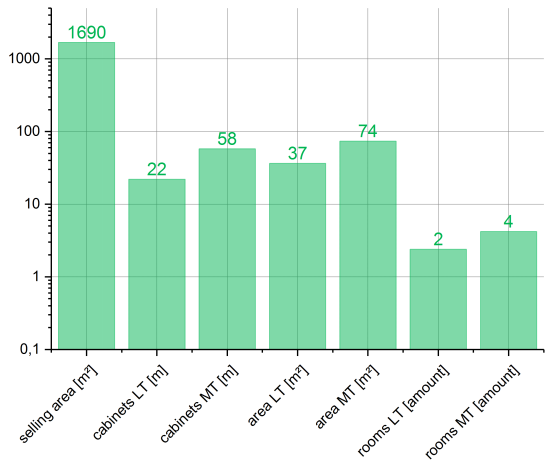
91m+74m²

R744



105m+95m²

R744++

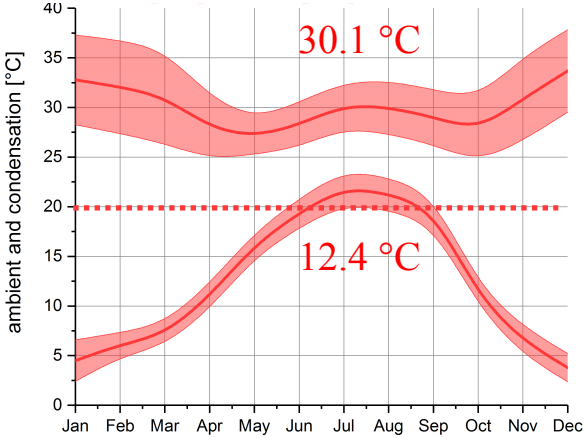


80m+111m²

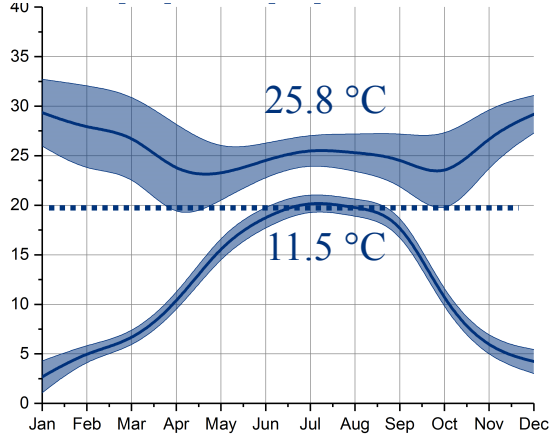
All markets have nearly equal selling areas but different MT+LT cabinets and room compositions. Later energy comparison is normalized for MT+LT cabinets and rooms with approx.1m² → 1m.

CONDENSATION / GAS COOLING

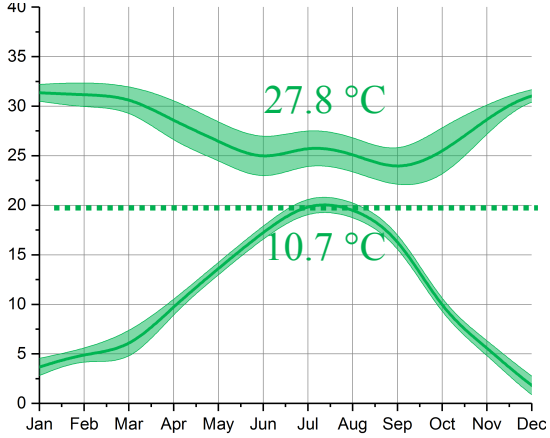
R134a



R744



R744++

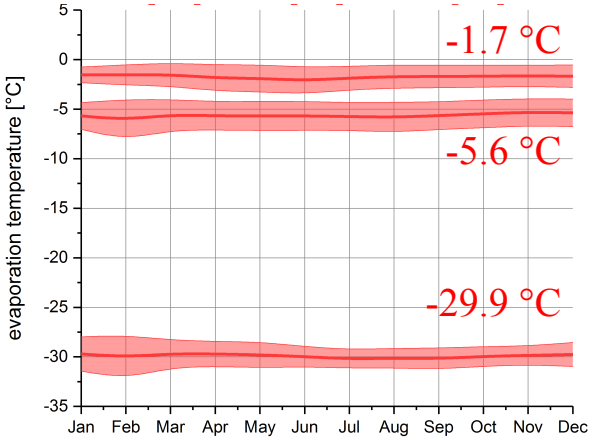


heat recovery = summer

The winter conditions that are beneficial for R744 in terms of energy efficiency are not available when heat recovery is used. High pressure is converted into equivalent temperature for better comparison using the optimal COP characteristic curve.

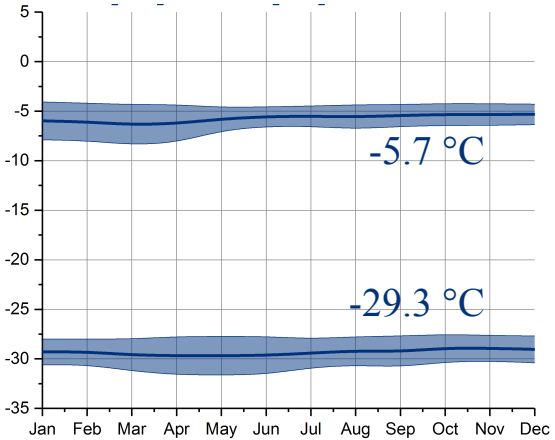
EVAPORATION

R134a



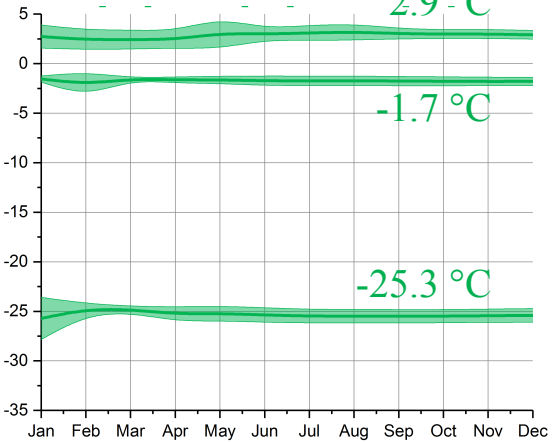
High efficiency

R744



Lower investment

R744++

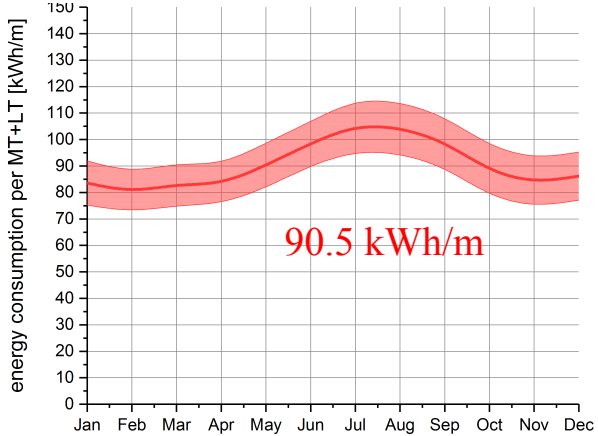


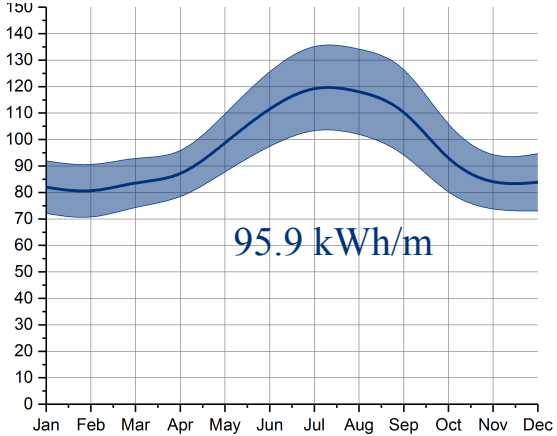
Highest efficiency

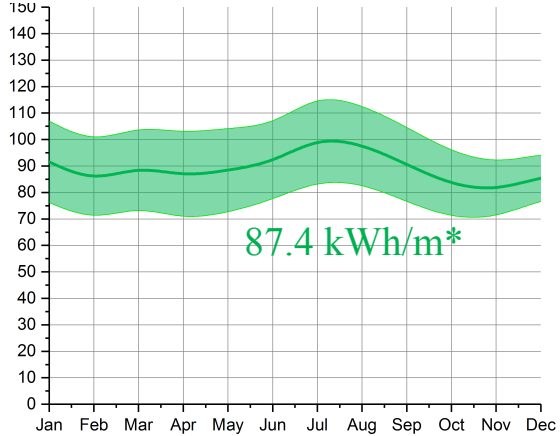
R744 has only one MT evaporation level due to lower investment, but lower efficiency in comparison. R744++ parallel compression, ejectors and semi-flooded evaporators increase the energy efficiency compared to R744.

ENERGY EFFICIENCY

R134a	R744	R744++





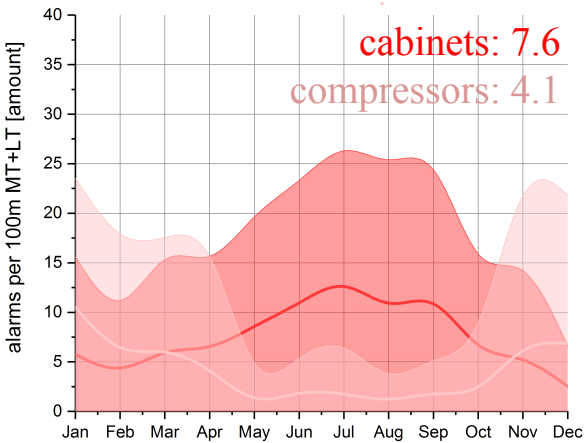


baseline	+6.0 %	-3.4 % (-8.9 %)

The absence of beneficial winter conditions and 2nd MT rack for R744 results in lower energy efficiency.*Hint: Value corrected due to facility setup in Jan-Mar 2016.

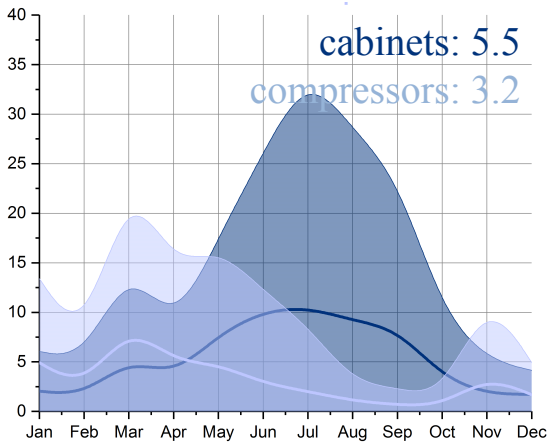
MAINTENANCE

R134a



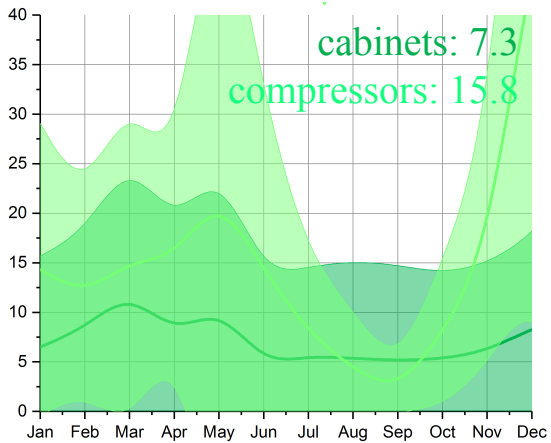
baseline

R744



less maintenance

R744++



Opened in Jan/Mar 2016

Primary maintenance:
R134a: High pressure, leakage –
R744: High pressure, oil - R744++: refrigerant migration, oil

FACE THE FACTS

R134a versus R744 versus R744++

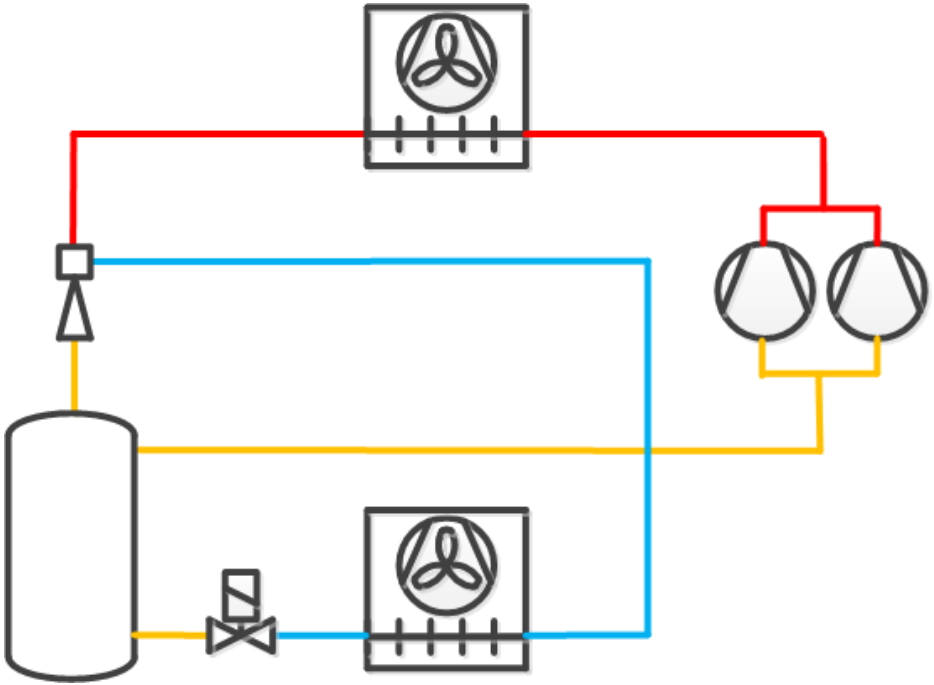
- Heat recovery = summer conditions during winter → no benefitial conditions for R744
- Parallel compression ratio in Germany <5% = less investment but → lower efficiency
- Only1xMT for R744 = less investment but → lower efficiency
- Maintenance frequency is OK. Technicians do a great job!
- Energy efficiency increase depends on compared baseline.
- **R744: „Evolution“ is still in progress in germany.**

Life cycle costs = efficiency and investment

INCREASE IN EFFICIENCY

INCREASE IN EFFICIENCY

- parallel compression
- ejectors
- Semi-flooded evaporators
- complexity reduction
- control system
- tools and services
- data science





Thank you for your attention and enjoy your time at ATMOsphere Europe 2017!