Global Market Trends for Natural Refrigerants in commercial refrigeration

Refrigeration in the supermarket sector
Taastrup, 9 November 2017

Alvaro de Oña, COO, shecco group
SHECCO - OVERVIEW

market accelerator for climate-friendly technologies

offices: brussels, new york, tokyo, berlin

focus is on the HVAC&R industry & natural refrigerants

   CO₂, NH₃, HC, H₂O, Air

150+ clients

reach 30,000+ individuals through our communication network
SHECCO - OVERVIEW

global market accelerator for natural refrigerant based technologies
INTERNATIONAL DEVELOPMENTS
Global phase-down of HFCs by 85% by late 2040s - first reductions by developed countries as of 2019, by most developing countries as of 2024

- Phase-down schedules by groups of countries under Montreal Protocol
- Based on baseline period,
- Entry into force: 1 January 2019 if 20 or more countries ratify it (so far 8 countries ratified)
- Top priorities: standards (initiated by China), access to finance, exemptions

Next key meeting

**20-24 Nov:** 29th Meeting of the Parties of the Montreal Protocol (Montreal, Canada)
STANDARDS: KEY DEBATE FOR HYDROCARBONS

IEC: 9 October in Vladivostok, Russia: Agreement to advance the draft amendment of standard IEC 60335-2-89 for commercial refrigeration, to raise the charge limit of propane from 150g to 500g.

- The final version of a draft amendment by December 2017.
- Charge limit raised for all safety classes of flammable refrigerants, but with different limits.
- A new IEC standard would influence the adoption of the same standards at national level across the world.

Next steps:

- The Committee Draft for Vote (CDV) will be circulated for votes & comments by all national committees within IEC in December 2017 earliest.

- Vote on the CDV expected in the first half of 2018 (provided that more than 2/3 of the committee members vote in favour).

- Final vote phase by the end of 2018 following the SC61C committee meeting in Busan, South Korea in October 2018.

- Final amended standard expected beginning of 2019 - Potentially opening up further opportunities to hydrocarbons globally.
POLICY TRENDS
EUROPE
02
2016: 7% cut in HFC quotas

2017: HFCs pre-charged in equipment covered under phase-down

Significant increase in HFC prices:

R404A and R507A: 225% increase since April 2017;
R134a and R410A: +50% since 1 April

2018-2020: 37% cut in HFC-quotas - further price increases of HFCs expected

NO negative impact on manufacturers & buyers of natural refrigerant-based equipment
EUROPE: EU F-GAS REGULATION

• F-Gas Regulation sends a clear signal for low-GWP refrigerants in light commercial refrigeration

• 2022 - ban on HFCs (GWP > 150) in hermetically sealed commercial refrigeration

• **Standards** - European Commission (EC) report (2016) revealed that standards at national and EU level are an important barrier to wider uptake of flammable refrigerants

  • EU level - EC standardisation request to the European Committee for standardisation (CEN), to work on developing standard parameters for flammable refrigerants

  • National level - France, Spain, Italy reported a number of national decrees that restrict use of flammable refrigerants
August 2017: U.S. Court of Appeals of Columbia - EPA cannot require companies to replace HFCs designated for HVAC&R equipment or other applications with low-GWP substances under the SNAP program

- long-term effects of this decision as well as the reaction by the EPA remain to be seen

Background:

- Hydrocarbons listed as alternatives in number of applications, including commercial refrigeration

- September 2016 SNAP published a rule to prohibit the use of certain high GWP fluorinated gases (R404A, R410A, R134a, and R407C).
US: CALIFORNIA LEADING THE WAY

Short-Lived Climate Pollutant (SLCP) Reduction Strategy - approved on 23 March 2017

- Aims to reduce HFCs by 25% below business-as-usual emissions by 2020; by 40% by 2030;

- CARB currently conducting a Scientific Assessment to investigate effective measures for low-GWP alternatives. FINANCE support available, but Industry not requesting it for HVAC&R.

- CARB consulting on the potential adoption into state regulations of SNAP Rule prohibitions of HFCs in stationary refrigeration and air conditioning.

**Sector-specific HFC bans in new stationary equipment:**

1. **non-residential refrigeration** *(GWP > 150) as of 2020*
2. **residential refrigeration** *(GWP > 150) as of 2021*
3. **air-conditioning** *(GWP > 750) as of 2021*

**Ban on sale of new high-GWP HFCs** *(GWP > 2,500) as of 2020*

**HFC phase-down**

- details to be specified at a later stage

**Financial incentives**
Canada implementing HFC phase-down until 2030, including reporting obligations

- Plans to introduce nation wide carbon pricing in 2018

- Sector specific bans on high-GWP HFCs

<table>
<thead>
<tr>
<th>Product</th>
<th>Use</th>
<th>Date</th>
<th>Maximum GWP</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stand-alone medium-temperature refrigeration</td>
<td>commercial / industrial</td>
<td>1 Jan 2020</td>
<td>700</td>
</tr>
<tr>
<td></td>
<td>residential</td>
<td>1 Jan 2025</td>
<td>150</td>
</tr>
<tr>
<td>Stand-alone low-temperature refrigeration</td>
<td>commercial / industrial</td>
<td>1 Jan 2020</td>
<td>1,500</td>
</tr>
<tr>
<td></td>
<td>residential</td>
<td>1 Jan 2025</td>
<td>150</td>
</tr>
<tr>
<td>Centralised refrigeration (capacity&gt; 30 kW)</td>
<td>commercial / industrial</td>
<td>1 Jan 2020</td>
<td>1,500</td>
</tr>
<tr>
<td>Condensing unit (capacity ≤ 20 kW)</td>
<td>commercial / industrial</td>
<td>1 Jan 2020</td>
<td>2,200</td>
</tr>
<tr>
<td>Chillers</td>
<td>commercial / industrial</td>
<td>1 Jan 2025</td>
<td>700</td>
</tr>
<tr>
<td>Mobile refrigeration</td>
<td>commercial / industrial</td>
<td>1 Jan 2025</td>
<td>2,200</td>
</tr>
</tbody>
</table>
POLICY TRENDS
JAPAN
04
JAPAN: F-GAS LAW

- Effective as of April 2015;

- Targets the entire life cycle of f-gases, from production to destruction;

- Reduced f-gas leakage from commercial equipment: periodical checks, maintenance, reporting etc.; proper refill and recovery; obligation of destruction;

- Promotion of low-GWP / non f-gases alternatives for designated products, incl. condensing units & refrigeration units > 1.5kW (target of average GWP 1500 by 2025).
JAPAN: HIGH PRESSURE GAS SAFETY ACT

- July 2017: CO₂ reclassified under High Pressure Gas Safety Act

- move from the strictest level of Group 3 to the least restricted level of Group 1

- What does it mean?

  - equipment under 20 tons does not require any government notification or permission (previously under 3 tons);

= OPPORTUNITY for larger CO₂ refrigeration (commercial and industrial) systems to be introduced in the market, creating more options for end users
JAPAN: SUBSIDIES CHANGING FOCUS

FY2018 (9.4 billion JPY - $86.1 mil) in food retail, food manufacturing and cold storage sectors

By 2022 (end of subsidy scheme) - achieve cost parity with conventional f-gas equipment, and accelerate the uptake of natural refrigerant-based technology
AUSTRALIA HFC PHASE-DOWN PLAN

- March 2017: New f-gas legislation introduced in Australia amending the Ozone Protection and Synthetic Greenhouse Gas Management (OPSGGM) Act by adding an HFC phase-down plan

- A statutory phase-down of HFC imports will be implemented, commencing January 2018, and will reduce HFC emissions by 85% by 2036

- Compared to Kigali Amendment requirements: lower baseline (reflecting Australia’s current demand), & more frequent reduction steps
New Zealand HFC phase-down plan:

- HFC import licensing system;
- Permit system for the exportation of HFCs and imports of recycled HFCs;
- Support programs for alternative refrigerants (open for consultation).

Targets: reduce HFC consumption by +80% and HFC imports from around 1,340 KtCO2 to < 260 by 2036.

Expected to come into force by January 1, 2019.
CO₂ TC STORES GROWING GLOBALLY (OCT 2017)

KEY/LEGEND
- ○ N/A
- 1-2 3-99
- 100+ 1000+

1. COLOMBIA
2. JAPAN
3. BRAZIL
4. CHILE
5. ARGENTINA
6. SOUTH AFRICA
7. MALAYSIA
8. AUSTRALIA
9. NEW ZEALAND
10. CANADA
11. UNITED STATES
12. E UROPE
13. INDONESIA
14. RUSSIA
15. CHINA
16. TAIWAN

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**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>
</tr>
</tbody>
</table>

Other regional markets also emerging as a result of individual food retailers' efforts.
KEY TREND: CO₂ BECOMING MAINSTREAM IN RETAIL

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
CO₂ IN CHINA (JULY 2017 UPDATE)

• First major CO₂ transcritical store to open January 2018

• Currently 40 subcritical CO₂ supermarkets in China (HFC/CO₂ cascades)

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

• Market opening up to natural refrigerants. Potential identified in:
  • CO₂ in commercial and industrial; heat pumps
EUROPE: KEY TRENDS & INSIGHTS (EUROSHOP 2017)

- 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
SUPERSMART PROJECT

Objectives:
- Remove non-technological barriers
- Increase market uptake of efficient heating and cooling technology

Activities:
- Trainings at conferences
- Preparation of EU Ecolabel for food retail stores

Retailer Benefits:
- Free of charge trainings at premises
- High quality reports available for free

- Horizon 2020 Program
- Start: 1.2.2016
- Duration: 36 months
- 9 project partners from all over Europe
- 8 reports about efficient food retail stores available

www.supersmart-supermarket.info
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: CO2 SOLUTIONS FOR EFFICIENCY IN WARM CLIMATES

Parallel Compression

Adiabatic Cooling

Ejector

Sub coolers
KEY TREND: DISSIPATING BOUNDARIES

Limits between “light-commercial” and “commercial” refrigeration become vague: HC pushing into larger store formats, and CO₂-based systems into smaller formats

= internal competition between different NR systems has increased
MARKET TRENDS
LIGHT - COMMERCIAL REFRIGERATION

02
CONSUMER BRANDS CHOOSING 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%
HC VENDING MACHINES IN JAPAN

1.35+ million beverage vending machines in Japan use either hydrocarbons or CO\textsubscript{2} - world’s highest number per capita

550,000+ HC (R600a) vending machines in the market

natural refrigerants make up over 50% of the market

from 0.1% to 52% market share in just 10 years
HYDROCARBONS GROWTH - AHT

Plug-in Units in Supermarkets with R290: A reality today

Market estimate by early 2017 - Figures reported by AHT (market leader):

1,500,000+ units worldwide

- over 300,000+ units manufactured per year

- Over 1000 units in the US in one year
KEY CHALLENGES

03
EUROPE: ON TRACK... BUT PROGRESS IS SLOW

Deadlines for F-Gas Regulation approaching fast for retail: only 10-20% of total stores in compliance.

Urgent progress in:

- Capacity building

- Solutions for existing stores (esp. in Southern Europe)

- Non market barriers: standards, Training, etc.
INTERNATIONAL: BUT PROGRESS IS SLOW

Kigali sends a powerful message: HFCs on their way out.

Challenges:

- Finance to developing countries
- Technology transfer
- Training
CHINA: WHAT WAY AHEAD?

Competition in NR area to increase... but setting the foundations is still needed
CONCLUDING REMARKS

• High GWP refrigerants on their way out globally = opportunity for natural refrigerants

• CO$_2$ transcritical is becoming a standard in commercial refrigeration in Europe, N. America, Japan

• Hydrocarbons - higher charge limits under revised standard could open up new market opportunities

• Competition between different types of natural refrigerant-based systems expected to intensify - competition to increase performance & reduce cost
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/
www.accelerateJapan.com/

ATMOsphere conferences:

www.ATMO.org

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www.thenaturalvoice.org
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