GLOBAL NATURAL REFRIGERANT TRENDS
ATMOsphere Network Montreal
21 November

Marc Chasserot, CEO, shecco Group
DOMESTIC & LIGHT COMMERCIAL REFRIGERATION
HC IN DOMESTIC REFRIGERATION

Biggest success story so far

Over 1.5 billion domestic refrigerators already use hydrocarbons today

HC is the standard for 50% global production of new domestic refrigeration equipment

By 2020, 75% of new production globally will use R600a / R290
CONSUMER BRANDS CHOOSE NATURAL REFRIGERANTS

5.5 million units using natural refrigerants (HC & CO₂) collectively installed

=> 33 million tonnes of avoided CO₂ (equivalent emissions of more than 6.7 million passenger cars over one year)

Increasing number of consumer brands choosing HCs for their point of sale equipment - often targeting global procurement 100%
KEY TREND: GROWTH IN HYDROCARBONS

- **Plug-in Units** in Supermarkets with R290 & HC-based waterloop refrigeration systems: A reality today

- **increase in R290 charge limit to 500g in early 2019** (under revision of IEC 60335-2-89) expected to open up opportunities for hydrocarbons in larger equipment

- **market estimate by early 2017 - Figures reported by AHT (market leader):**
  - **1,500,000+ units** worldwide (over 300,000 / year)
CASE STUDY: HC BOTTLE COOLERS IN MEXICO

From CO₂, **Coca Cola now focusing on bottle coolers with hydrocarbons** (charges < 150g)

Imbera: division of Mexico-based Femsa

- largest Coca Coca bottle cooler in the world
- New HC cooler design meets stringent ENERGY STAR 4.0 standard

**U.S. market:** about 20,000 HCs coolers sold by Imbera

**Mexican market:** above 350,000 installed HCs coolers

Manufacturing facility in Mexico equipped with HCs production in 2016
CO₂ TC STORES GROWING GLOBALLY (SEPT 2017)
## CO₂ TC MAJOR MARKETS: GROWTH TRENDS

<table>
<thead>
<tr>
<th>Region</th>
<th>2015</th>
<th>2017</th>
<th>Growth</th>
</tr>
</thead>
<tbody>
<tr>
<td>Europe</td>
<td>5.500</td>
<td>12.000</td>
<td>118%</td>
</tr>
<tr>
<td>USA</td>
<td>52</td>
<td>290</td>
<td>458%</td>
</tr>
<tr>
<td>Canada</td>
<td>139</td>
<td>160</td>
<td>15%</td>
</tr>
<tr>
<td>Japan</td>
<td>1.500</td>
<td>2.700</td>
<td>80%</td>
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</tbody>
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Other regional markets also emerging as a result of *individual food retailers' efforts*
KEY TREND: CO₂ RACK SYSTEM

Highly competitive evolving market for suppliers providing CO₂ solutions
KEY TREND: CONDENSING UNITS / SMALLER SYSTEMS

Japan - leader in CO₂ condensing units for smaller store formats

Europe traditionally working with large capacity CO₂ racks, but several manufacturers introduced small systems

Competition increasing: more efficiency, lower prices
KEY TREND: SMALLER NH$_3$/CO$_2$ SYSTEMS

Growing line up of **small size NH$_3$/CO$_2$ systems** - potential to serve supermarkets?
KEY TREND: SOLUTIONS FOR EFFICIENCY IN WARM CLIMATES

- Parallel Compression
- Ejector
- Adiabatic Cooling
- Sub coolers
KEY TREND: CO₂ COST OF EQUIPMENT DECREASING

In **Europe**:

Cost of equipment becoming comparable to systems using HFCs

**HFC alternatives growing in availability ⇒ prices 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
CHINA: CO$_2$ BECOMING POPULAR

First major CO$_2$ transcritical store to be completed in 2017

Currently 40 subcritical CO$_2$ supermarkets in China (HFC/CO$_2$ cascades)

Majority operated by Metro China, first ever installed by Tesco

Market opening up to natural refrigerants. Potential identified in:

- CO$_2$ in commercial and industrial; heat pumps
ChinaShop - biggest tradeshow on commercial refrigeration in China; 2-4 November in Chongqing

leading refrigeration system suppliers such displayed their natural refrigerant solutions for the Chinese market:

- **Carrier - Haier**: cascade R134a-CO₂ system
- **Panasonic**: 2HP outdoor CO₂ condensing unit, targeting the Chinese retail market + developing CO₂ TC for China
- **Danfoss - CAREL**: CO₂-based system, incl. ejectors
- **Holo** (Hong Kong-based): 24-hour fully automated convenience store concept which requires zero staff; partnered up with AHT & Husky to supply R290 cabinets
CASE STUDY: FIRST CO₂ TRANSCRITICAL SYSTEM IN CHILE

Jumbo supermarket in Valdivia

First CO₂-only transcritical refrigeration system installed by SCM Frigo

The project was implemented by the Ministry of Environment’s Ozone Unit and was funded by the Climate and Clean Air Coalition (CCAC).

5,300 m² store built to the highest standards in sustainability

Includes 100% LED lighting and an integrated building energy management system

Project leaders claim that the system delivers energy savings of about 20%

First instance of CO₂ TC refrigeration in Chile; an opportunity to promote the technology, eliminate HCFCs and minimise the use of HFC-based systems in the country.
INDUSTRIAL REFRIGERATION
COMPETITION BETWEEN NR SYSTEMS INCREASING

market traditionally dominated by **ammonia** and HFCs

NR cutting edge technologies becoming strong trend and competing:

- **ammonia low charge**
- **CO₂ transcritical**
- **NH₃/CO₂**

**Key drivers:**

- increased safety - lower risk
- higher efficiency
- easier servicing
- return on investment for the end user
- growing competition - prices pushed down, technology becoming more available
KEY TREND: INDUSTRIAL APPLICATIONS WITH CO$_2$ & NH$_3$
The market is changing, from a strong reliance on R22 to a renewed uptake of (lower charge) \( \text{NH}_3 \) systems

Estimated **450+ installations** use secondary \( \text{NH}_3-\text{CO}_2 \) systems

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

**BUT**: the use of \( \text{CO}_2 \) transcritical systems still faces restrictions through the High Pressure Gas Safety Act
CASE STUDY: R290 COLD STORAGE IN COLOMBIA

R290 tested in cold storage for post-harvest flower processing and export in Colombia (with support by Ozone unit)

Colombia’s flower sector: 31.1 million kW of cooling capacity, 99% of which is R22

Opportunity to increase efficiency by switching to R290

Challenges: lack of expertise, training, lack of technical standards, insurance policies or legal structures
RAC: INDIA, CHINA MOVING TOWARDS R290

INDIA

• Strong trend towards R290 RAC
• Currently 400,000+ units installed in the market (led by Godrej Appliances)
• India’s first ACs with 7-star performance

CHINA

• 1,300+ units of R290 RAC installed already
• Major players: Midea, Gree, Haier
HC based water chillers introduced by several companies targeting commercial air-conditioning and process cooling applications.

Examples:

**Triple Aqua** - heat pump using hydrocarbons in 2 offices and a supermarket in NL, saves up to 50% in heating and cooling costs.

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.
CONCLUSIONS

• **Legislation** is key in creating pressure in the industry to switch away from high GWP HFCs / HCFCs - Kigali Amendment will accelerate the transition around the world = **opportunity to leapfrog to natural refrigerants**

• **Availability** of natural refrigerant technologies is increasing = **competition to increase performance & reduce cost**

• **Updating standards to allow higher hydrocarbon charges** is vital to enable market uptake of HFC-free technology at wider scale
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