



solutions for europe

natural refrigerants

15-16 October 2013, Brussels



ATMOsphere Europe 2013

Advanced CO₂-booster system
for warm climates

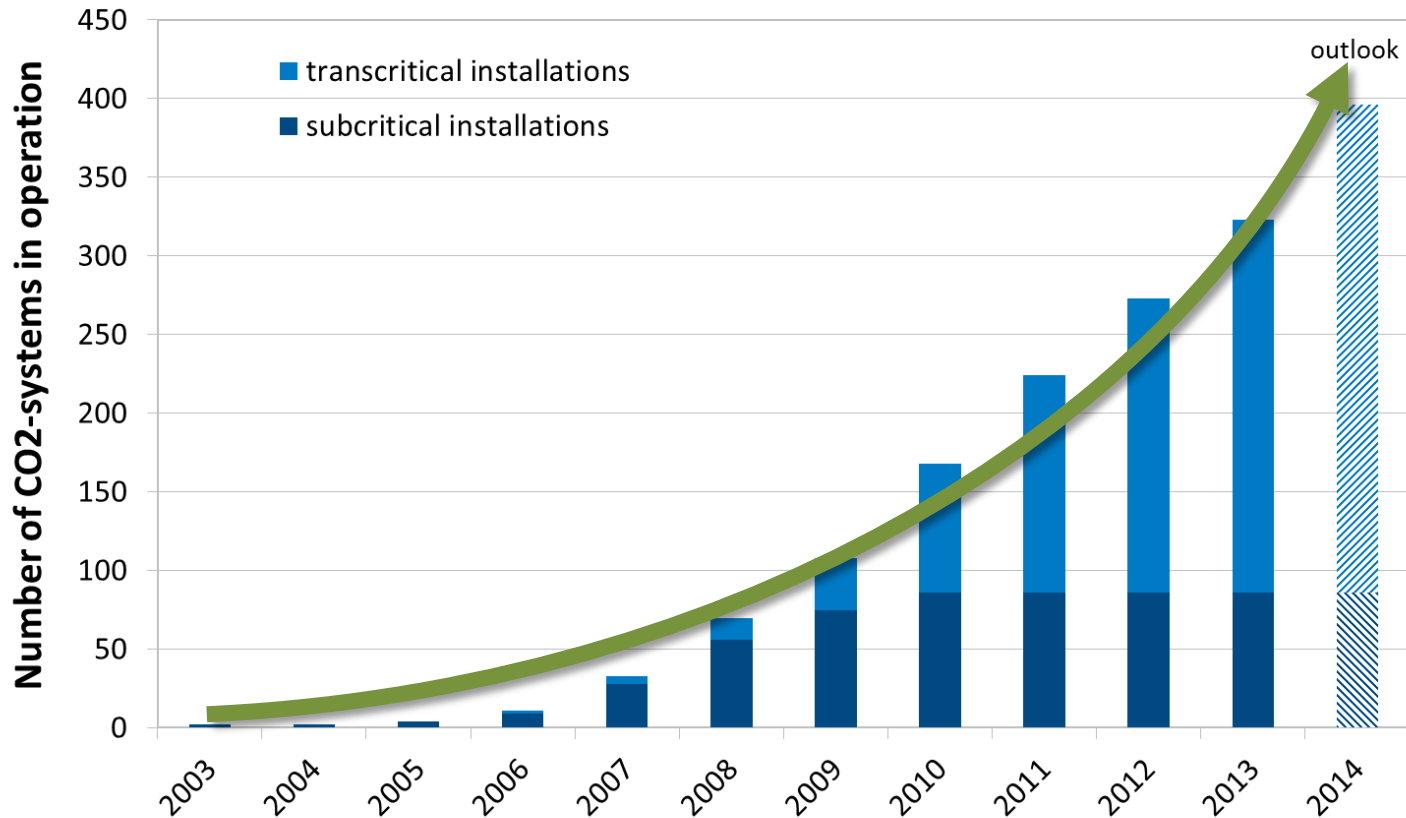
16.10.2013

Jonas Schönenberger

CO₂ commercial references



CO₂-systems in operation by Frigo-Consulting Ltd





Partners

2

MIGROS Neuchâtel Fribourg



ALPIQ



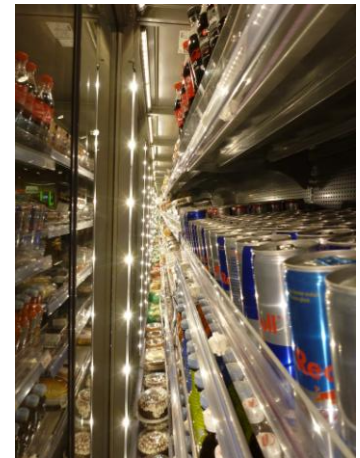
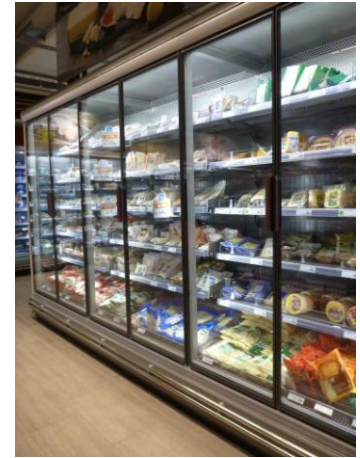
Schweizerische Eidgenossenschaft
Confédération suisse
Confederazione Svizzera
Confederaziun svizra

Bundesamt für Energie BFE
Office fédéral de l'énergie OFEN

Job site

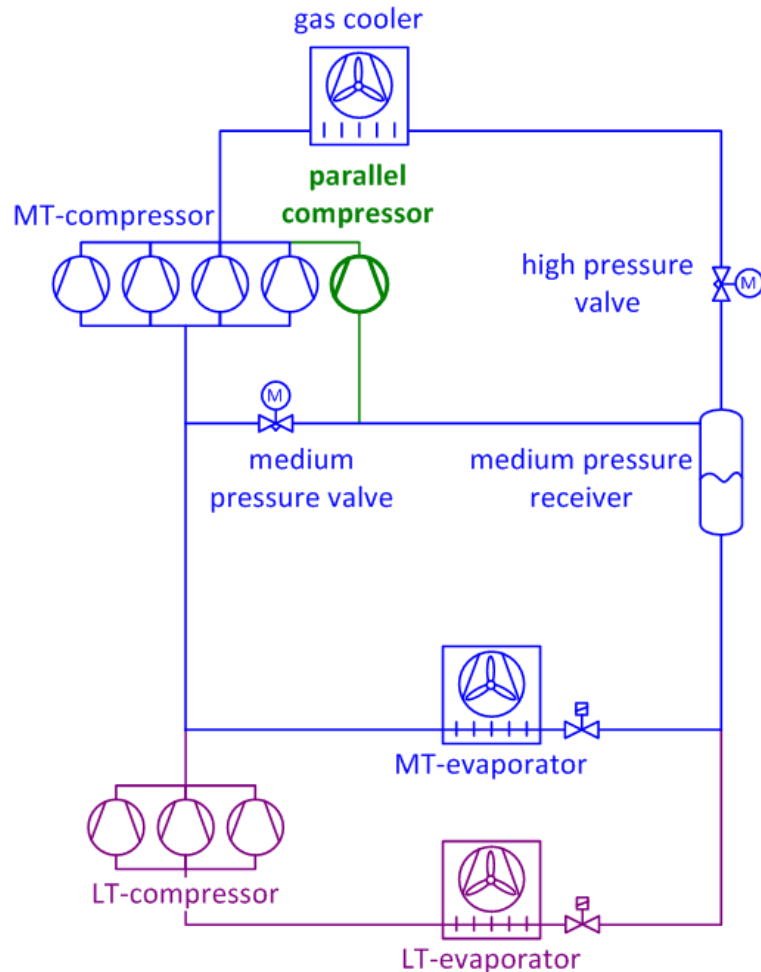
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- ❑ Supermarket: Migros Bulle, Switzerland
- ❑ Sales area: 5'000 m²
- ❑ Total length of cabinets: 135 m
- ❑ All cabinets closed with glass doors
- ❑ Cabinets with LED-lighting
- ❑ Walk-in-cooler/freezer: 14 pcs
- ❑ Medium temperature capacity: 120 kW
- ❑ Low temperature capacity: 55 kW



Transcritical CO₂-booster

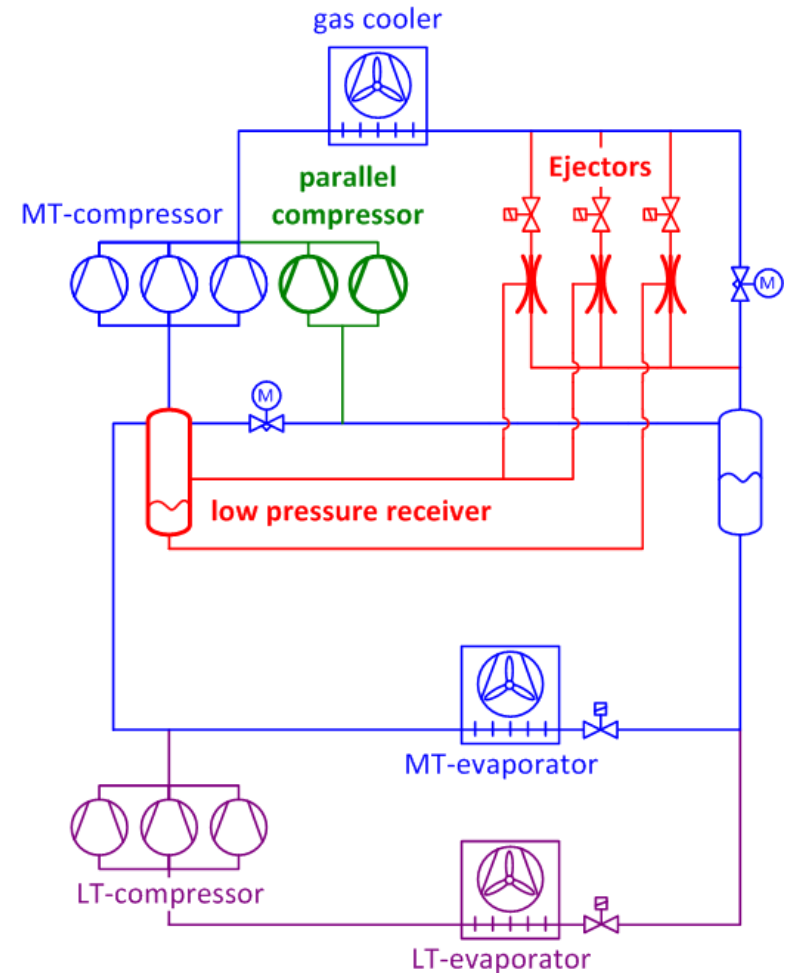
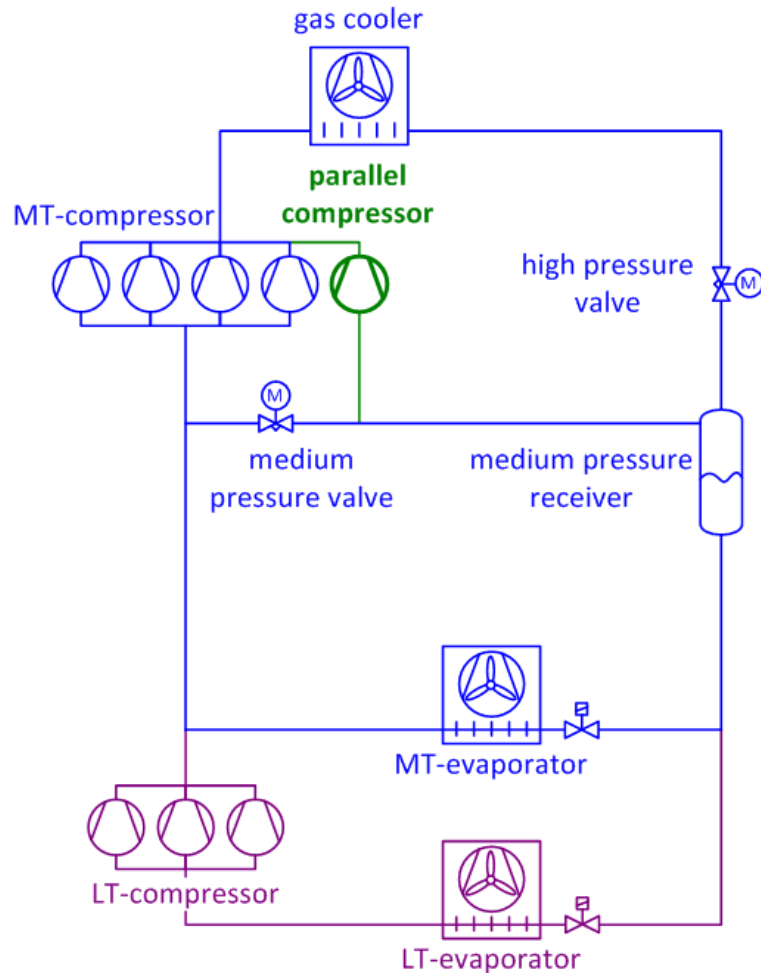
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- Superheat evaporator: 8 K
- Dry expansion
- No liquid in suction line
- Evaporation temperature: -8°C

Transcritical CO₂-booster with EJECTOR

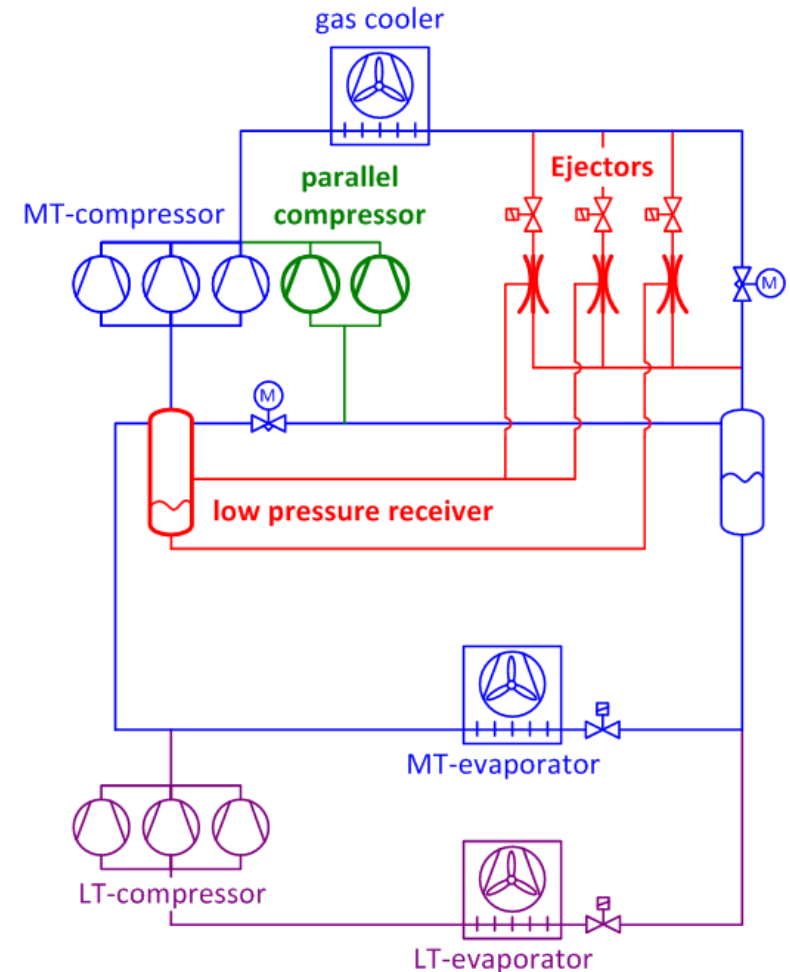
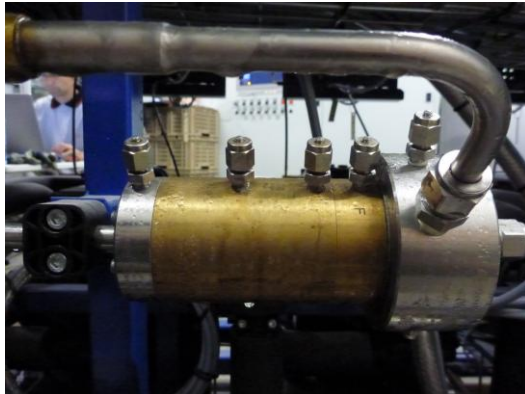
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Transcritical CO₂-booster with EJECTOR

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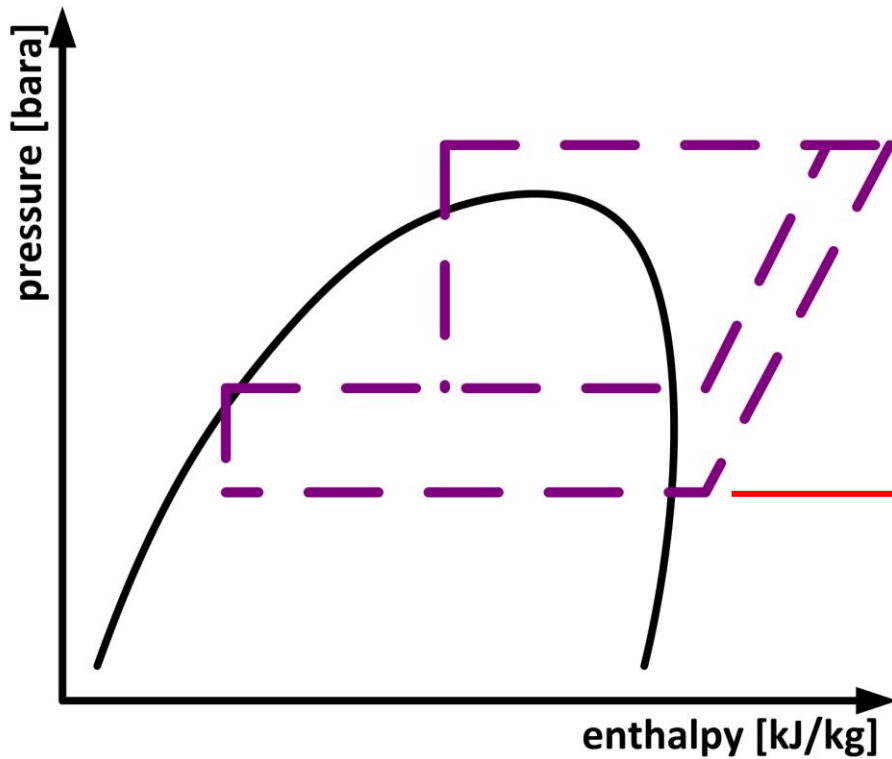
- Liquid in suction line acceptable
- Reduce superheat at cabinet: 0 K
- Flooded evaporators
- High heat exchange efficiency
- Increased evaporation temperature to -1.5°C



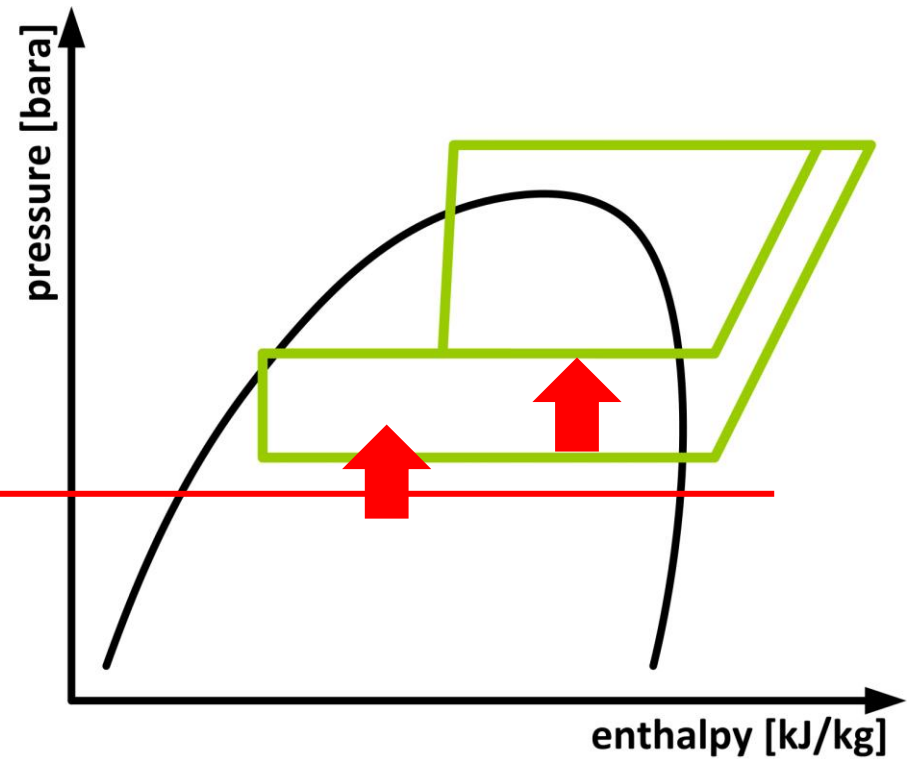
Process in pressure enthalpy diagram

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CO₂-Booster System



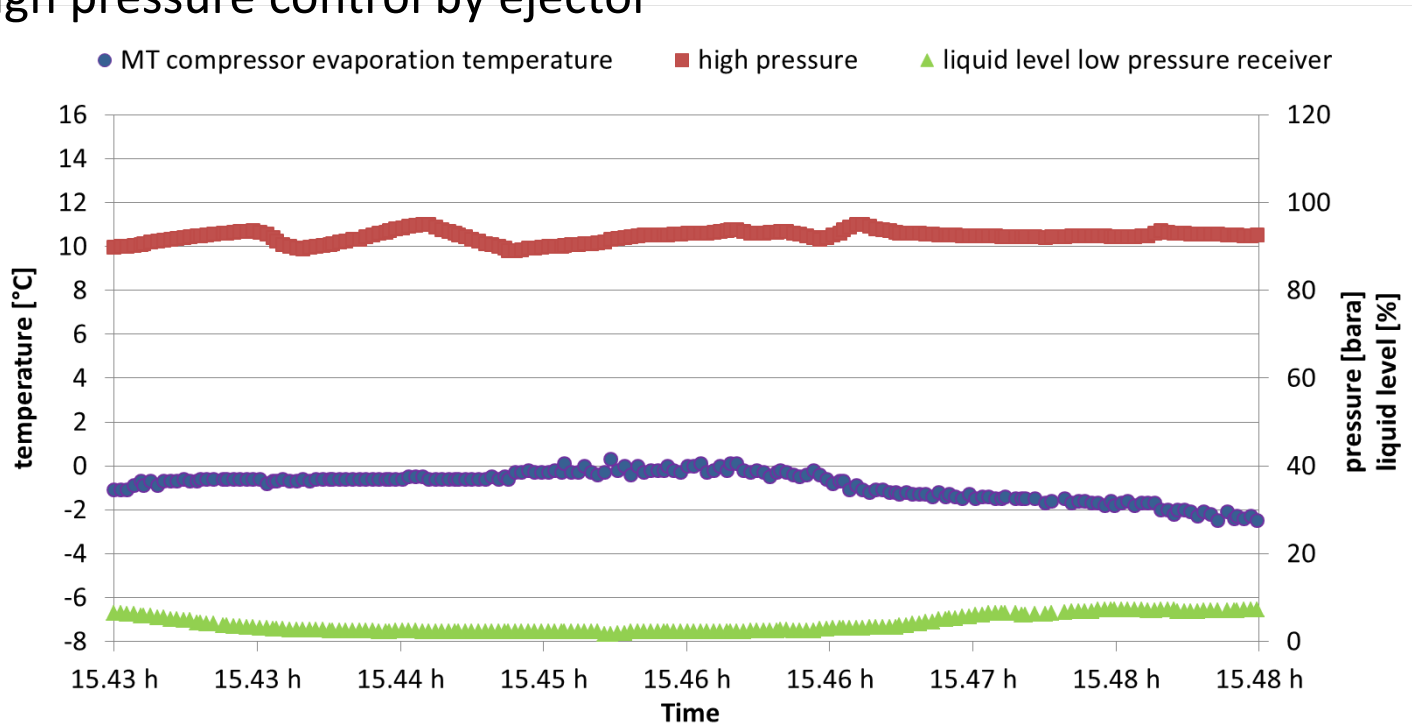
CO₂-Ejector System



Transcritical CO₂-Booster with Ejector

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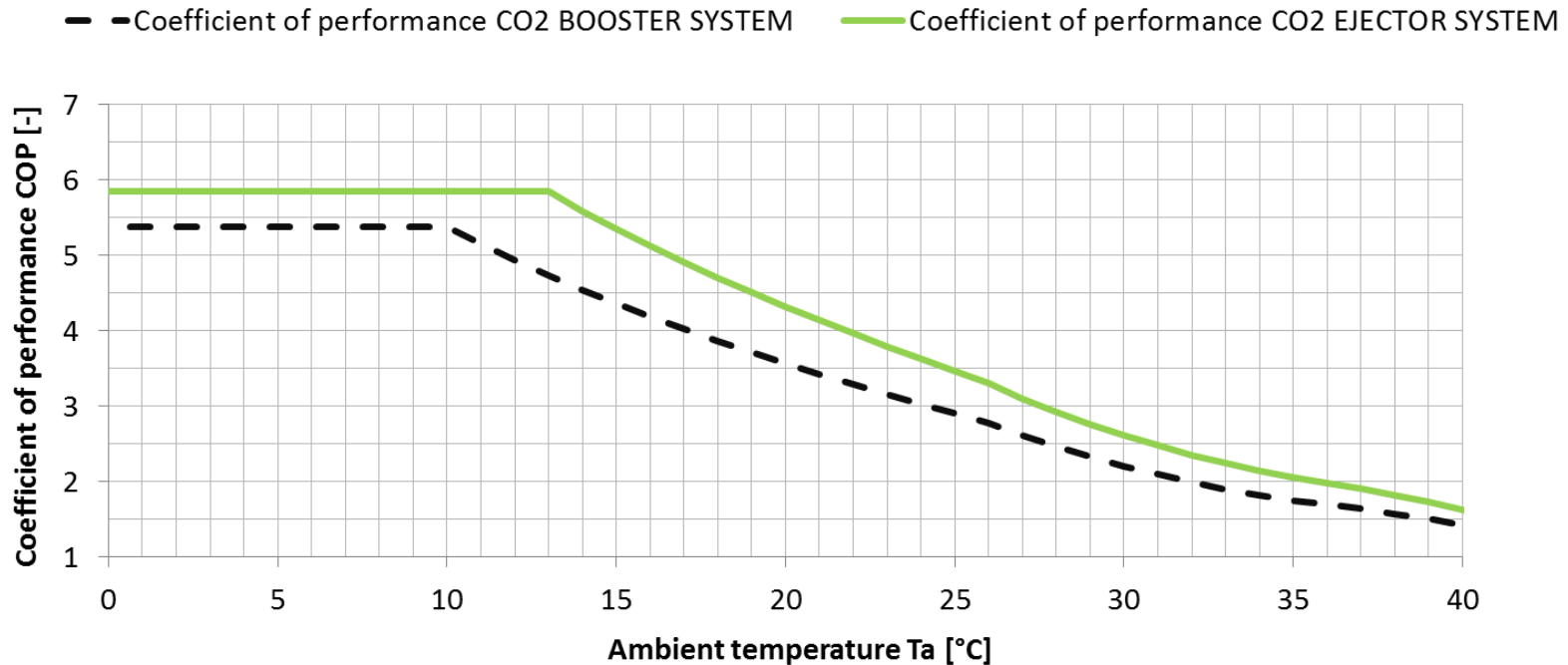
- Date: 09.10.2013, transcritical operation
- Average evaporation temperature -1.5°C
- High pressure control by ejector



Efficiency increase

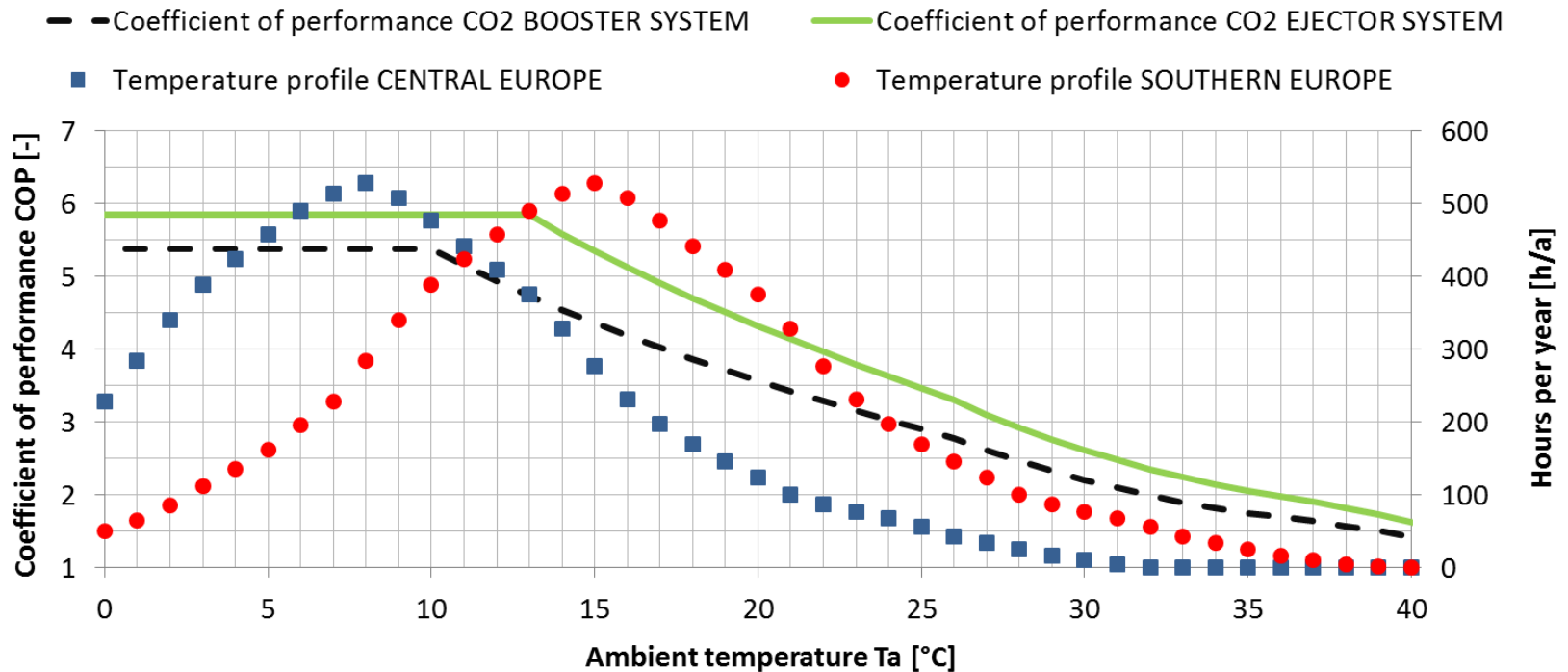
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- Increased evaporation temperature
- Shift mass flow to parallel compressor



Energy consumption

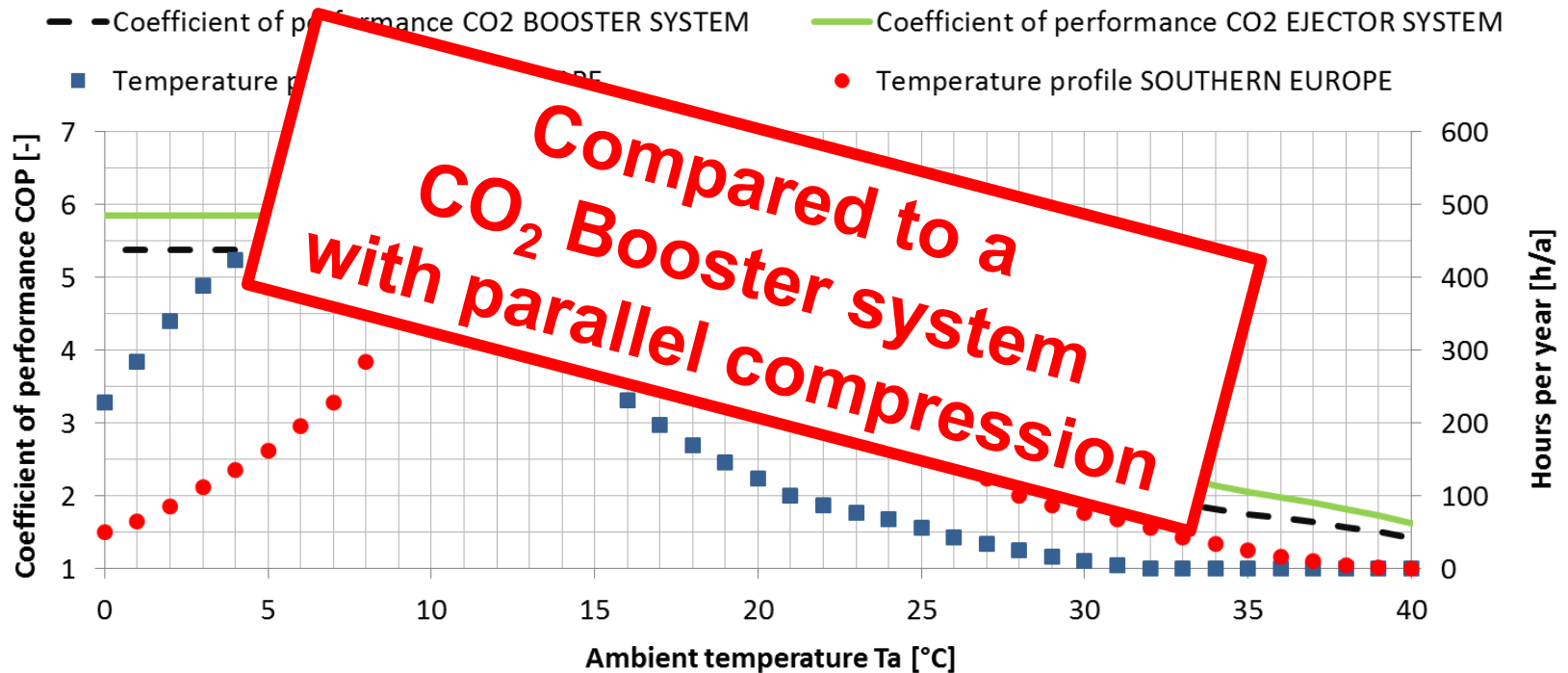
- **12%** less energy consumption in **Central Europe**
- **16%** less energy consumption in **Southern Europe**



Energy consumption

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- **12%** less energy consumption in **Central Europe**
- **16%** less energy consumption in **Southern Europe**



Summary



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- ❑ Installation at Migros Bulle Switzerland, in operation since summer 2013
- ❑ CO₂-booster with ejector successful in operation
- ❑ Implementation based on standard components
- ❑ 6.5 K higher evaporation temperature
- ❑ Increase operation of parallel compressor
- ❑ Efficiency increase of 12% in Central Europe
- ❑ Efficiency increase of 16% in Southern Europe