Modulating Ejectors

next steps for CO_2 transcritical systems in the USA

AMERICA ATMOsphere

Business Case for Natural Refrigerants

June 12-14, 2018 – Long Beach

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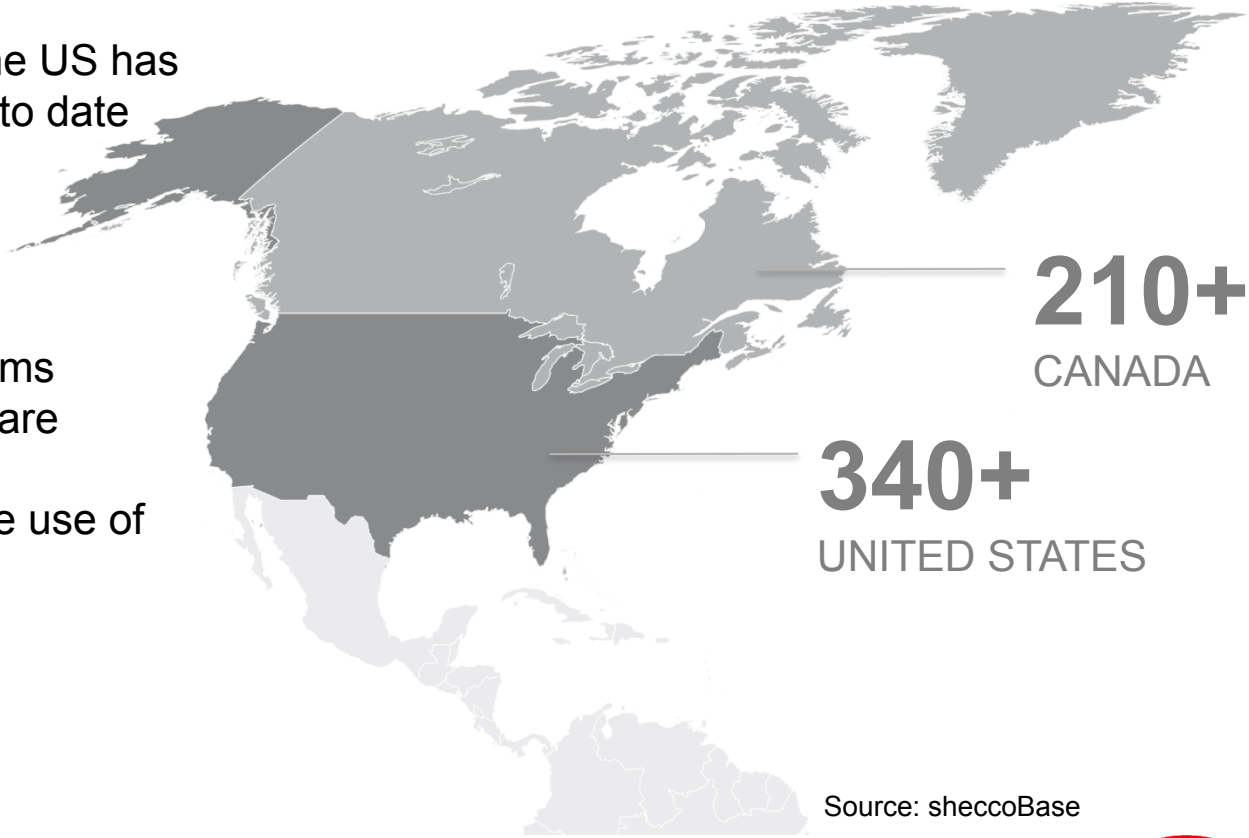
US background

The number of installation in the US has increased by 458% from 2015 to date (2015-52 to 2017- 290)

Factors driving growth:

- Availability of efficient systems
- Several European retailers are entering the USA
- ROI is being proven with the use of modern technologies



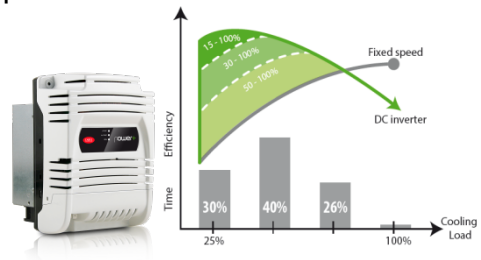
Source: sheccoBase

CO_2 Continuous Modulation

Top perfomance comes from system control and stability

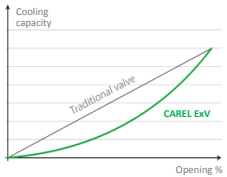
DC technology

- **Wide modulation range** to always fit the cooling capacity
- **Maximum energy efficiency** at part load



EEV

- **Stepper** electronic expansion valves
- **Continuous and precise** control of evaporator feeding
- **Equal percentage** profile for perfect control in part load operation



EMJ

- **Continuous modulation** to match the different rack requirements
- **No need for** high pressure valve to modulate high pressure flow
- **Maximum** energy efficiency in ejector mode

EmJ : Modulating Ejectors

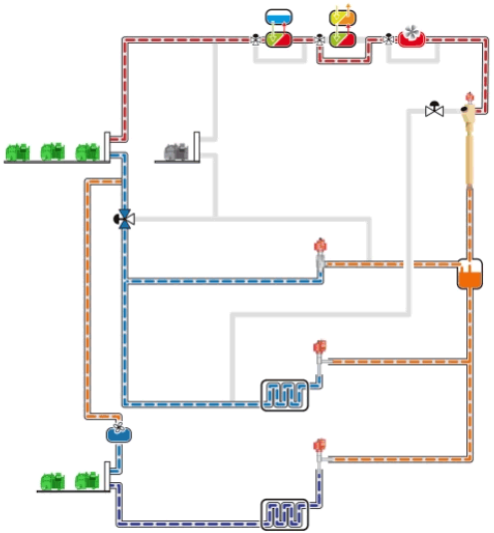
Full **RANGE** of **MODULATING EJECTORS**

From 20kW to 135kW

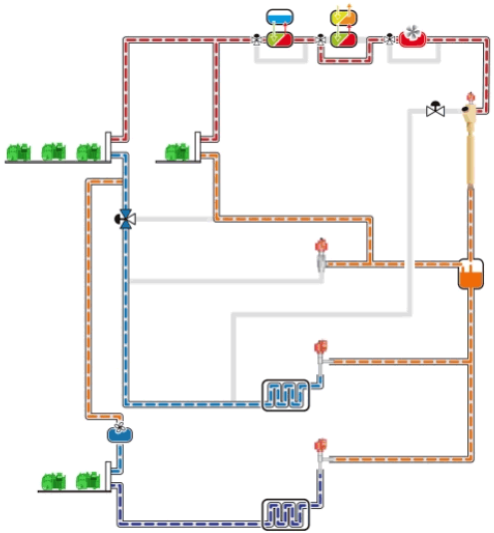
- Vapor ejectors are designed for full mass flow
- Continuous stepper modulation
- Easy adaptation to all working conditions and part loads
- High Pressure Valve & Modulating Ejectors in one
- Available in different sizes to match different compressor rack capacities, even for small formats
- Simplified rack design to reduce capital investment
- Full advanced control system (rack, cabinets, monitoring) for whole system optimization

System configuration

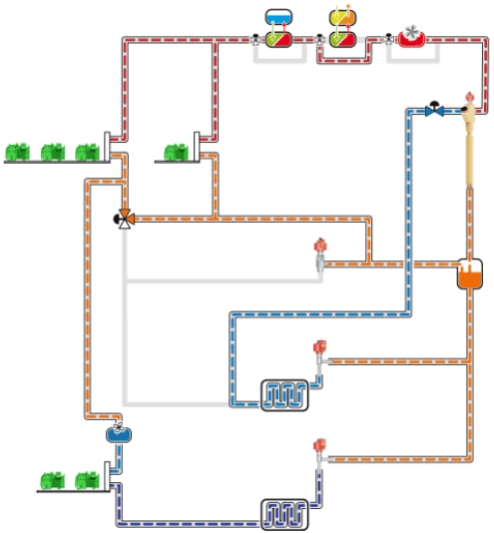
Winter mode
Standard CO2 transcritical system



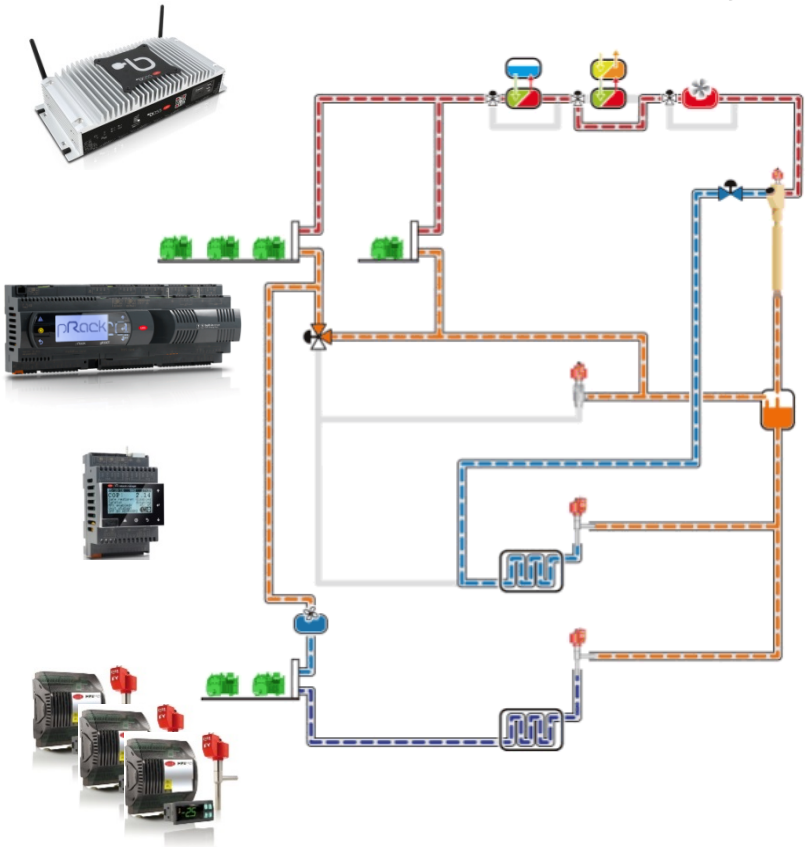
Mid-Season mode
Parallel compressor activation



Summer mode
Ejector activation



System control



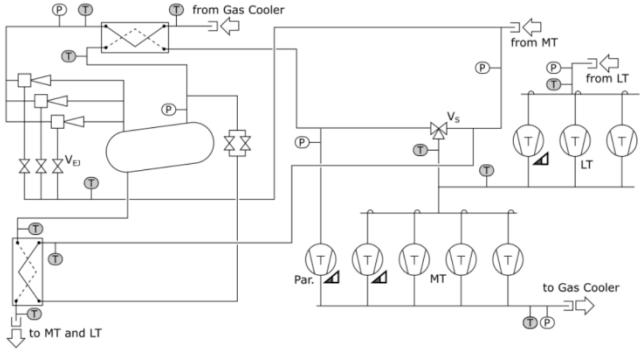
Rack

- Ejectors working as high pressure valve in winter and mid-season mode
- Reduced number of compressors required thanks to interchangeability of medium temp and parallel compressors
- No need for a liquid receiver
- All compressors running as parallel compressors in summer mode

Case

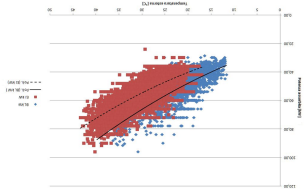
- Semi flooded operation, SH=2K
- Synchronization with rack working mode thanks to Ethernet connectivity

From real stores to model calculation

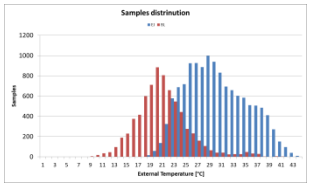


From real stores/labs running in Europe
1 year of data was acquired to create a mathematical model for validation

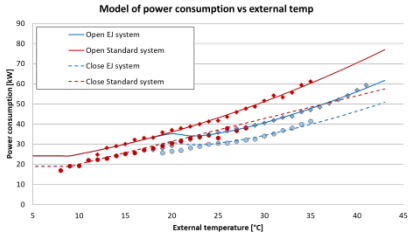
Example
Spain: 130kW MT, 40kW LT
3 ejectors installed



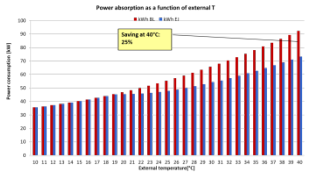
Power cons vs T



Mode distribution

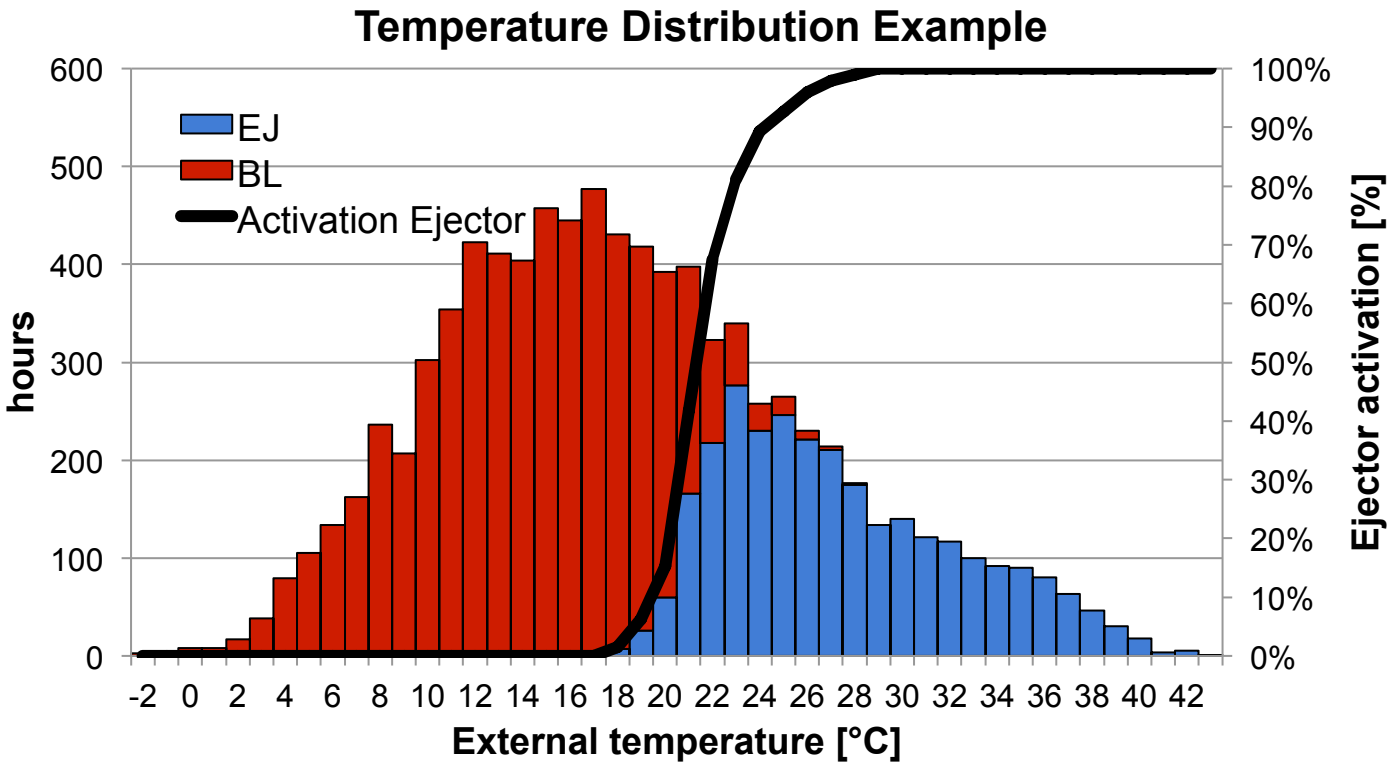


Power abs model

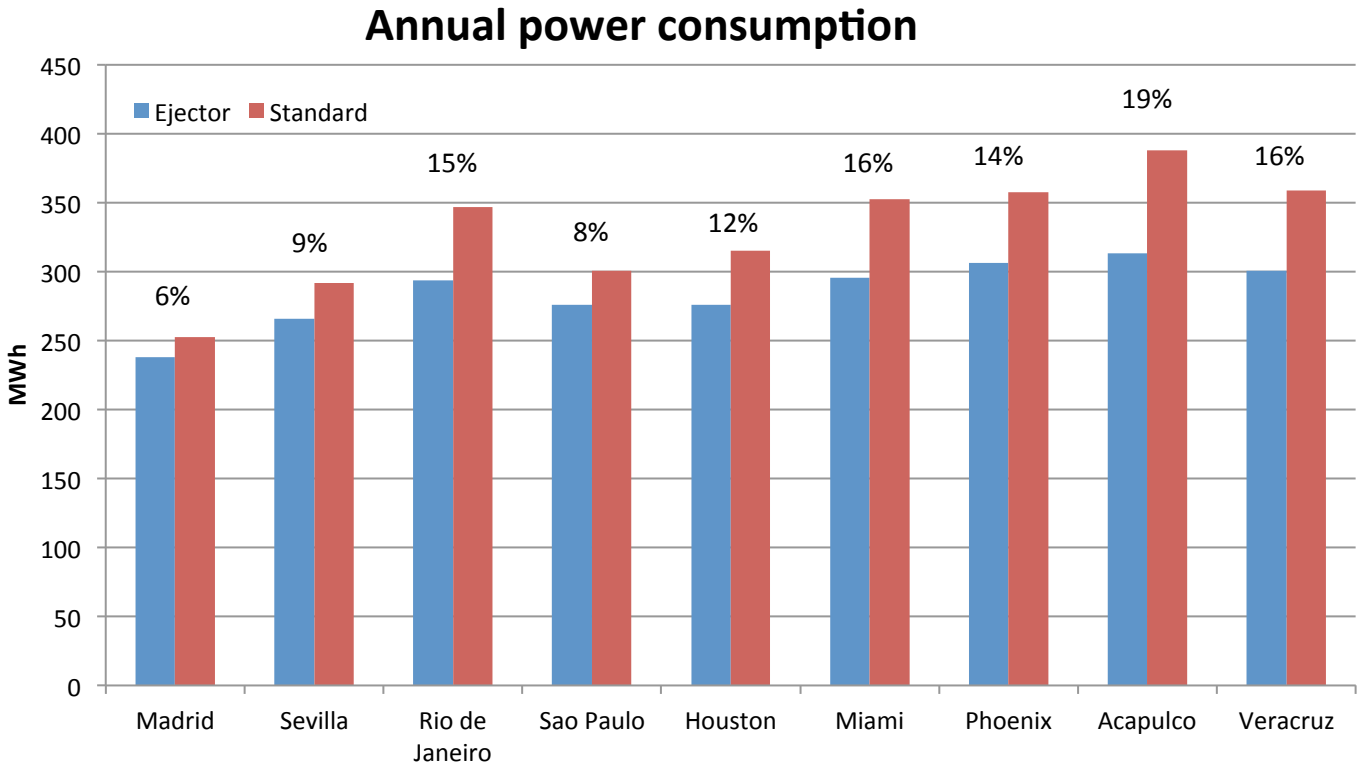


Energy saving vs T

EmJ activation



NAM expectations



Hillphoenix

A DOVER COMPANY

Lab testing: 2H 2018

Go to market strategy: Q4 2018

Conclusions

- Efficient CO_2 systems in warm climates are now viable thanks to modulating ejector technology.
- The US market can benefit from the development and tests done in Europe. This equates to a significant reduction in time and investment to test and implement the technology.
- «Americanization» is a key factor to global adoption of new technologies from other continents.
- Modulating Ejector technology allows CO_2 to be a viable solution for large and small format applications by reducing system complexity and improving the energy benefits.

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