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Global Market Trends
A Danfoss Perspective

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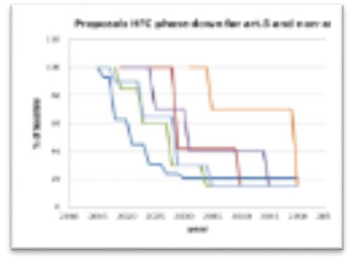
Source: *Danfoss internal*
Open RIEP Refrigerant Inventories & Emissions
Atmospheric Environment – Velders study 2015

Refrigerant Transitions

History and Future Outlook



≈1800 — 1930 — **M**ontreal **P**rotocol **ODP** 1987 — Kyoto Protocol **GWP** 2008 — 2nd F-gas **GWP** 2015 — 2016 — 2025 — End of F-gas **-79% CO2eq** 2030 — 2035 — End of MP **-85% CO2eq** 2045

MP to include GWP reduction

1st gen.: Naturals
R290, R717, Sulphur dioxide,…

Requirement:
- Must work

Issues:
- Explosive, toxic or both (A3, B3, B2)

2nd gen.: CFCs/HCFCs
R11, R12, R502, R22

Requirement:
- Safe
- Stable
- Efficient
- …

Issues:
- Ozone depleting (ODP)

3rd gen.: HFCs
R123a, R407C, R404A, R410A, R32

Requirement:
- Zero ODP
- Stable
- Efficient
- …

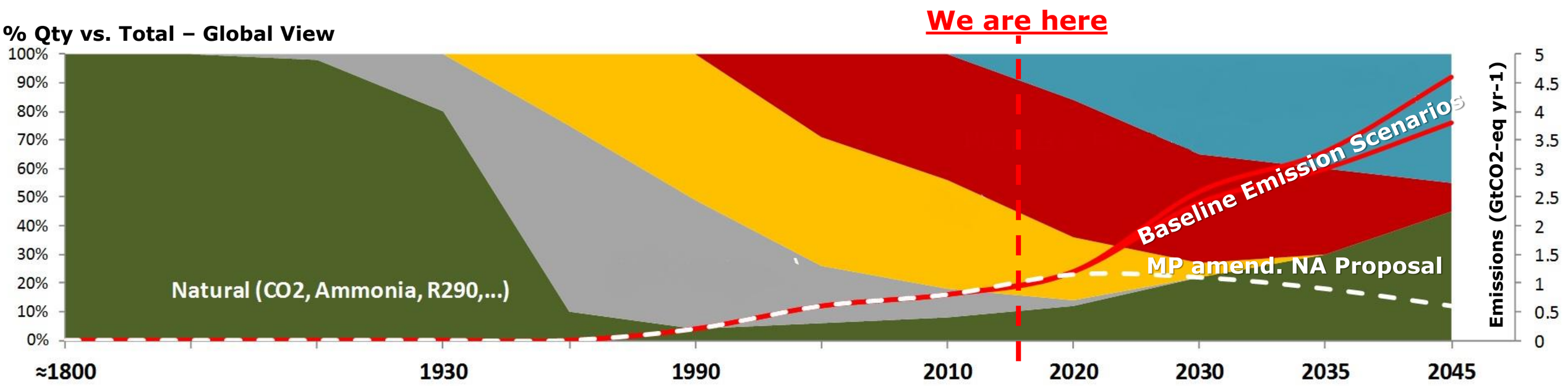
Issues:
- Global warming (GWP)

4th gen.: HFOs/Naturals
R1234yf/ze, R1233zd, HFO blends

Requirement:
- Zero ODP
- Low / ultra low GWP
- Stable
- Efficient
- …

Issues:
- Flammability (A2, A2L, A3)
- Mainly Low / very Low density

% Qty vs. Total – Global View



Long-term outlook

Air Conditioning

Applications Industries	Present	Short term Up to 2022	Long term 2022-2030
Centrifugal & Screw Chillers	R134a R1234ze	R134a R1233zd R1234ze	R1233zd R1234ze
Scroll Chillers & Rooftops	R410A RR22 407C	R410A R32 R452B R454B	R290 R32 R452B R454B
Heat Pumps, Window units, split systems	R290 R410A R32 R22/R407C	R290 R410A R32 R452B R454B	R290 R452B R454B R32
VRF	R410A	R410A	R32

Natural Refrigerants

Long-term outlook

Refrigeration

Applications Industries	Present	Short term Up to 2022	Long term 2022-2030	Natural Refrigerants
Industrial	R717 R744	R717 R744	R717 R744	
Centralised systems, Supermarkets	R744 R134a R404A	R744 R134a R448A/R449A R513A	R744 R290 HFO Blends	
Condensing units	R134a R404A R407A/F	R744/R290 R134a R513A/R450A R407A/F R448A/R449A R452A	R744 R290 HFO blends	
Self contained units	R290 R600a R744 R134a R404A	R600a R290 R134a R452A R513A	R290 R600a R744 HFO blends	

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Natural refrigerants – Leading Danfoss solutions

Light commercial refrigeration

Green cooling range with R290

GREEN COOLING

Green Cooling : Sustainable compressors for commercial refrigeration applications

- Most advanced design of compressors with remarkable efficiency improvement.
- Extended range of efficient compressors for R290 and R600a for any type of applications.
- Enhanced efficient application.
- Sustainability.
- No particular adaptation on refrigeration systems.
- Reduction of CO_2 emissions to atmosphere

Industrial refrigeration

Leading innovation with NH_3 and CO_2 solutions

2004

ICV small and medium sizes

2006

ICF 20-25

2009

ICV large sizes

2011

AKS 4100

2012

SVL Flexline

2013

EKE 347

ICLX two-step servo-operated

2014

SVL SS Flexline

ICF 15

2016

ICF Large

CO_2 transcritical technology development continues

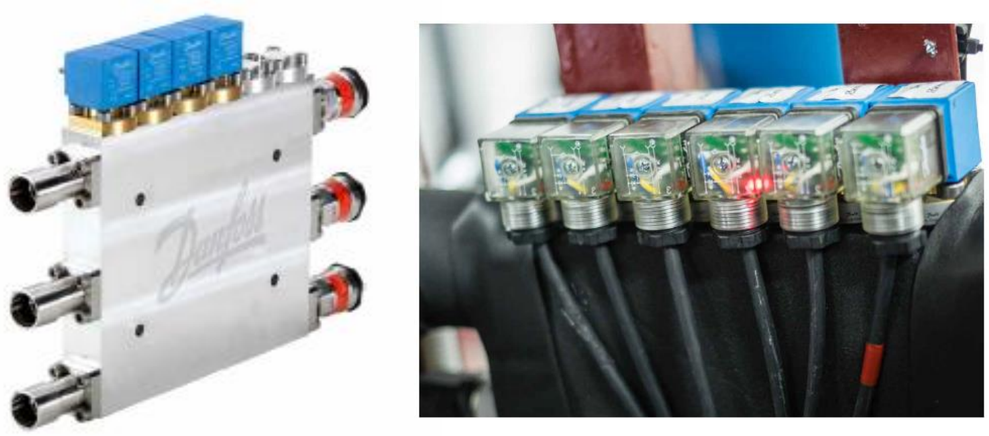
Ready for prime team with Multi-Ejectors!

Ejector technology

- Bring cost down over time
- Reduce energy consumption

Next Steps

- Heat recovery
- Integrated Systems w/ Air Conditioning
- Flooded Systems



Danfoss Multi Ejector

System	Energy saving CO2 vs. R404a	Compressor saving vs. Booster
Booster	-11%	0%
Parallel compression	7%	15%
Gas ejector	10%	18%
Liquid & gas ejector	22%	27%

Potential energy savings by using parallel compression with Gas ejector or Liquid+Gas ejector. Comparisons made at 32^{0}C

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Natural refrigerants – spreading awareness

Danfoss Mobile Training Unit

Coming to Singapore in Q4 2017

Features:

- **Three CO_2 Transcritical Modes:**
  - Booster System
  - Parallel Compression System
  - Multi-Ejector System
- **Controller training stations (Pack, Case and Front End)**
- **Charging/filling/servicing training station (safety, procedure etc.)**
- **Simple one stage system with control system training station**

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REFRIGERANT WEEK 2017

September 18-22

Let's bring the refrigerant transition down to earth.

Refrigerants.danfoss.com

An entire week
dedicated to cool events, training, games, and shared moments, etc.

27 webinars
planned all over the globe

Online quiz
to test your knowledge

24/7 online resources for
your refrigerant transition

Refrigerants.danfoss.com

CoolTools

Converting to the correct refrigerant requires the right refrigerant tools. We created these digital solutions to help you select the right refrigerant for your situation, find a compatible component, and ensure that the refrigerant is installed correctly in the cooling system.

- **Low GWP Brochure**
- **Retrofit Guideline**
- **Coolselector2**
- **Low-GWP Tool**

CoolSchool

Danfoss offers a variety of educational solutions to help you understand the refrigerant changes and make the the best decisions about how to adapt to them. Watch videos, take online courses, attend webinars - we have something for everyone.

- **Refrigerant Videos**
- **Danfoss Learning Programs for Refrigerants**
- **White Paper**

Webinars

Newsletter

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2 Confirm sign-up on email

3 You are signed up

First name * First name

Last name * Last name

Email * Email

Email * Confirm email

SIGN UP

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