

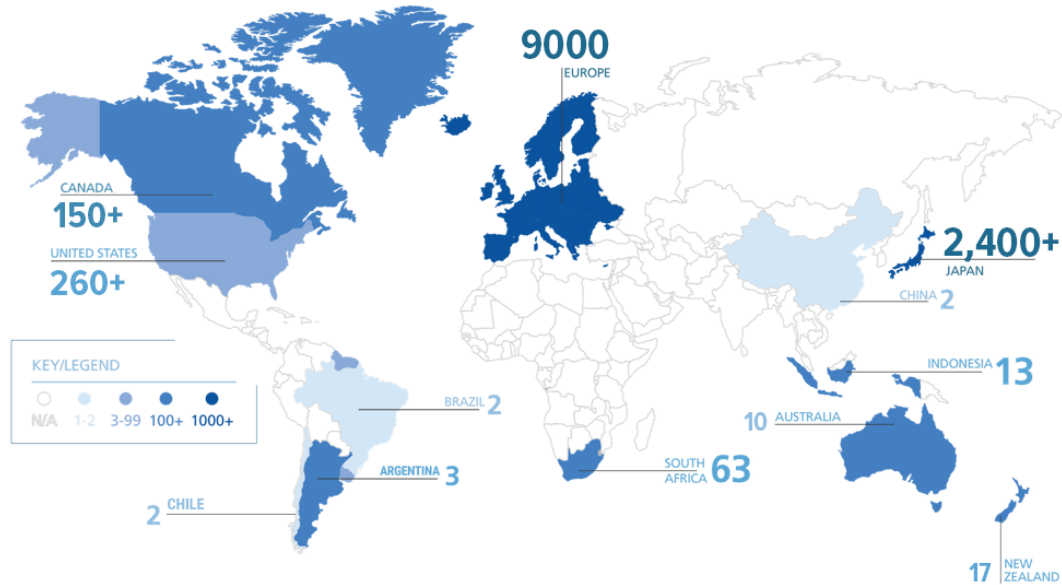
Market trends overview

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MAJOR TRENDS

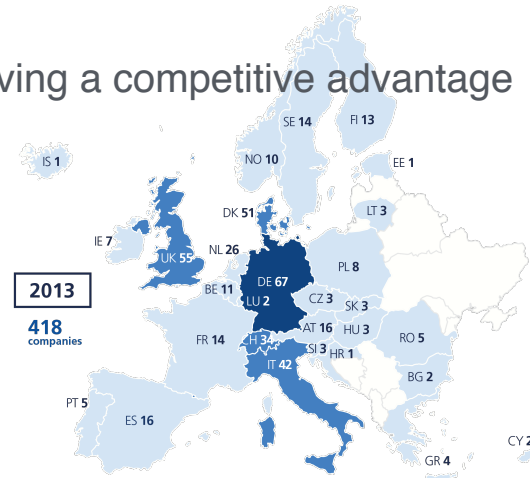
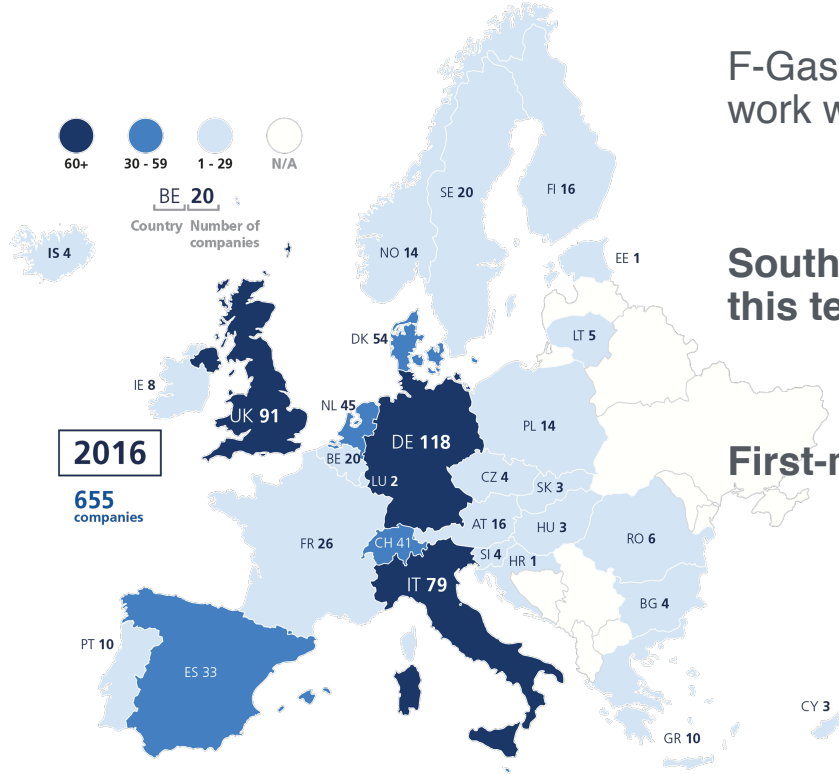
01



F-Gas Report survey (in Europe): **Over 650 companies** work with natural refrigerants

Southern European countries increasingly investing in this technology

First-movers having a competitive advantage



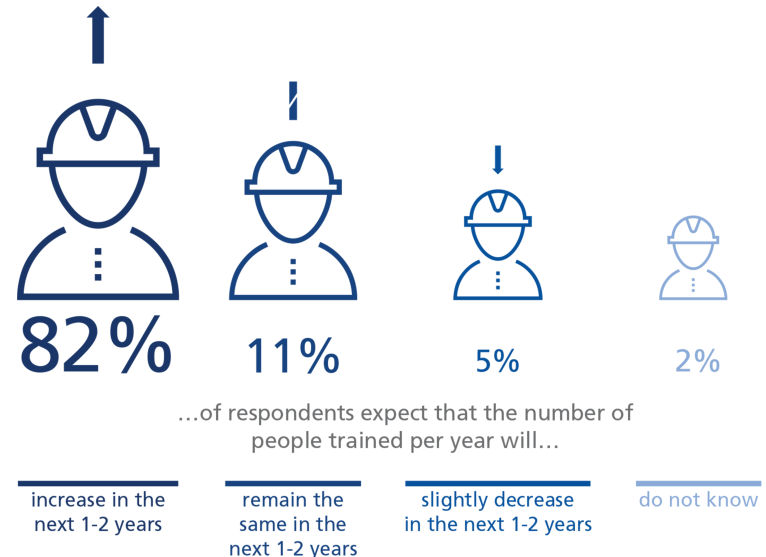
Recent survey in Europe:

Out of 160,000 technicians in Europe, **8,000 - 10,000 received training on natural refrigerants in 2015**

Close to **200 companies in Europe** offer training related to natural refrigerants

4 in 5 industry experts expect the **number of people trained in HFC alternatives will grow** in the next 1-2 years

Industry expectations on the growth of trained technicians in HFC-free technology



REFRIGERATION TRENDS

02

Strong investment of large food retail groups = CO₂
Transcritical systems becoming the norm in Europe, N.
America, Japan.

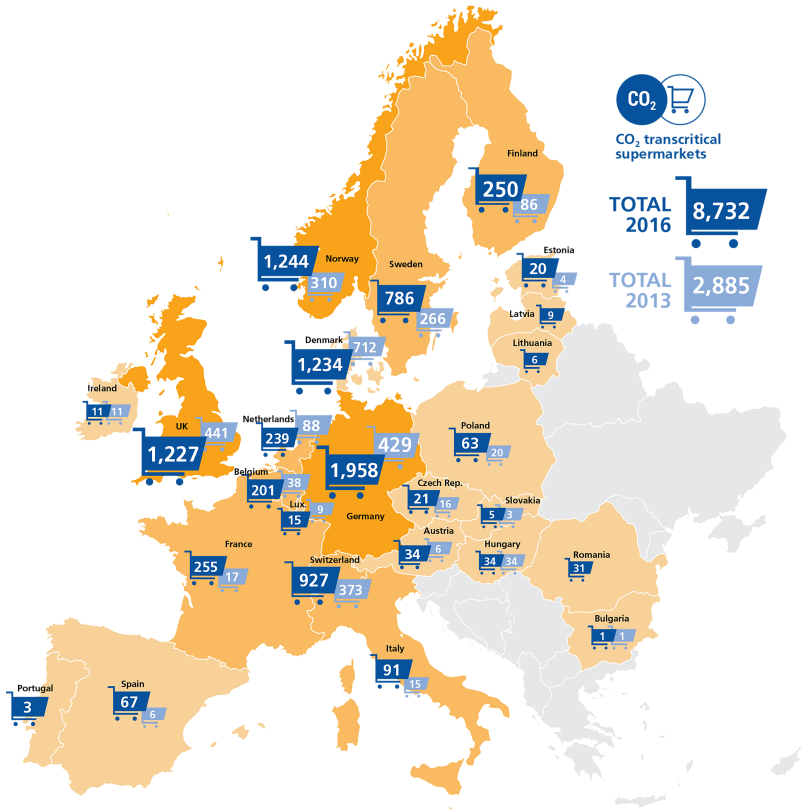
Case Study: Aldi Süd reaches 1000th installation:

- Strategic decision in 2010: Exclusive focus on natural refrigerants
- Now: Over 54% of all Aldi Süd's stores globally are running on CO₂



Source: [r744.com/articles/7423/aldi-sud-proud-to-install-1-000th-co2-system](https://www.r744.com/articles/7423/aldi-sud-proud-to-install-1-000th-co2-system)

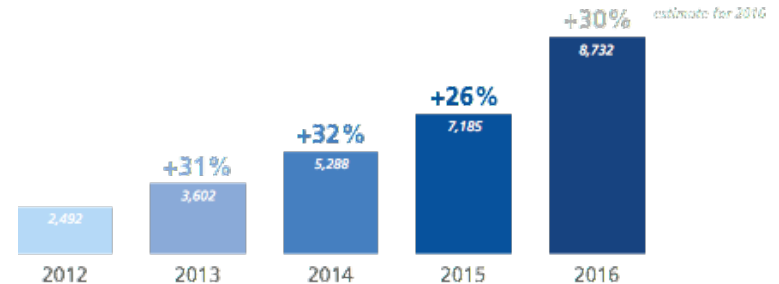
Key trend 1: EU Stores using cutting-edge HFC-free technology



Amount of CO₂ stores in the EU, Norway, Switzerland has tripled in the last 3 years = 8% of the overall market share in the food retail market

New installations is growing steeply in Southern Europe

Growth of CO₂-based stores

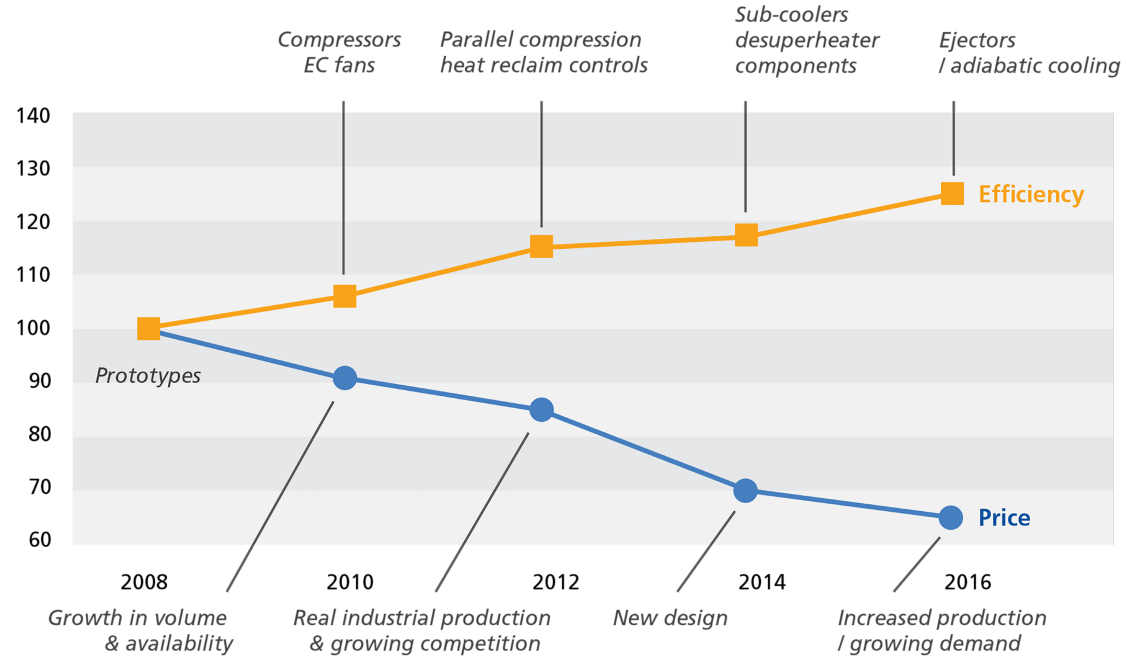


Key trend 1: CO₂ cost of equipment decreasing

Higher energy efficiency
 but lower prices

In Commercial
 Refrigeration, price is
 the same as HFC
 technology or 5-10%
 higher

—■— efficiency index
 —●— price index



Additional case studies/ market updates:

- **Albert Heijn - Europe's most sustainable store (February 2017)**

Accelerate Europe # 6

- **Metro Group invests in natural refrigerant (Aug 2016)**

<http://r744.com/articles/7118/the-metro-group-gives-a-renewed-impulse-to-natural-refrigerants>

- **Carrefour leading the European market on CO₂ and increasing efficiency (June 2016)**

<http://www.r744.com/articles/7016/crossing-the-co-sub-2-sub-equator-carrefour-leads-the-march-south>

- **Sainsbury's- return on investment after 14 months (April 2016):**

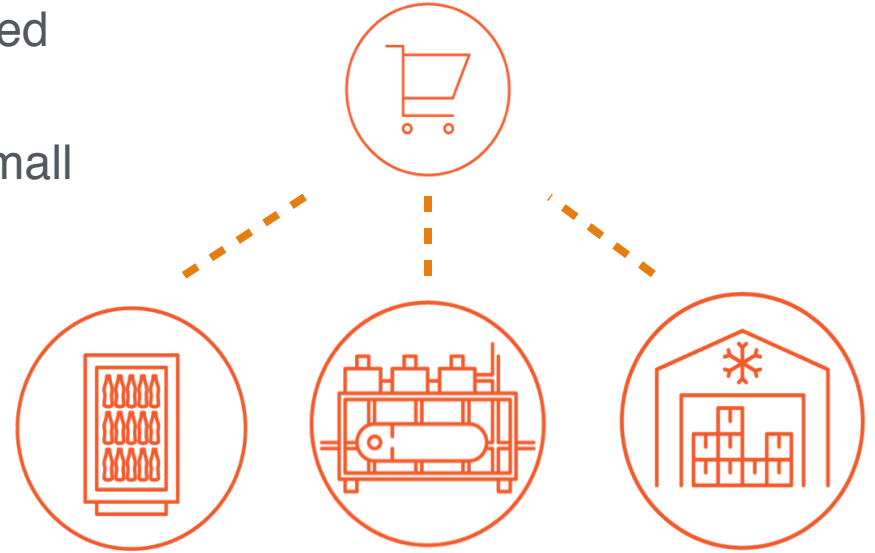
<http://www.atmo.org/media.presentation.php?id=764>

Competition between NR solutions increased

HC, CO₂ low-charge NH₃ competing for small and high cooling capacities.

Limits between “light-commercial” and “commercial”?

And “commercial” vs “industrial”?



Suited to small stores: compact, CO2 TC units, with high efficiency

Led by Japanese Technology originally (Panasonic, Sanden):
towards a larger offer of low to medium capacity solutions (0,6 to 30kW range)

Growth now in Europe: Advansor, SCM Frigo, Green & Cool all developing

Competition increasing: more efficiency, lower prices (i.e. Mitsubishi, the last to join the race)

Key trend 2: condensing units



Promising innovations to address challenge of CO₂ performance in warm climates, showing results already today.

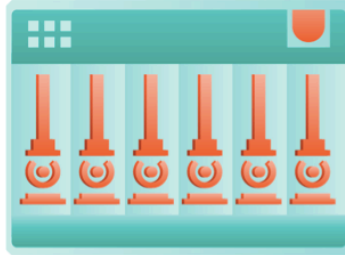
Key drivers:

Legislative pressure

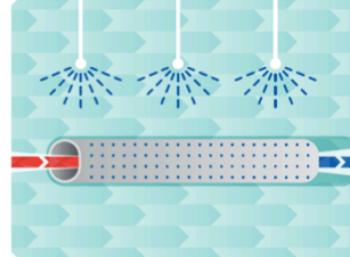
Strong retail groups asking for solutions

Increasing competition among manufacturers = better and cheaper components

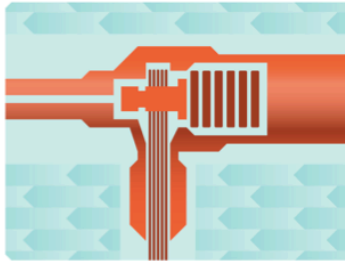
Technology:



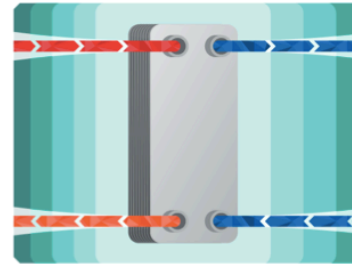
**PARALLEL
COMPRESSION**



ADIABATIC COOLING



EJECTORS



SUBCOOLERS

Case Studies:

Australian Brewery on Ammonia (Jan 2017)

http://ammonia21.com/articles/7375/australian_brewer_renews_faith_in_ammonia

First transcritical CO₂ installation in **Chile** (Dec 2016)

http://r744.com/articles/7392/chile_installs_first_co2_transcritical_system

Cold storage facility in Colombia with R290 (Dec 2016)

http://www.hydrocarbons21.com/articles/7338/cold_store_converted_to_r290_in_colombia

South African Brewery running on CO₂ (Sept 2016)

http://r744.com/articles/7193/south_african_brewery_opts_for_r744

Unilever rolling out hydrocarbons in **India** (Sept 2016)

http://www.hydrocarbons21.com/articles/7170/hindustan_unilever_rolling_out_hydrocarbon_fridges



Thank you!