



16-17 March 2015 in Brussels

## Segment Trends - CO<sub>2</sub> systems in Europe

*Speaker: Stuart Webb, Sales Support CO<sub>2</sub> (international)*  
*Sponsor: Christoph Brouwers, Director Turnkey Operations*

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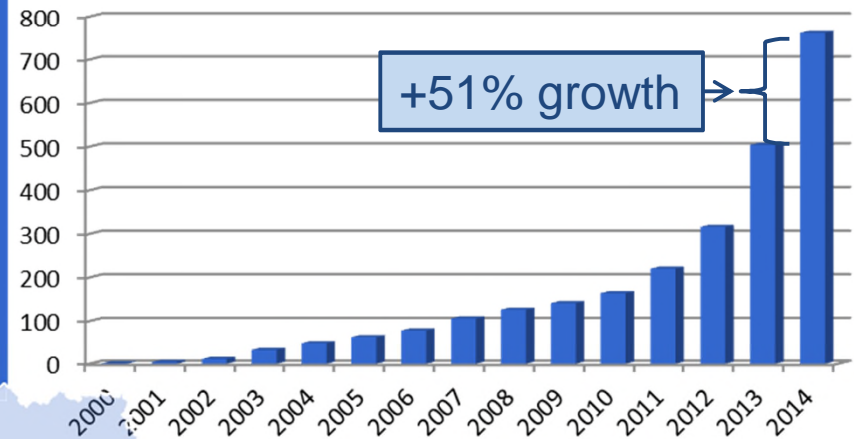
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# SEGMENT EVOLUTION & CURRENT STATUS

## Carrier<sup>®</sup> CO<sub>2</sub> HFC/CO<sub>2</sub> subcritical projects in Europe

TOTAL 2014  
**761**

Segment uptake trend  
# Projects in operation



HybridCOOL<sub>2</sub>

Source: Carrier Commercial Refrigeration Europe  
Data by country end of December 2014



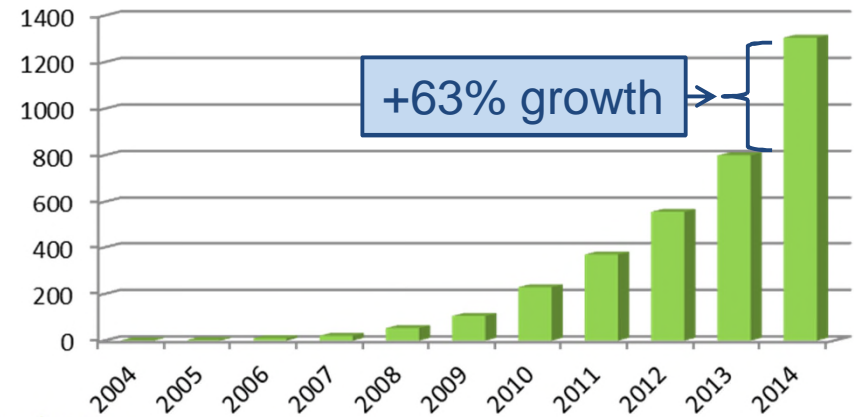
# SEGMENT EVOLUTION & CURRENT STATUS

## Carrier CO<sub>2</sub> transcritical projects in Europe

TOTAL 2014

1306

Segment uptake trend  
# Projects in operation



COOLtec

Source: Carrier Commercial Refrigeration Europe  
Data by country end of December 2014



# NATURAL REFRIGERANTS

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## Building on success: segment development

- Natural refrigerants now a mainstream solution
- >60% European supermarkets using natural solutions<sup>1</sup>
- In the past, initial investment presented a barrier for cost-sensitive segments



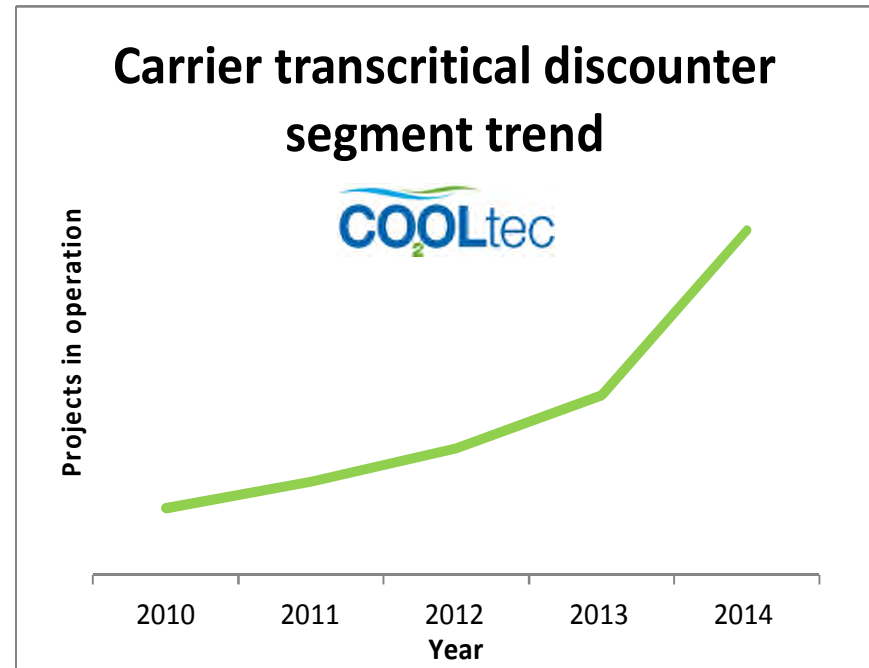
- Revised EU F-Gas Regulation
- Renewed interest in CO<sub>2</sub> from cost-sensitive buyers
- Forward-thinking purchasing strategies are a must



# NATURAL REFRIGERANTS

## Building on success: segment development

- Continued uptake by supermarkets / hypermarkets
- Increased interest from cost-sensitive buyers
- Momentum in discounter segment
- Cost-effectiveness & life-cycle cost



# NATURAL REFRIGERANTS

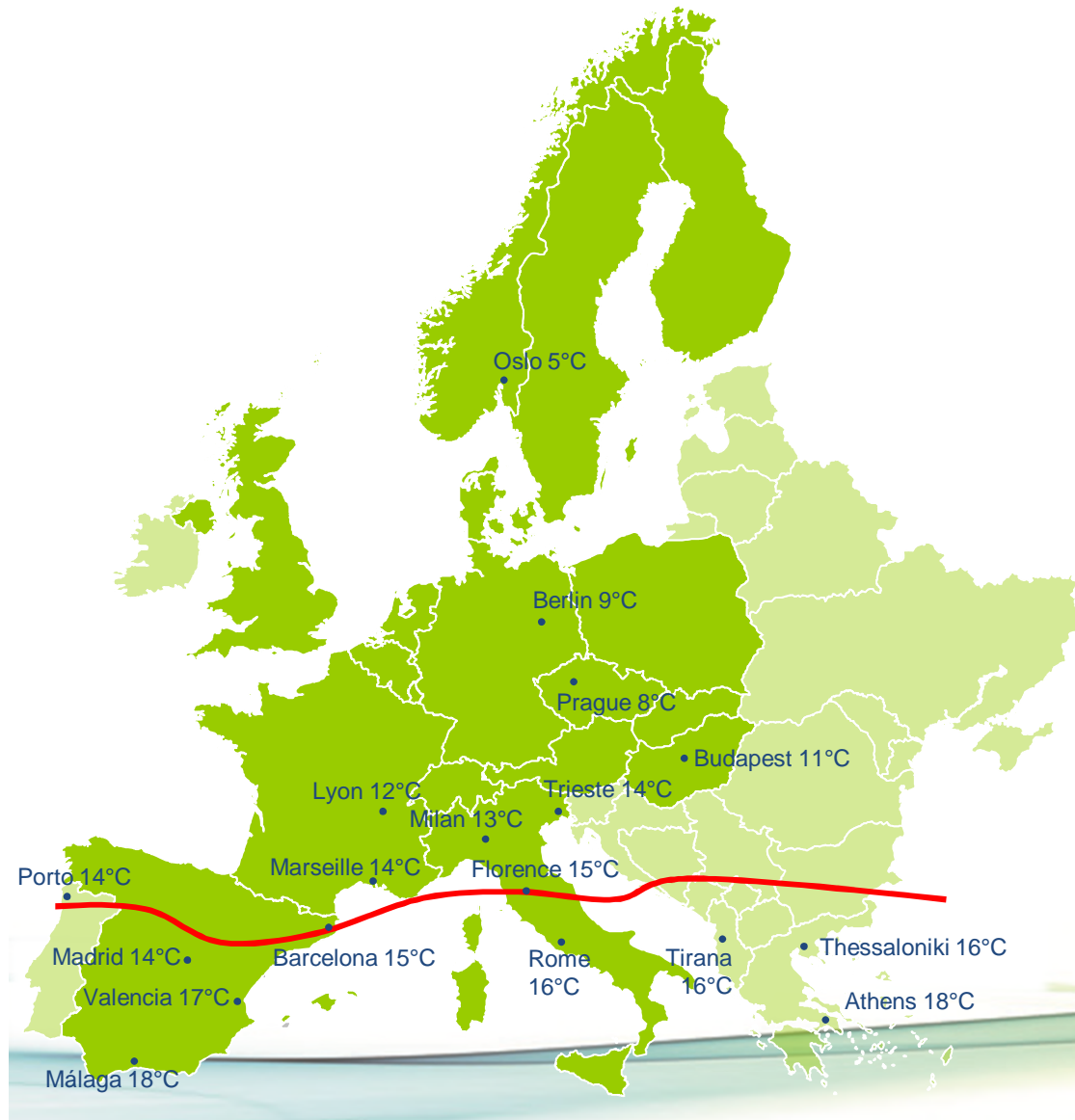
## Building on success: field expertise in CO<sub>2</sub>

- Knowledge and training remain key
- **COOL<sub>2</sub>academy** opening March 2015
- 400m<sup>2</sup> “real life” store environment
- Tailored training programs
- Target groups:
  - In-house field technicians
  - In-house project engineers
  - External field technicians



# CO<sub>2</sub> HIGH EFFICIENCY

## CO<sub>2</sub> transcritical - solutions for warm climates



### Efficiency

Proven energy efficiency of transcritical CO<sub>2</sub> DX systems in cold to mild climates

### Innovation

Next generation CO<sub>2</sub> DX systems being developed and field tested

Targeting attractive energy performance across all of Europe, eliminating current *“CO<sub>2</sub> equator”*



# INNOVATION

## CO<sub>2</sub> transcritical - solutions for warm climates

Installations:

**Economizer**

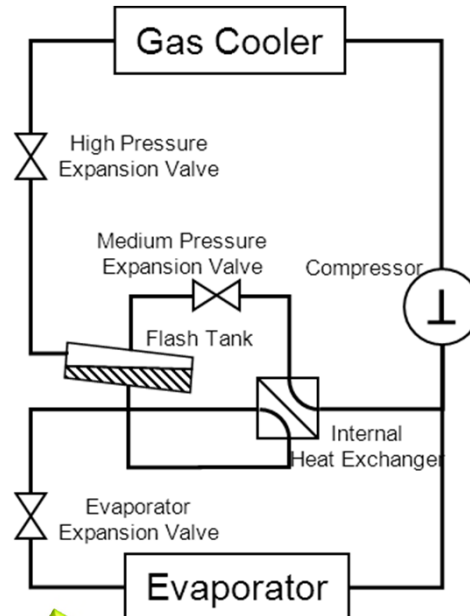
Denmark, Germany,  
Netherlands, Switzerland,  
Italy and Spain

**Mechanical subcooler**

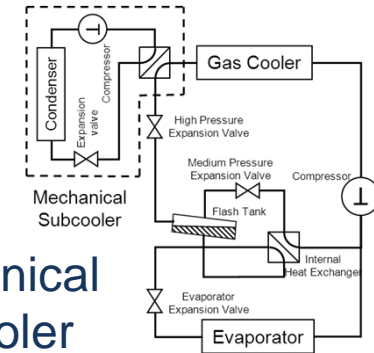
Spain  
Portugal (2015)

**Ejector**

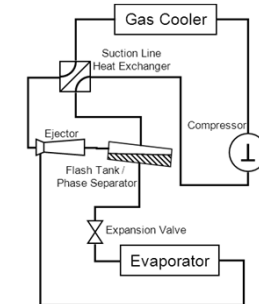
Spain



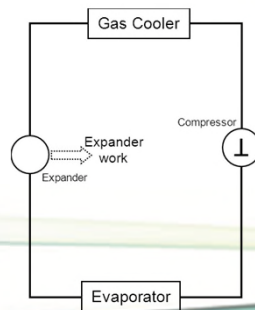
**Mechanical Subcooler**



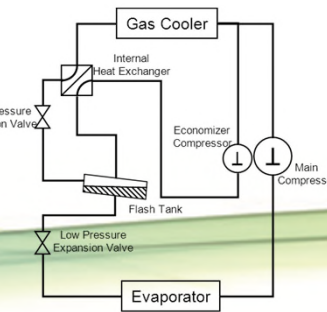
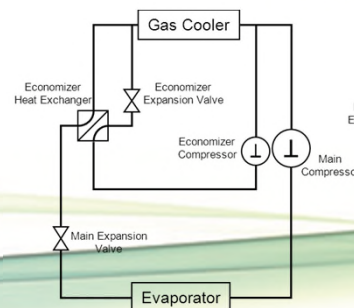
**Ejector**



**Expander**



**Economizer**





# CO<sub>2</sub> BOOSTER WITH EJECTOR

## Field trial, Spain

Measuring operational performance, efficiency & reliability

Application: Food retail hypermarket,  
Location: Castellón de la Plana, Spain  
Total MT capacity: 222 kW  
Total LT capacity: 57 kW  
Controls: Carrier PLC rack controller  
Commissioned: September 2014



# CO<sub>2</sub> BOOSTER WITH EJECTOR

## Field trial, Spain: preliminary performance results

Measurement results for daily energy consumption (24h) during operation

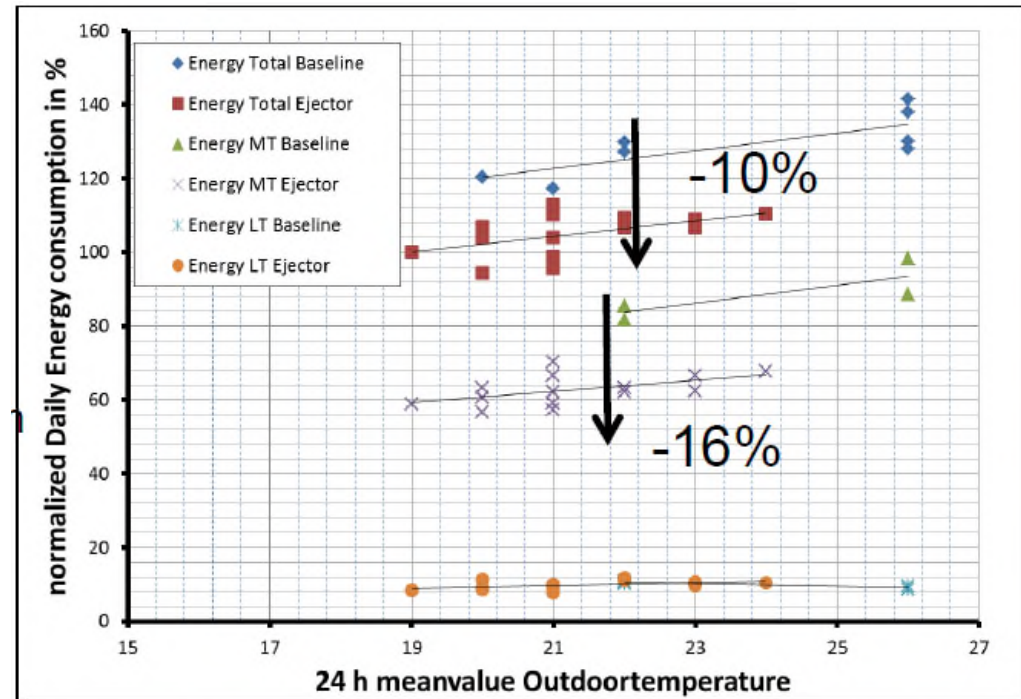
Operation with/without ejector for comparison

Reduced energy consumption in ejector operation mode:

-16% MT compressor rack

**-10% total refrigeration system**

(MT rack + LT rack + cabinets light/defrost)



y-axis normalized, Total Energyconsumption Ejector @19°C = 100%

Further optimization ongoing



# SUMMARY

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- CO<sub>2</sub> has become a mainstream technology in commercial refrigeration
- Revised EU F-Gas Regulation expected to further accelerate interest
- Continued growth for CO<sub>2</sub> systems
- Build technical field expertise across Europe (CO<sub>2</sub>OLacademy)
- Solid progress being made towards elimination of the “CO<sub>2</sub> equator” across Europe





Thank you for your attention!  
For further information please visit our website  
[www.carrier.com](http://www.carrier.com)

Innovative solutions,  
naturally...



*Carrier has the right refrigerant for every application, but every application will not have the same refrigerant solution.*