



# Natural Refrigerants: Global market trends



**ATMOsphere Japan**  
**Tokyo**  
**20 February 2017**

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## global market accelerator for natural refrigerant based technologies



Government **Projects**

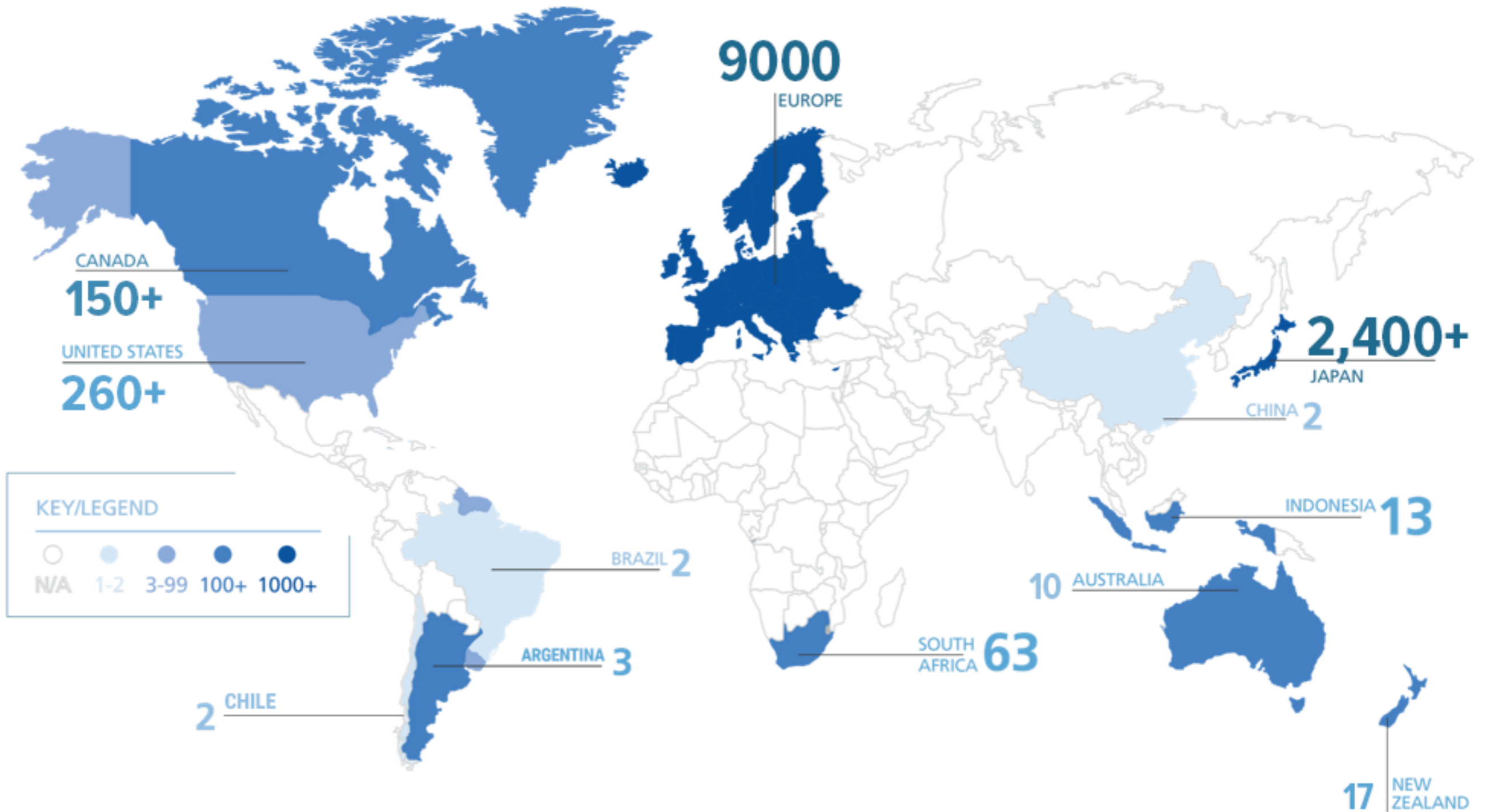


# COMMERCIAL REFRIGERATION

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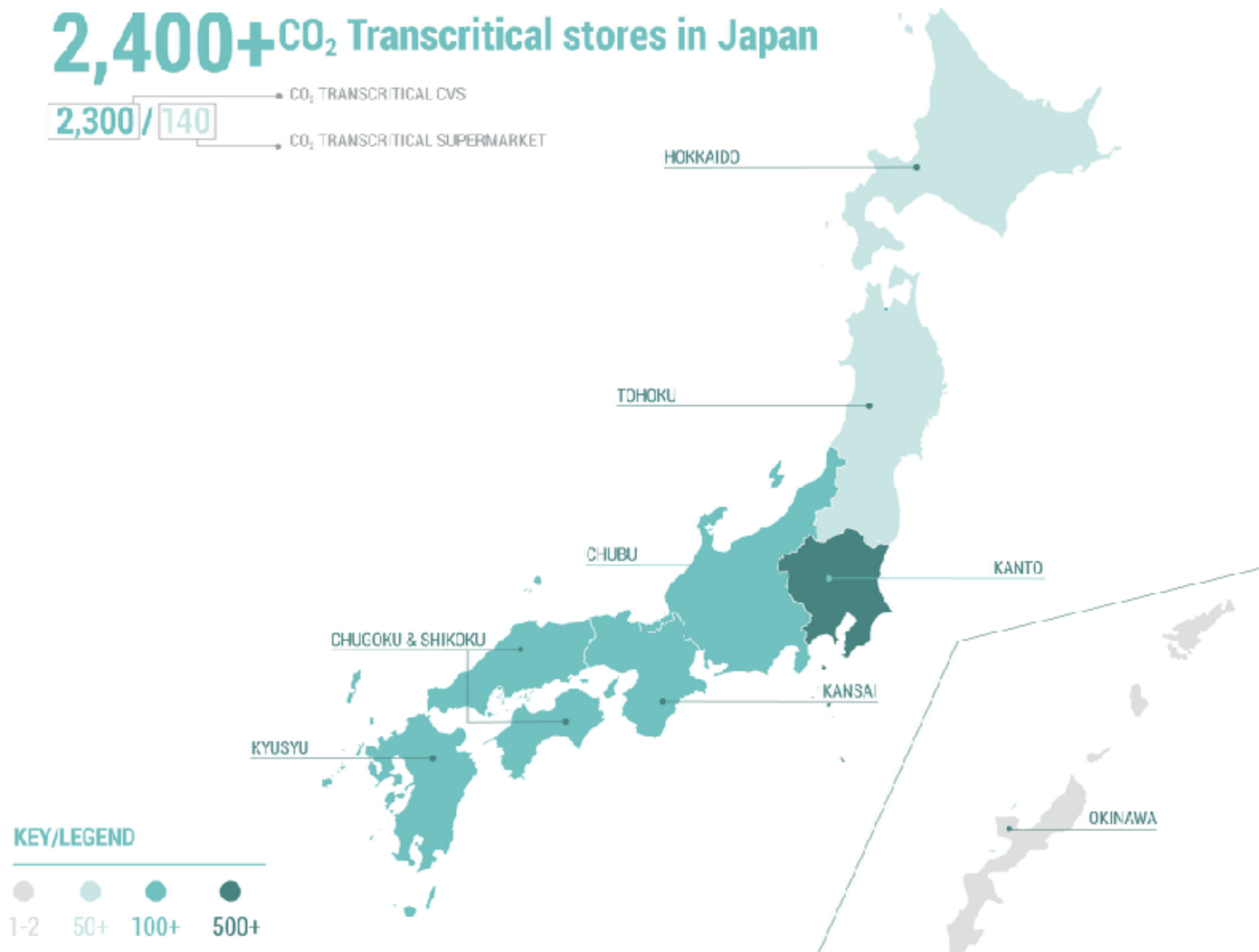
# CO<sub>2</sub> TC STORES GROWING GLOBALLY (FEB 2017)





## 2,400+ CO<sub>2</sub> Transcritical stores in Japan

2,300 / 140  
CO<sub>2</sub> TRANSCRITICAL CVS  
CO<sub>2</sub> TRANSCRITICAL SUPERMARKET





LAWSON

<ローソン>

設立年：1975年

本社：東京都品川区

国内店舗数：12,921

CO<sub>2</sub> 店舗数：2,000



<セブンイレブン>

設立年：1973年

本社：東京都千代田区

国内店舗数：19,220

CO<sub>2</sub> 店舗数：155



<ファミリーマート>

設立年：1972年

本社：東京都豊島区

国内店舗数：18,185

CO<sub>2</sub> 店舗数：59



<ミニストップ>

設立年：1980年

本社：東京都千代田区

国内店舗数：2,247

CO<sub>2</sub> 店舗数：20

データは、ヒアリングを基にした調査結果によるものです。数字は2017年2月末現在（予定）



<西友>

設立年：1963年

本社：東京都北区

国内店舗数：341

CO<sub>2</sub> 店舗数：5



<コープさっぽろ>

設立年：1965年

本社：北海道札幌市

国内店舗数：108

CO<sub>2</sub> 店舗数：9



<みやぎ生協>

設立年：1982年

本社：宮城県仙台市

国内店舗数：448

CO<sub>2</sub> 店舗数：4



<イオン (スーパーのみ)>

設立年：1929年

本社：千葉県千葉市

国内店舗数：約 2,400

CO<sub>2</sub> 店舗数：99

データは、ヒアリングを基にした調査結果によるものです。数字は2017年2月末現在（予定）



**3 major Japanese manufacturers supply CO<sub>2</sub> condensing units**

**The Question is not IF but WHEN**

**will the other Japanese manufactures join the CO<sub>2</sub> race?**



# KEY TREND: CO<sub>2</sub> PLUG-IN SHOWCASES (SMTS 2017)





**Growing line up of small size NH<sub>3</sub>/CO<sub>2</sub> systems -  
potential to serve supermarkets?**



**High Pressure Safety Act - barrier to introduction of larger CO<sub>2</sub> systems**

**Change coming in 2018?**



**Number of R290 plug-in showcases in 2015: 150+**



**Number of R290 plug-in showcases estimated to be 300+ in Feb 2017**

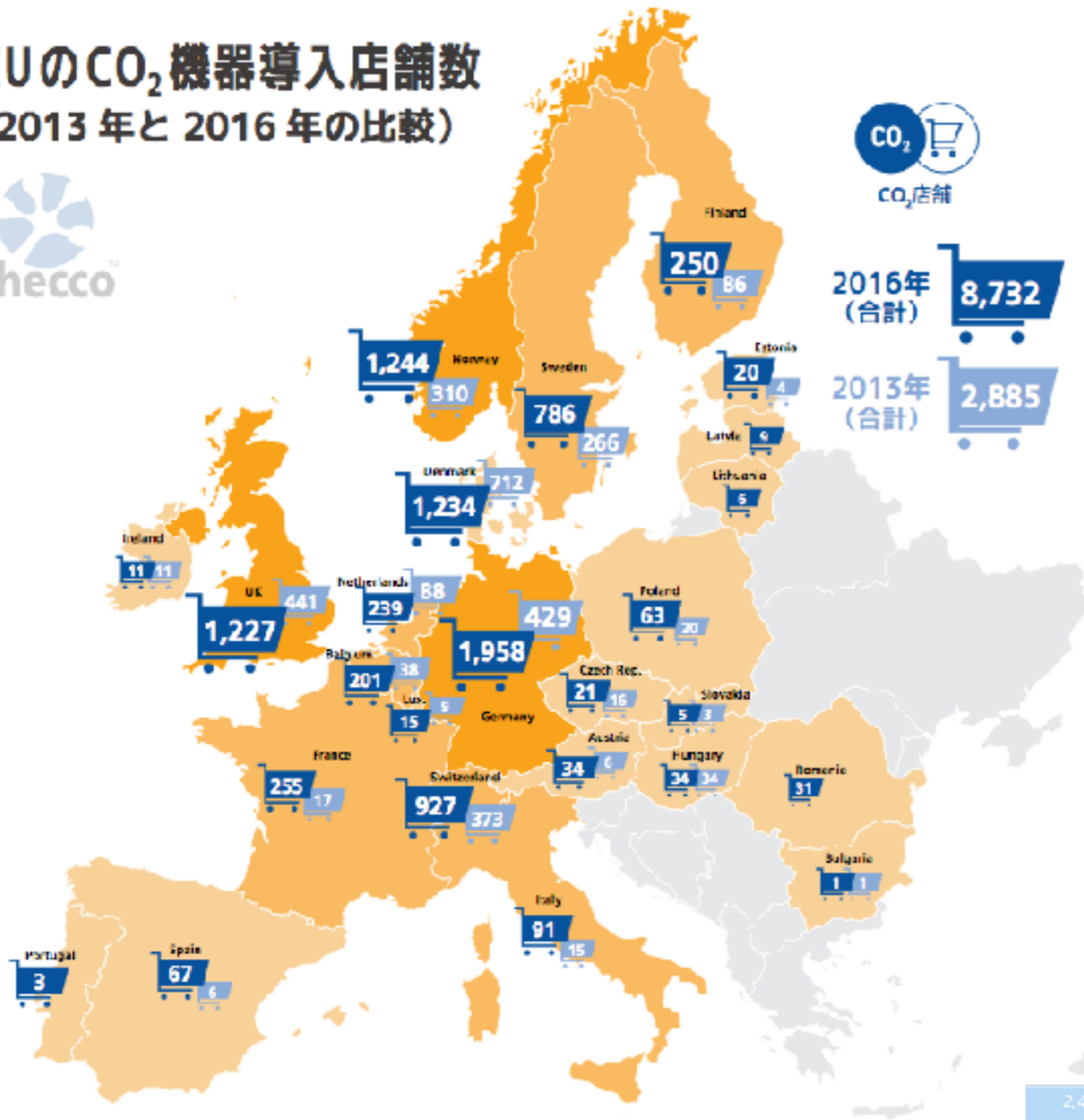


**4 major European manufacturers supply HC R290 showcases to Japan**

**Will Japanese manufactures follow the global HC trend?**



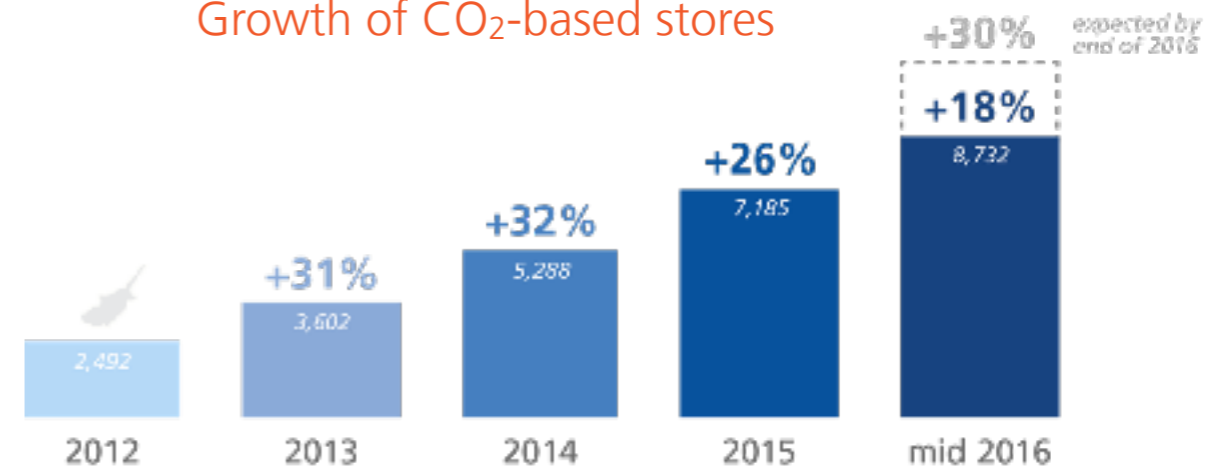
## EUのCO<sub>2</sub>機器導入店舗数 (2013年と2016年の比較)



Number of CO<sub>2</sub> stores in the EU, Norway, Switzerland has **tripled** in the last 3 years = **8% of the overall market share** in the food retail market

Despite earlier claims that there are no viable solutions for warmer climates, the **number of new installations is growing steeply in Southern Europe**

### Growth of CO<sub>2</sub>-based stores

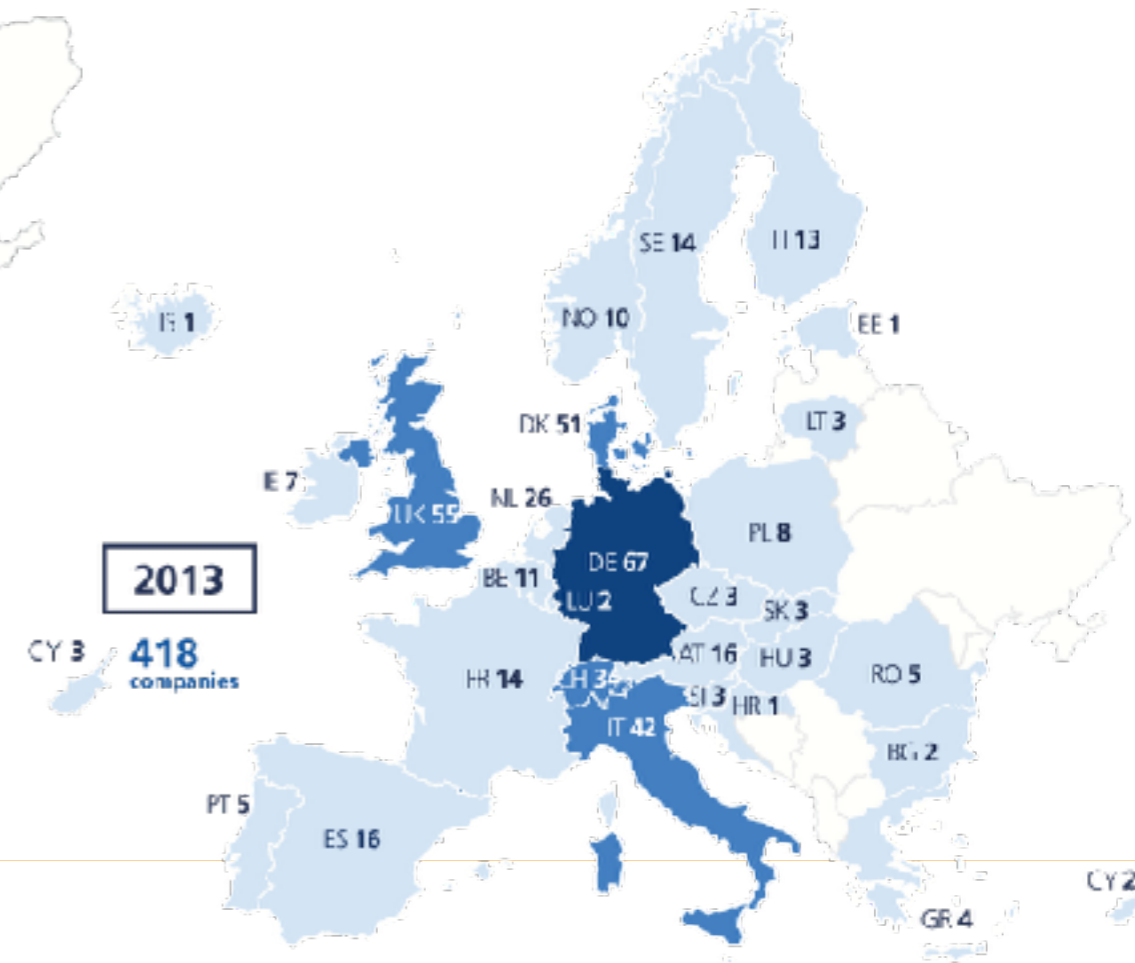
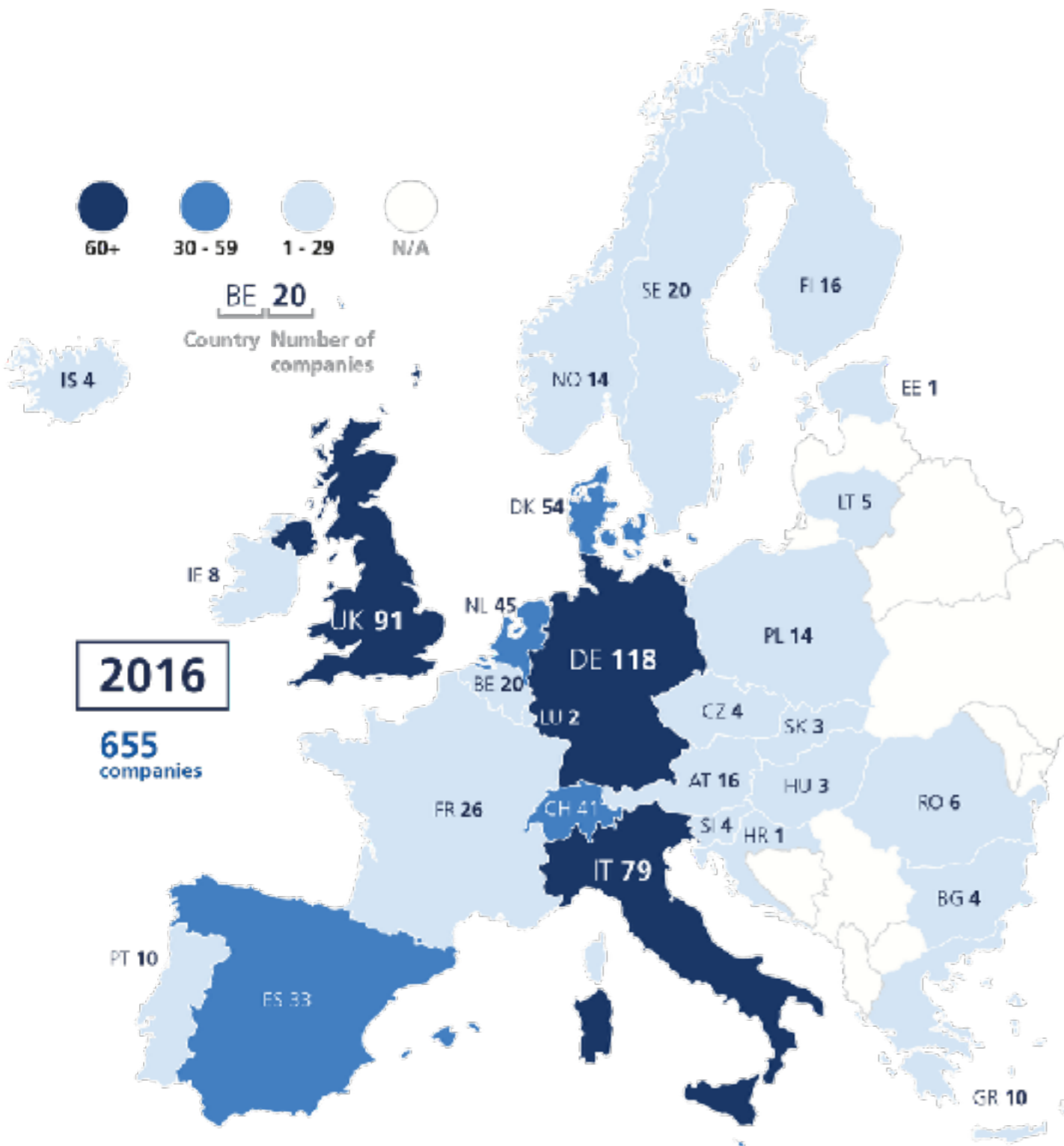




F-Gas Report survey: **Over 650 companies** work with natural refrigerants (HFC alternatives) in the EU, Norway, Switzerland and Iceland

**Southern European countries are increasingly investing in this technology**

**First-movers** were able to benefit from their competitive advantage across the EU and beyond





Recent survey in Europe:

Out of a total 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







In many markets, especially Europe, North America, Japan, the availability and quality of training options on CO<sub>2</sub> technology has improved dramatically. Training integrates latest technology, simulations, etc.

**Case study:** Danfoss CO<sub>2</sub> Mobile training unit (launched Nov 2016)





Strong investment of large food retail groups = CO<sub>2</sub> Transcritical systems becoming the norm in Europe, N. America, Japan.

Efficiency and reliability are increasing, and prices are going down.

## **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 CO<sub>2</sub>



Source:

[r744.com/articles/7423/aldi\\_sud\\_proud\\_to\\_install\\_1\\_000th\\_co2\\_system](http://r744.com/articles/7423/aldi_sud_proud_to_install_1_000th_co2_system)



As HFCs are being phased down globally, the competition among natural refrigerant solutions is increasing...but they can also coexist successfully.

## Case Study:

NH<sub>3</sub>/ CO<sub>2</sub> Supermarket retailer in the US saving 30% on energy bills

[http://r744.com/articles/7329/nh3\\_co2\\_system\\_continues\\_to\\_save\\_energy\\_at\\_piggly\\_wiggly\\_store\\_nbsp](http://r744.com/articles/7329/nh3_co2_system_continues_to_save_energy_at_piggly_wiggly_store_nbsp)





Belgian retailer **Colruyt** targeting 100% hydrocarbons for refrigeration. Exclusive use of hydrocarbons as of 2017

## Based on:

- Medium capacity chiller (2,5kg of R290 charge) + secondary glycol loop
- Standalone chest freezers (R600a)

## Reported:

- High energy savings
- Reduced leakage rate to approx 5%

Source: Accelerate Europe

([https://issuu.com/shecco/docs/ae1609/34?utm\\_source=shecco+natural+refrigerants&utm\\_campaign=5dfd40d6b5-AE1606&utm\\_medium=email&utm\\_term=0\\_9db972ca57-5dfd40d6b5-](https://issuu.com/shecco/docs/ae1609/34?utm_source=shecco+natural+refrigerants&utm_campaign=5dfd40d6b5-AE1606&utm_medium=email&utm_term=0_9db972ca57-5dfd40d6b5-))

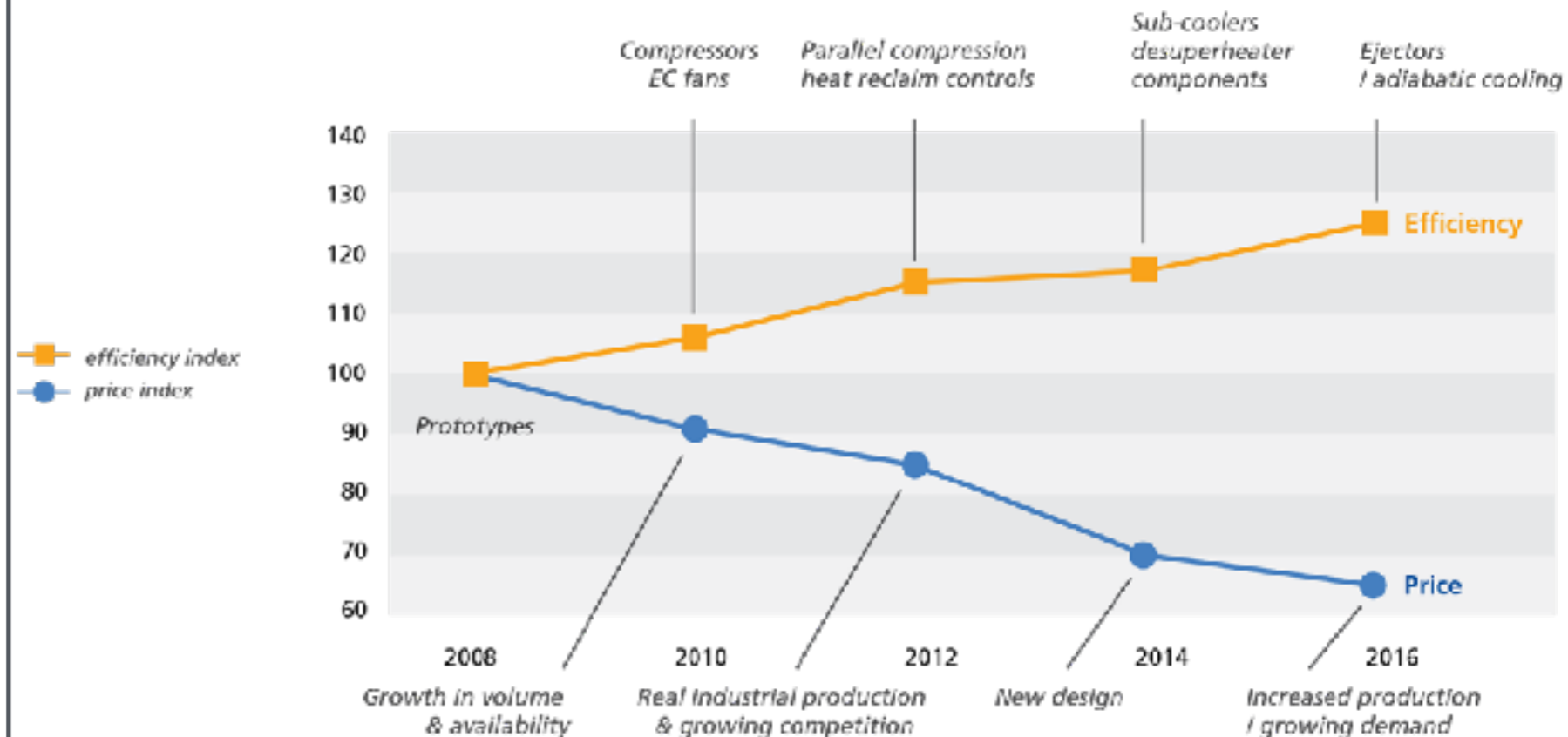




The cost of equipment is becoming comparable to systems using HFCs

In sectors where **HFC alternatives are growing in availability, prices are falling** - in commercial refrigeration same as HFC technology or 5-10% higher

Each year, reported higher energy efficiency, lower prices as technology reaches mass production





**Europe traditionally working with large capacity CO<sub>2</sub> racks**

**Recently several manufacturers introduced small systems**

**Competition increasing: more efficiency, lower prices**



Plug-in units in supermarkets with R290: A reality today

Market estimate by early 2017:

**1,000,000+ units worldwide**

Figures reported by AHT (market leader) by 2016

- over 700 000 units in Europe alone

- 3500+ in Thailand

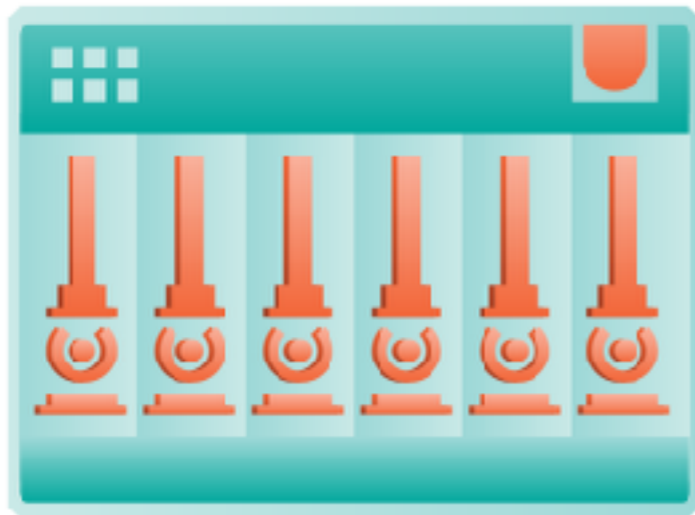


Source: Atmosphere Europe

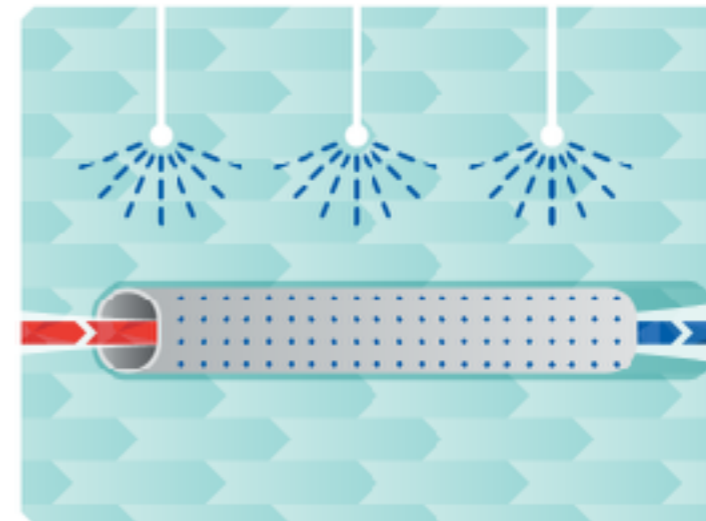
<http://www.atmo.org/presentations/files/571d609d687c41461543069pAbOu.pdf>



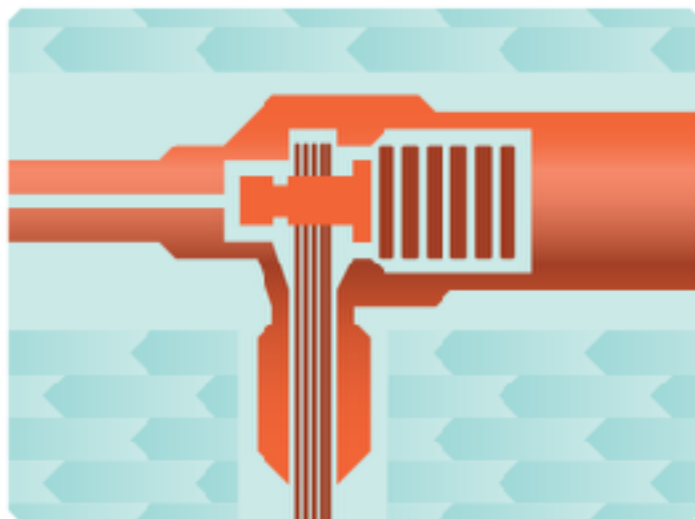
## Technology:



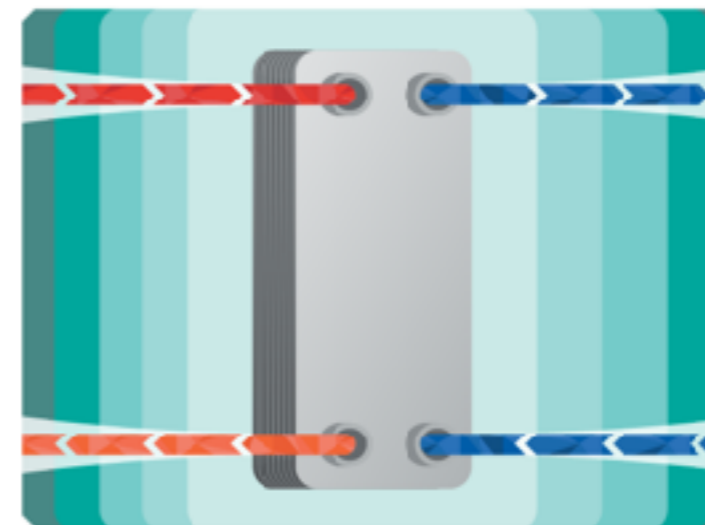
PARALLEL COMPRESSION



ADIABATIC COOLING



EJECTOR



SUBCOOLERS





## Case Studies:

- Ejectors' developments- increasing competition (Jan 2017)

[http://r744.com/articles/7359/ejectors\\_to\\_efficiency\\_and\\_beyond](http://r744.com/articles/7359/ejectors_to_efficiency_and_beyond)

- Efficiency in warm climates explained (Nov 2016)

[http://r744.com/articles/7273/market\\_ready\\_solutions\\_for\\_co2\\_systems\\_in\\_warm\\_climates\\_explained](http://r744.com/articles/7273/market_ready_solutions_for_co2_systems_in_warm_climates_explained)





## Case Studies:

### **Australian** Brewery on Ammonia (Jan 2017)

[http://ammonia21.com/articles/7375/australian\\_brewer\\_renews\\_faith\\_in\\_ammonia](http://ammonia21.com/articles/7375/australian_brewer_renews_faith_in_ammonia)

### First transcritical CO<sub>2</sub> installation in **Chile** (Dec 2016)

[http://r744.com/articles/7392/chile\\_installs\\_first\\_co2\\_transcritical\\_system](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](http://www.hydrocarbons21.com/articles/7338/cold_store_converted_to_r290_in_colombia)

### **South African** Brewery running on CO<sub>2</sub> (Sept 2016)

[http://r744.com/articles/7193/south\\_african\\_brewery\\_opts\\_for\\_r744](http://r744.com/articles/7193/south_african_brewery_opts_for_r744)

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

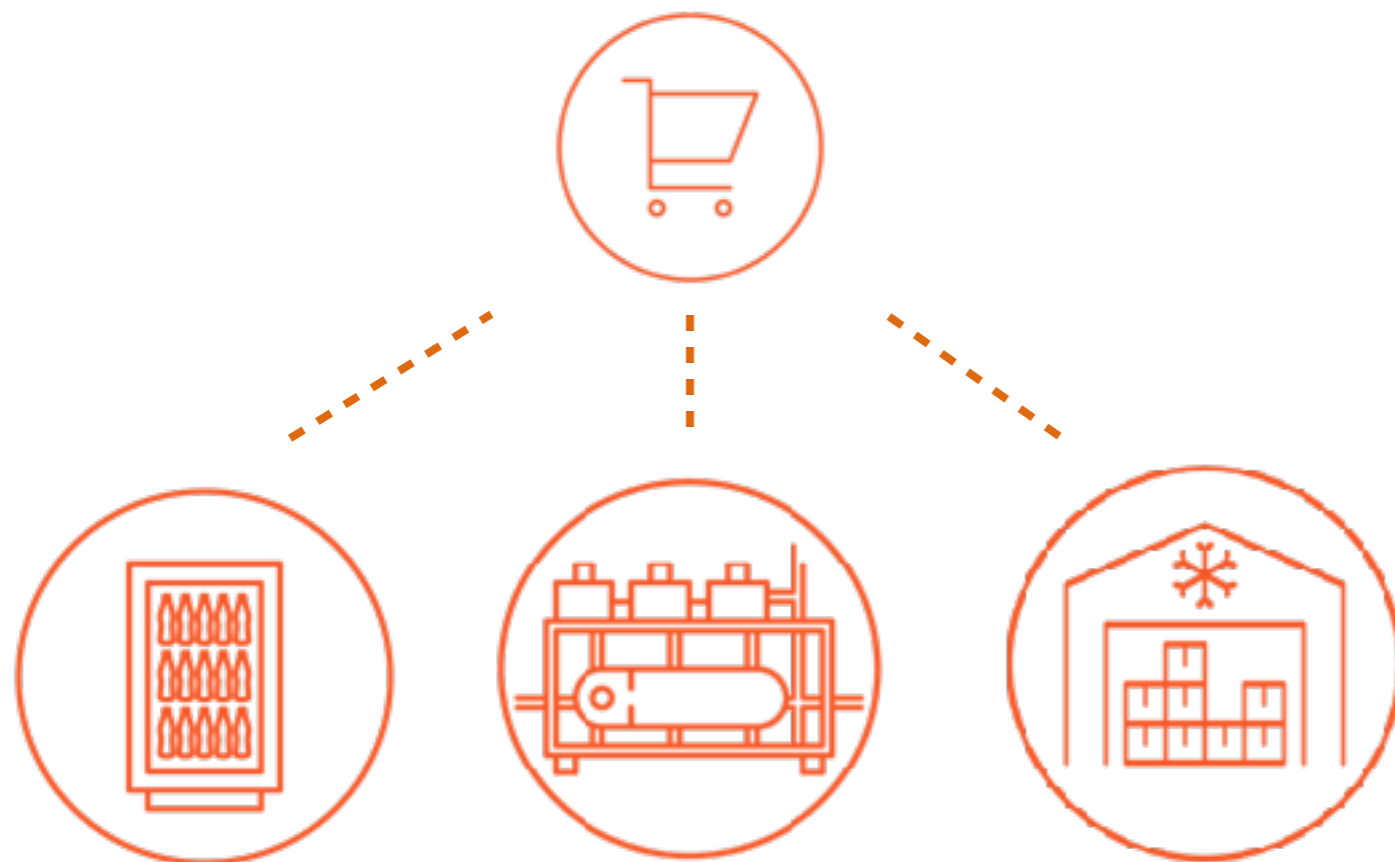
[http://www.hydrocarbons21.com/articles/7170/hindustan\\_unilever\\_rolling\\_out\\_hydrocarbon\\_fridges](http://www.hydrocarbons21.com/articles/7170/hindustan_unilever_rolling_out_hydrocarbon_fridges)



# INDUSTRIAL REFRIGERATION

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Limits between “light-commercial” and “commercial” refrigeration become vague: HC pushing into larger store formats, and CO<sub>2</sub>-based systems into smaller formats

Distinction between “commercial” and “industrial” is less clear, since NH<sub>3</sub>/CO<sub>2</sub> systems push into the food retail sector

= internal competition between different NR systems has increased



Low-charge Ammonia are becoming a strong trend for industrial refrigeration, traditionally dominated by HFCs/ large Ammonia installations with big refrigerant charge

## **Key drivers:**

- increased safety- lower risk
- higher efficiency
- easier servicing (more compact units)
- return on investment for the end user



the market is changing, from a strong reliance on R22 to a renewed uptake of (lower charge) NH<sub>3</sub> systems

Estimated **400+ installations** use secondary NH<sub>3</sub>-CO<sub>2</sub> systems

**NEXT:** export of the technology to other regions

**BUT:** the use of CO<sub>2</sub> transcritical systems still faces restrictions through the High Pressure Gas Safety Act





As the know-how on CO<sub>2</sub> Transcritical systems increases, CO<sub>2</sub> is now becoming an option for higher cooling capacity needs, traditionally dominated by Ammonia and HFCs.

## Key drivers:

- increased reliability and performance of CO<sub>2</sub> systems
- growing competition in the segment pushing prices down and technology becoming more available
- excellent safety record
- return on investment for the end user









## **World's biggest CO<sub>2</sub> industrial plant**

(vegetable processing plant in the Netherlands by Advansor for Staay Food group):

- 3,36 Megawatt (MW) total cooling capacity
- 7 transcritical CO<sub>2</sub> racks
- 45 high capacity compressors
- 600 kW of heat recovery, providing "free" heating for the office facilities
- Installation in 2016, in operation since early 2017

Source:

[http://www.r744.com/articles/7124/advansor\\_to\\_deliver\\_world\\_s\\_biggest\\_co\\_sub\\_2\\_sub\\_system\\_so\\_far](http://www.r744.com/articles/7124/advansor_to_deliver_world_s_biggest_co_sub_2_sub_system_so_far)





## Other recent Case Studies:

Bitzer launches high capacity compressor (Feb 2017)

[http://r744.com/articles/7420/bitzerandrsquo\\_s\\_new\\_50\\_hp\\_compressors\\_make\\_u\\_s\\_debut](http://r744.com/articles/7420/bitzerandrsquo_s_new_50_hp_compressors_make_u_s_debut)

Case Study Industrial: Transcritical CO<sub>2</sub> warehouse with low-charge Ammonia chiller (Australia-Jan 2017)

[http://r744.com/articles/7415/gourmet\\_australian\\_food\\_firm\\_commissions\\_transcritical\\_co2\\_plant](http://r744.com/articles/7415/gourmet_australian_food_firm_commissions_transcritical_co2_plant)

CO<sub>2</sub> in Industrial-type Heat Pumps (UK, by Sanden- Dec 2016)

[http://r744.com/articles/7312/co2\\_heat\\_pumps\\_target\\_uk\\_farmers](http://r744.com/articles/7312/co2_heat_pumps_target_uk_farmers)

CO<sub>2</sub> In Data Centre (by Carrier- Sept 2016)

[http://r744.com/articles/7151/carrier\\_develops\\_co\\_sub\\_2\\_sub\\_product\\_for\\_data\\_centre\\_cooling](http://r744.com/articles/7151/carrier_develops_co_sub_2_sub_product_for_data_centre_cooling)

CO<sub>2</sub> Ice Rink (in Belgium, Sweden, Canada, etc.)

[http://r744.com/articles/7348/will\\_ice\\_rinks\\_go\\_co2\\_in\\_future](http://r744.com/articles/7348/will_ice_rinks_go_co2_in_future)



## **Industry Platforms:**

[www.hydrocarbons21.com](http://www.hydrocarbons21.com)

[www.R744.com](http://www.R744.com)

[www.ammonia21.com](http://www.ammonia21.com)

## **shecco Publications, incl. GUIDEs**

<http://publications.shecco.com>

## **Accelerate Magazines:**

[www.accelerateEU.com/](http://www.accelerateEU.com/)

[www.accelerateNA.com/](http://www.accelerateNA.com/)

[www.accelerateAUNZ.com/](http://www.accelerateAUNZ.com/)

[www.accelerateJapan.com/](http://www.accelerateJapan.com/)

## **ATMOsphere conferences:**

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## **#WebinarWednesday**

[www.webinarwednesday.net](http://www.webinarwednesday.net)

## **The Natural Voice**

[www.thenaturalvoice.org](http://www.thenaturalvoice.org)

THANK YOU

