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ATMO sphere network Natural Refrigerants
21/11/2017-Montreal

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GLOBAL NATURAL REFRIGERANT TRENDS

ATMOsphere Network Montreal
21 November

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DOMESTIC & LIGHT COMMERCIAL REFRIGERATION

01

HC IN DOMESTIC REFRIGERATION

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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

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Refrigerants, Naturally!

Coca-Cola

pepsi

Red Bull

Unilever

5.5 million units using natural refrigerants (HC & CO_2) collectively installed

=> 33 million tonnes of avoided CO_2 (equivalent emissions of more than 6.7 million passenger cars over one year)

SAB MILLER

TRADE MARK Heineken®

All Natural BEN & JERRY'S VERMONT'S FINEST

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 CO_2, **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

COMMERCIAL REFRIGERATION

01

CO_2 TC STORES GROWING GLOBALLY (SEPT 2017)

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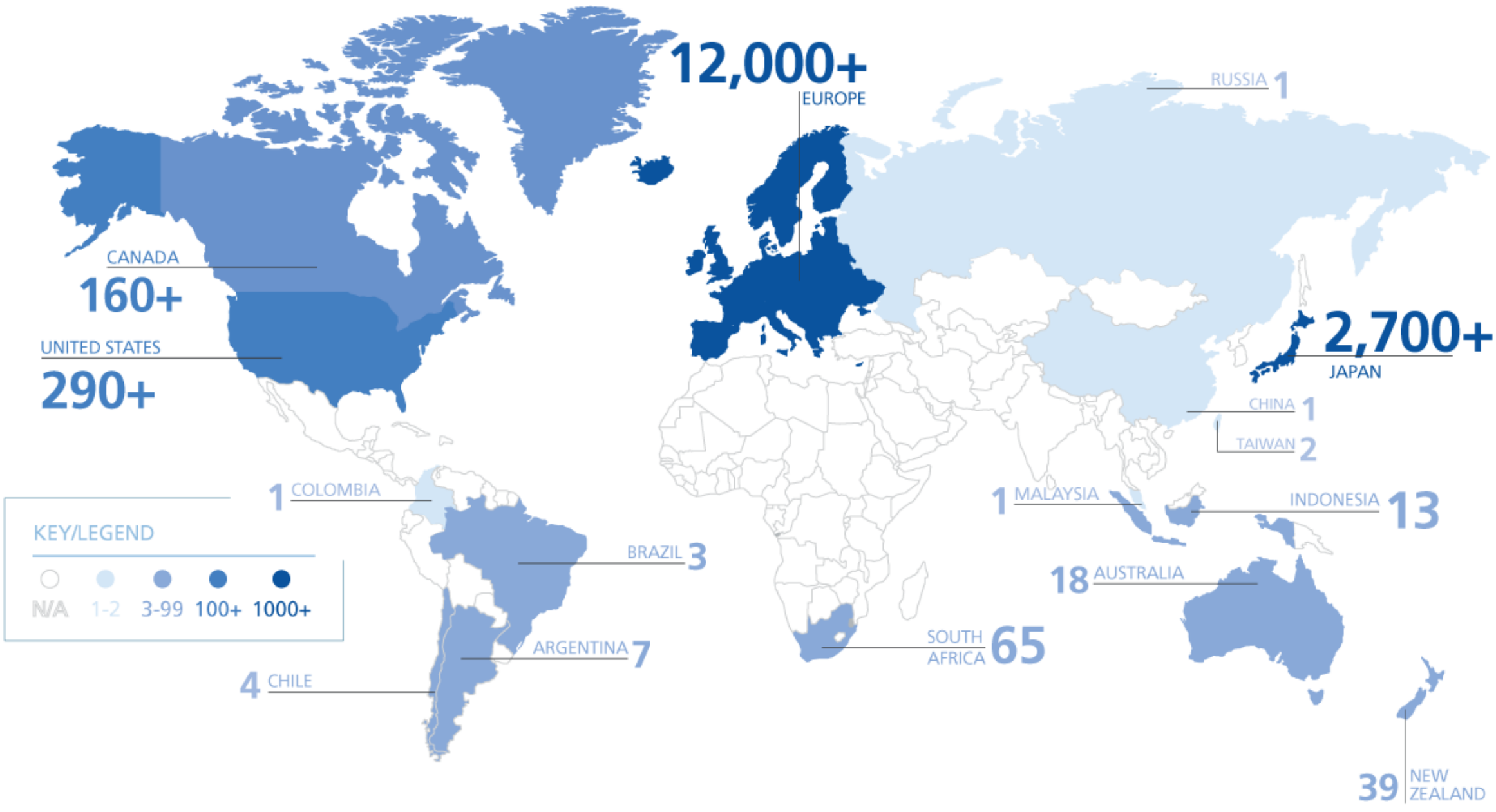


CO_2 TC MAJOR MARKETS: GROWTH TRENDS

	2015	2017	Growth
Europe	5.500	12.000	**118%**
USA	52	290	**458%**
Canada	139	160	**15%**
Japan	1.500	2.700	**80%**

Other regional markets also emerging as a result of **individual food retailers' efforts**

KEY TREND: CO_2 RACK SYSTEM

Highly **competitive evolving market** for suppliers providing CO_2 solutions

KEY TREND: CONDENSING UNITS / SMALLER SYSTEMS

Japan - leader in CO_2 condensing units for smaller store formats

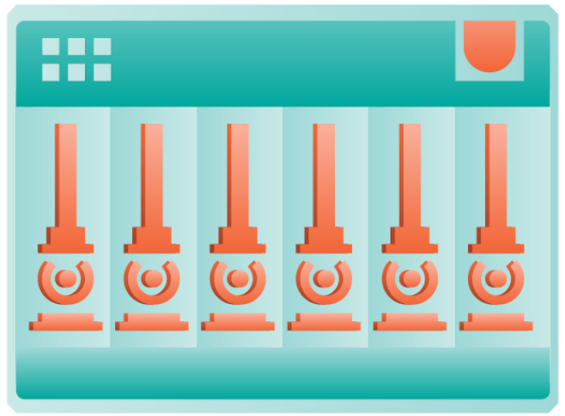
Europe traditionally working with large capacity CO_2 racks, but several manufacturers introduced small systems

Competition increasing: more efficiency, lower prices

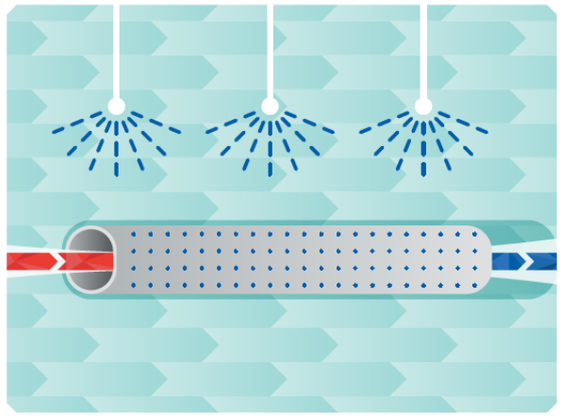
KEY TREND: SMALLER NH_3/CO_2 SYSTEMS

Growing line up of **small size NH_3/CO_2 systems** - potential to serve supermarkets?

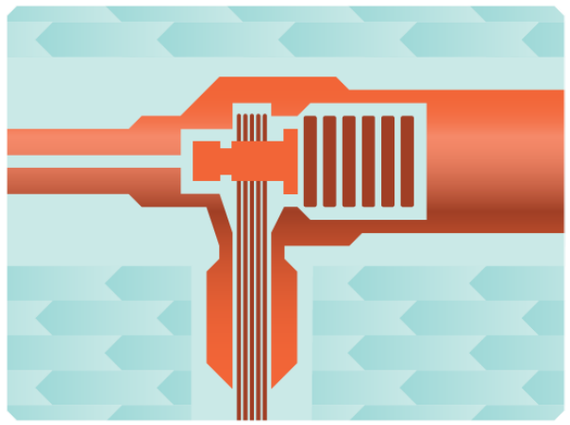
KEY TREND: SOLUTIONS FOR EFFICIENCY IN WARM CLIMATES



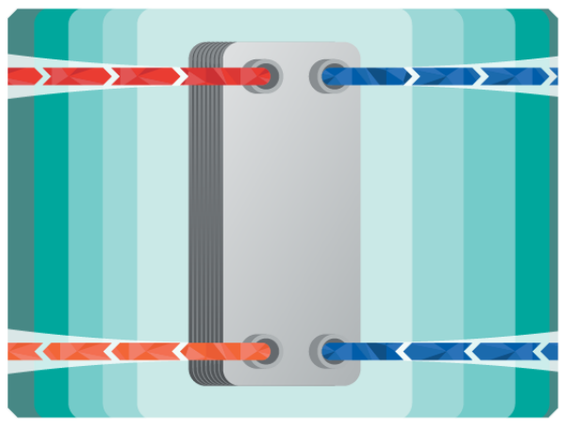
Parallel Compression



Adiabatic Cooling



Ejector



Sub coolers

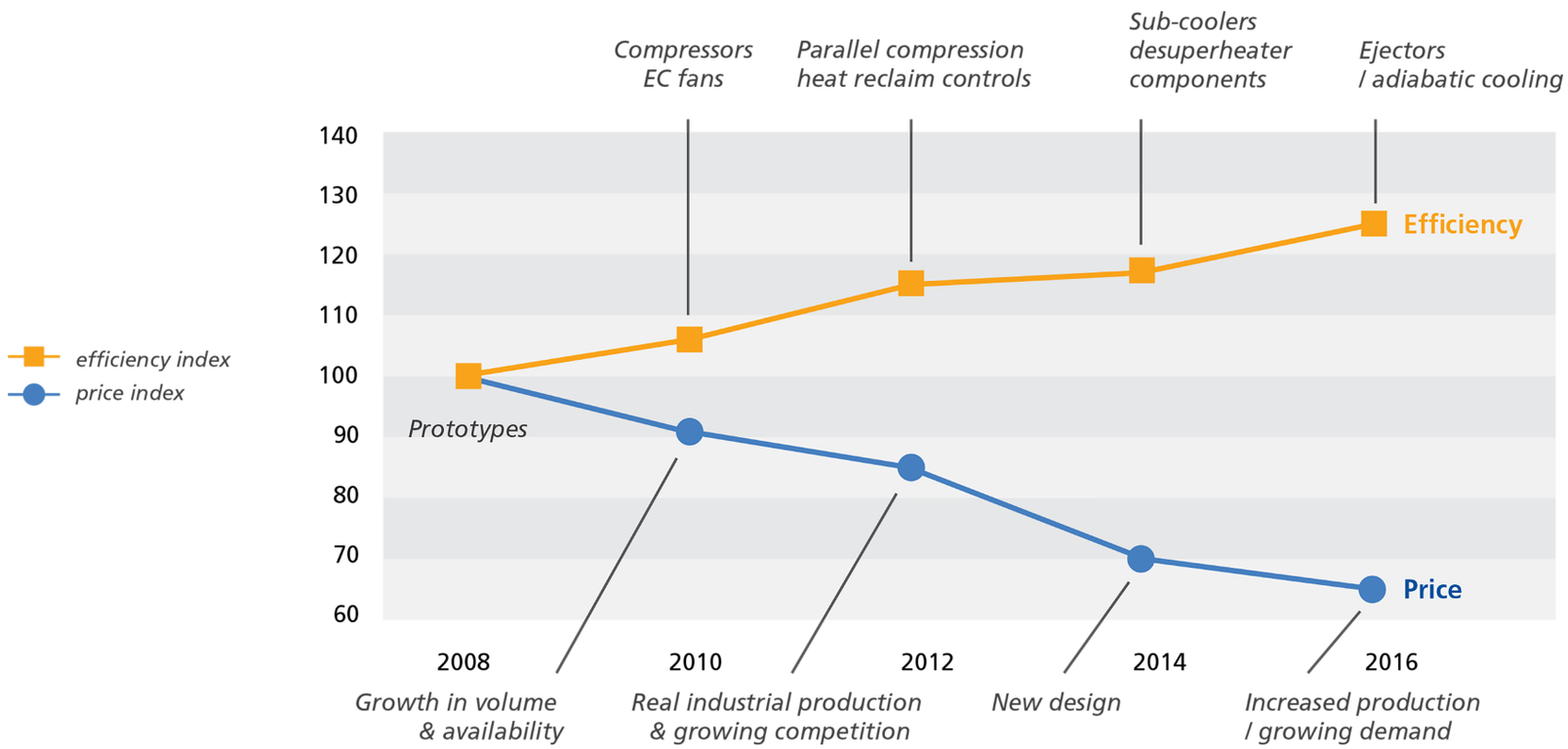
KEY TREND: CO_2 COST OF EQUIPMENT DECREASING

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:

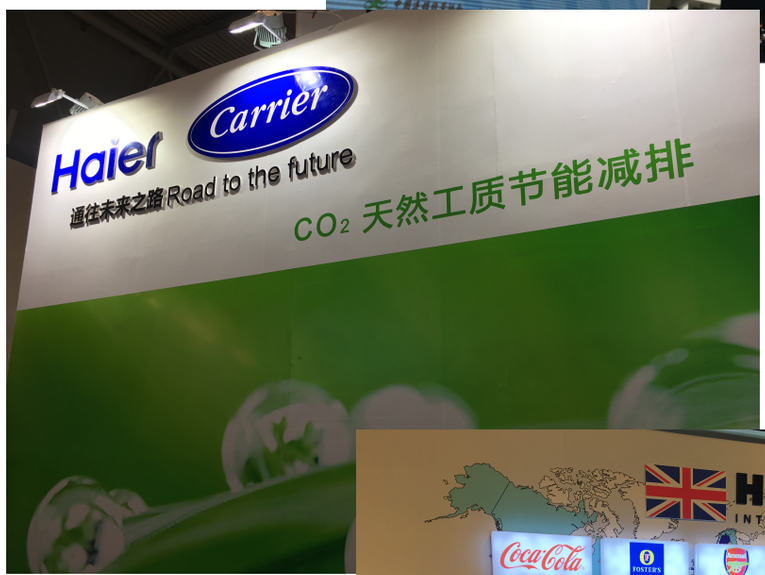
- CO_2 in commercial and industrial; heat pumps

CHINA: CHINASHOP 2017 - STRONG INTEREST IN NR

ChinaShop - biggest tradeshow on commercial refrigeration in China; 2-4 November in Chongquing

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

- **Carrier - Haier**: cascade R134a-CO_2 system
- **Panasonic**: 2HP outdoor CO_2 condensing unit, targeting the Chinese retail market + developing CO_2 TC for China
- **Danfoss - CAREL**: CO_2-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 CO_2 TRANSCRITICAL SYSTEM IN CHILE

Jumbo supermarket in Valdivia

First CO_2-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 CO_2 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

02

COMPETITION BETWEEN NR SYSTEMS INCREASING

market traditionally dominated by **ammonia** and HFCs

NR cutting edge technologies becoming strong trend and competing:

- **ammonia low charge**
- **CO_2 transcritical**
- **NH_3/CO_2**

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

JAPAN: INDUSTRIAL REFRIGERATION WITH CO_2 & NH_3

The market is changing, from a strong reliance on R22 to a renewed uptake of (lower charge) NH_3 systems

Estimated **450+ installations** use secondary NH_3-CO_2 systems

NEXT: export of the technology to other regions

BUT: the use of 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

AIR CONDITIONING

03

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 HEAT PUMP & WATER CHILLERS

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

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/

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ATMOsphere conferences:

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