



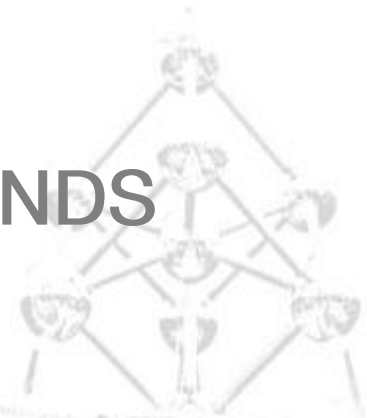
TECHNOLOGY and MARKET TRENDS

In Industrial Refrigeration

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MARKET and TECHNOLOGY TRENDS
Industrial Refrigeration



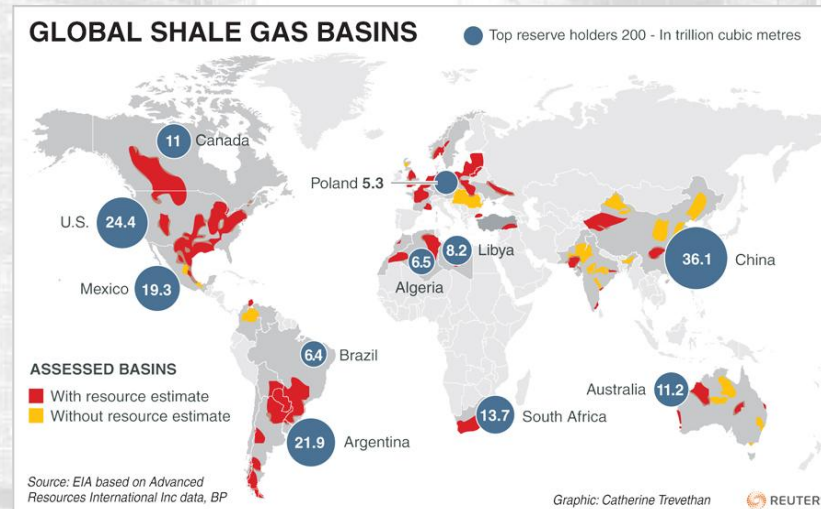
The context

Shale gas : Global shifts
European economical challenges
EU HFC legislation
D-day for R22 based equipments



Process industry cooling

Crude oil by-products : production migration



Opportunities : plant extentions

Process industry cooling

Highly Controlled environments:

- *allow for ATEX applications > HC*
- *Propylene & Propane availability*

Ammonia equally strong

R22 phase out : important transition opportunities

Industrial refrigeration

Ammonia:

- *Historically most common used refrigerant*
- *Accounts for most HCFC&HFC conversions*

CO₂:

Settling in negative temperature applications

HC & Air: *very low temperature applications*

Industrial refrigeration

New installed base, greenfield & extensions

	R717 R717+R744	R744	HC	HFC
Now	≈ 95%	≈ 4%	< 0,3%	< 0,5%
Trend	++	+	+	-

EU Industrial refrigeration +500kW installations CE marked

Technological trends

Screw vs. reciprocating

Pistons: COP \uparrow & Capex \downarrow

Latest generation Pistons : opex \downarrow

Minimize refrigerant charge

Cascade systems

Innovative heat exchangers

Technological trends

Increase efficiency

Frequency control, PM motors

Advanced valve control systems

Multi-stage systems (compound compressors)

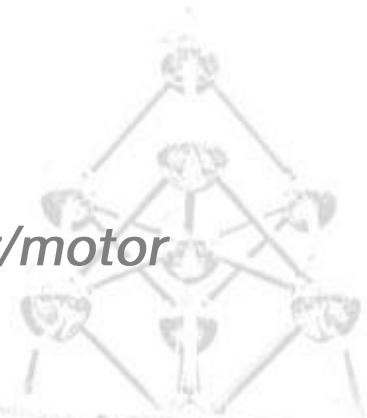
Heat recuperation

Hot gas recuperation vs. Low Tc

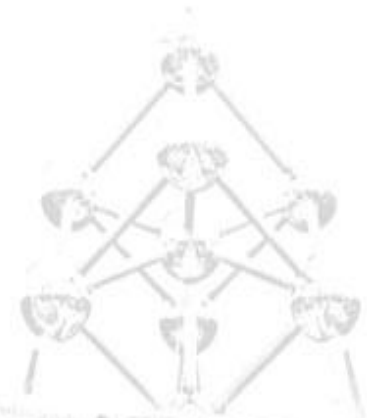
Technological trends

system safety

Introduction semi-hermetic compressor/motor



Ammonia semi-hermetic piston chiller



Industrial heat pump trends

NH3 : hot water temperatures up to 90°C

- *Using condensing waste heat*
- *Using stable thermal heat source*

HC : allowing to exceed 120°C temperatures

➤ *Competition fossil fuel steam boilers*



*Mayekawa Industrial Heatpump
Water chilling 10°C to 1°C / 1MW - 90°C hot water*



Industrial refrigeration

Short term challenges

January 2015, R22 ban

Investments: faster from project to start-up

Resource shortage : generation switch

Legislation : implementation & training



Industrial refrigeration and synthetic refrigerants

*Industry needs a stable legislative environment
Capex life cycle is 20, 25, 30...years*

*HFC ban for new industrial refrigeration equipment
can be applied TODAY*

Natural refrigerants are PROVEN technology in Industrial Refrigeration



solutions for europe

natural refrigerants

15-16 October 2013, Brussels

Thank you very much!

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