Natural Refrigerants: Global market trends

ATMOsphere Australia
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Jan Dusek
Business Development Manager APAC, shecco
COMMERCIAL REFRIGERATION
CO₂ TC STORES GROWING GLOBALLY (FEB 2017)
Number 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.

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 CO₂-based stores**

<table>
<thead>
<tr>
<th>Year</th>
<th>Estimate</th>
<th>Growth</th>
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</thead>
<tbody>
<tr>
<td>2012</td>
<td>2,492</td>
<td></td>
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<tr>
<td>2013</td>
<td>3,462</td>
<td>+31%</td>
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<tr>
<td>2014</td>
<td>5,288</td>
<td>+32%</td>
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<tr>
<td>2015</td>
<td>7,185</td>
<td>+26%</td>
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<td>2016</td>
<td>8,732</td>
<td>+30%</td>
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• Currently **32 subcritical CO₂ supermarkets** in China (HFC/CO₂ cascades) - south east region

• Majority operated by Metro China, first ever installed by Tesco

• 5 contractors able to handle CO₂ installations

• **Market opening up to CO₂ TC** - discussion about subsidy for retailers from the Gov
Natural Refrigerants recommended by MEP/FECO China in majority of targeted HVAC&R segments

- **R290** - Room air conditioner, Heat pump water heater, Stand-alone refrigeration system

- **R600a** - Stand-alone refrigeration system

- **CO₂** - Domestic heat pump water heaters, industrial or commercial heat pump water heaters, Industrial or commercial refrigeration system (refrigerant or secondary refrigerant)

- **NH₃** - Cold storage, condensing unit, industrial refrigeration system
Plug-in Units in Supermarkets with R290: A reality today

Market estimate by early 2017:

1,500,000+ units worldwide

Figures reported by AHT (market leader) by 2017:

- over 300,000+ units manufactured per year
Strong investment of large food retail groups = CO₂
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 CO₂

Source:
r744.com/articles/7423/aldi_sud_proud_to_install_1_000th_co2_system
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: hydrocarbons21.com

Whole Foods pushes the propane envelope

The organic/natural food retailer Whole Foods Market, which has installed small-charge propane cases in many stores, is the first in the U.S. to test a centralised propane/CO\textsubscript{2} cascade system

Source: Accelerate America

( http://acceleratena.com/sites/action/AA1610/read/s_main )
KEY TREND: CO$_2$ RACK SYSTEM

10+ suppliers providing CO$_2$ solutions - highly competitive market
Europe traditionally working with large capacity CO₂ racks

Recently several manufacturers introduced small systems

Competition increasing: more efficiency, lower prices
On-the-spot survey to 33 companies, including major players of the sector

Ejectors, parallel compression and waterloop systems identified to be the main technology trends,

Approximately 15-20% increase in production of natural refrigerant systems expected for the period 2017-2018

R290 dominating plug-ins, showing the greatest potential

Even higher growth expected by 2020 and beyond, with a few companies claiming that they will be ready to have their entire production moving to only natural refrigerants

Regulation and mainly customer demand are the reasons for the expectations, especially for Europe
AUSTRALIA joins natural refrigerant race
EuroShop special from Düsseldorf

WWW.ACCELERATEAUNZ.COM
• True Manufacturing (Global)
  • **Committed to move entire manufacturing to 100% HC (R290) by 2019**
  • Heavy investments in R&D over the last five years
  • Currently 2/3 through the transition from R134a and R404A to R290
  • Partly motivated by regulation (**F-GAS, US DOE, US SNAP**)
  • HC systems cheaper to run and more cost effective than HFC counterparts (**25+% more efficient**)
  • 327 HC base models that meet DOE’s 2017 standards
  • T-23-HC single door commercial refrigerator consumes 1.27kWh daily (DOE’s limit: 2.27kWh daily) => 31.76$ energy costs saved over a year (at 10cents/kWh)
Low-charge Ammonia systems 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
KEY TREND: INDUSTRIAL APPLICATIONS WITH CO₂ & NH₃
Estimated 100+ refrigeration projects in industrial sector with $CO_2$ & $NH_3$
the market is changing, from a strong reliance on R22 to a renewed uptake of (lower charge) NH\textsubscript{3} systems

Estimated 450+ installations use secondary NH\textsubscript{3}-CO\textsubscript{2} systems

**BUT:** the use of CO\textsubscript{2} transcritical systems still faces restrictions through the High Pressure Gas Safety Act
World’s biggest CO₂ industrial plant
(vegetable processing plant in the Netherlands by Advansor for Staay Food group):

• 3,36 Megawatt (MW) total cooling capacity

• 7 transcritical CO₂ racks

• 45 Bock compressors (28 medium temp., 14 parallel, 3 frost)

• 600 kW of heat recovery, providing “free” heating for the office facilities

• Installation in 2016, in operation since early 2017

• Lower capital, installation & maintenance costs.

Evaporating capacity of system
• 0,53 MW at -7 °C,
• 1,87 MW at -5°C,
• 0,78 MW at 0°C and
• 0,03MW at -28°C.
• 0,15 MW of cooling for AC purpose.

Source:
http://www.r744.com/articles/7124/advansor_to_deliver_world_s_biggest_co_sub_2_sub_system_so_far
System installed at a Carrefour distribution centre in Buenos Aires.

First of its kind in Argentina, and second in Latin America

• Ammonia - CO₂ - brine system

• Installation began in 2016, running since 19 Jan 2017

• Biggest in the region: 14,000 m²

• High cooling and freezing efficiency; low pressure system with a high coefficient of heat transfer

• Lower cost of installation

• Another installation planned for a 3,000 m² Arca Continental ice cream facility in Mexico
AIR CONDITIONING

03
R290 AIR-CONDITIONING, IS IT COMING?
R290 AIR-CONDITIONING, IS IT COMING?
Godrej Appliances

- Replaced CFC, HFC and HCFC as early as 2002
- Efficient and green ACs using R290; first in the world
- India’s first ACs with 7-star performance
- 300,000+ units sold since launch
- Earliest brand to opt for voluntary energy labelling of its refrigerators
• **Japanese Government (METI) & New Energy Development Organisation (NEDO)**

• 4 companies participating in the research projects to develop technologies for high energy efficiency low-GWP based small and mid-size air-conditioning systems

• **DENSO** - development of **CO$_2$ (R744) AC system with high efficiency ejector**

• **MITSUBISHI ELECTRIC** - development of **HC based room air-conditioning system**
• HC based water chillers introduced by several companies targeting **commercial air-conditioning** and **process cooling applications**

• RSA Cooling - water chiller for outdoor installations, and are available with **cooling capacity from 3,0 to 15,0 kW**

• HC water chillers in Australia, **reliable performance at 45C days this summer**
SHECCO USEFUL LINKS

Industry Platforms:
- www.hydrocarbons21.com
- www.R744.com
- www.ammonia21.com

shecco Publications, incl. GUIDEs
- http://publications.shecco.com

Accelerate Magazines:
- www.accelerateEU.com/
- www.accelerateNA.com/
- www.accelerateAUNZ.com/
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