

Safe and Responsible Usage of Natural Refrigerants



Verdemar – a Brazilian Case Study

A CO2 Refrigeration System with Danfoss

A close-up photograph of several clear water droplets resting on a vibrant green leaf. The background is a soft, out-of-focus green. Two circular callouts are overlaid on the image: a light green one on the left and a dark green one on the right.

42%

more efficient
than the average market

First

installation

In 2010 Verdemar became the first to install a supermarket refrigeration system using CO₂ as refrigerant

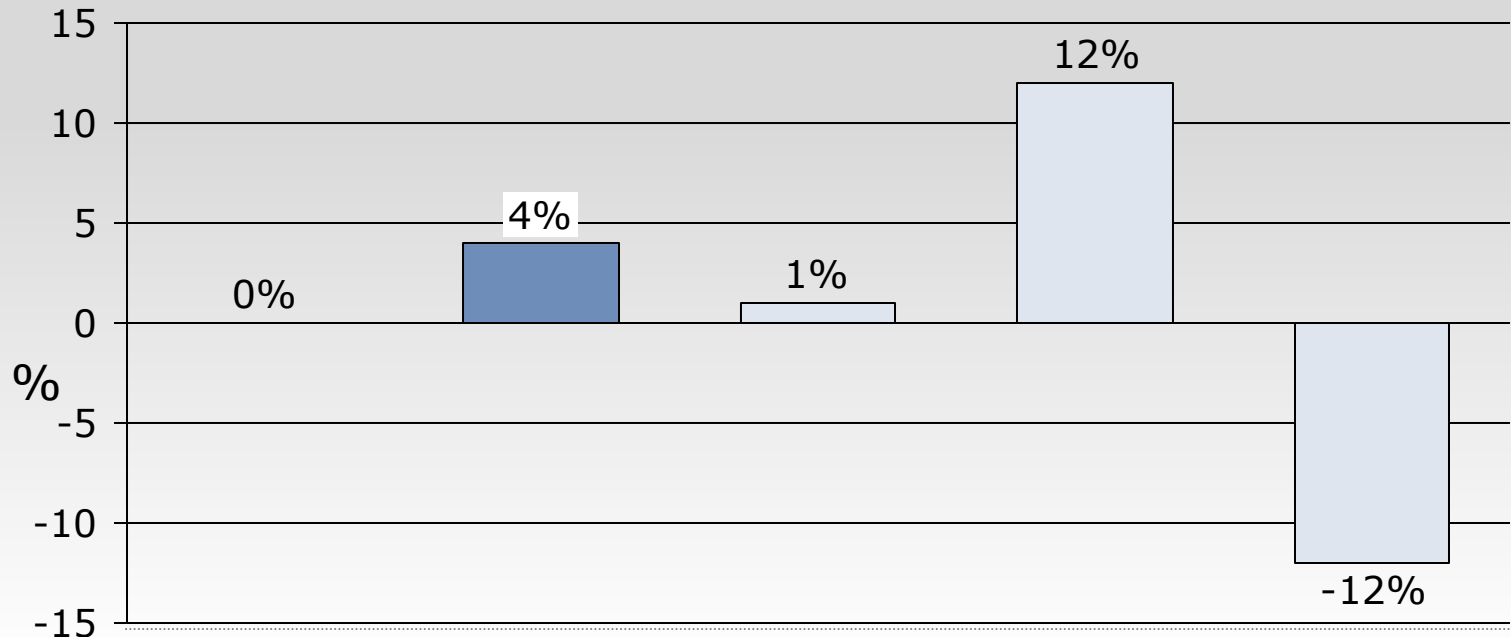
Verdemar – the combination of R134a and CO2 = the key to success

- A sustainable choice which encompasses **efficiency, safety** and **cost**
- By building safety into the components and by taking measures **to ensure the safe and responsible use**, Danfoss now allows these components to be sold globally
- Guidance in terms of choosing the right solutions per application **to provide the greatest customer benefit**



Operating Cost Savings with Natural Refrigerants

Energy savings compared to state of the art HFC solutions (Brazilia)

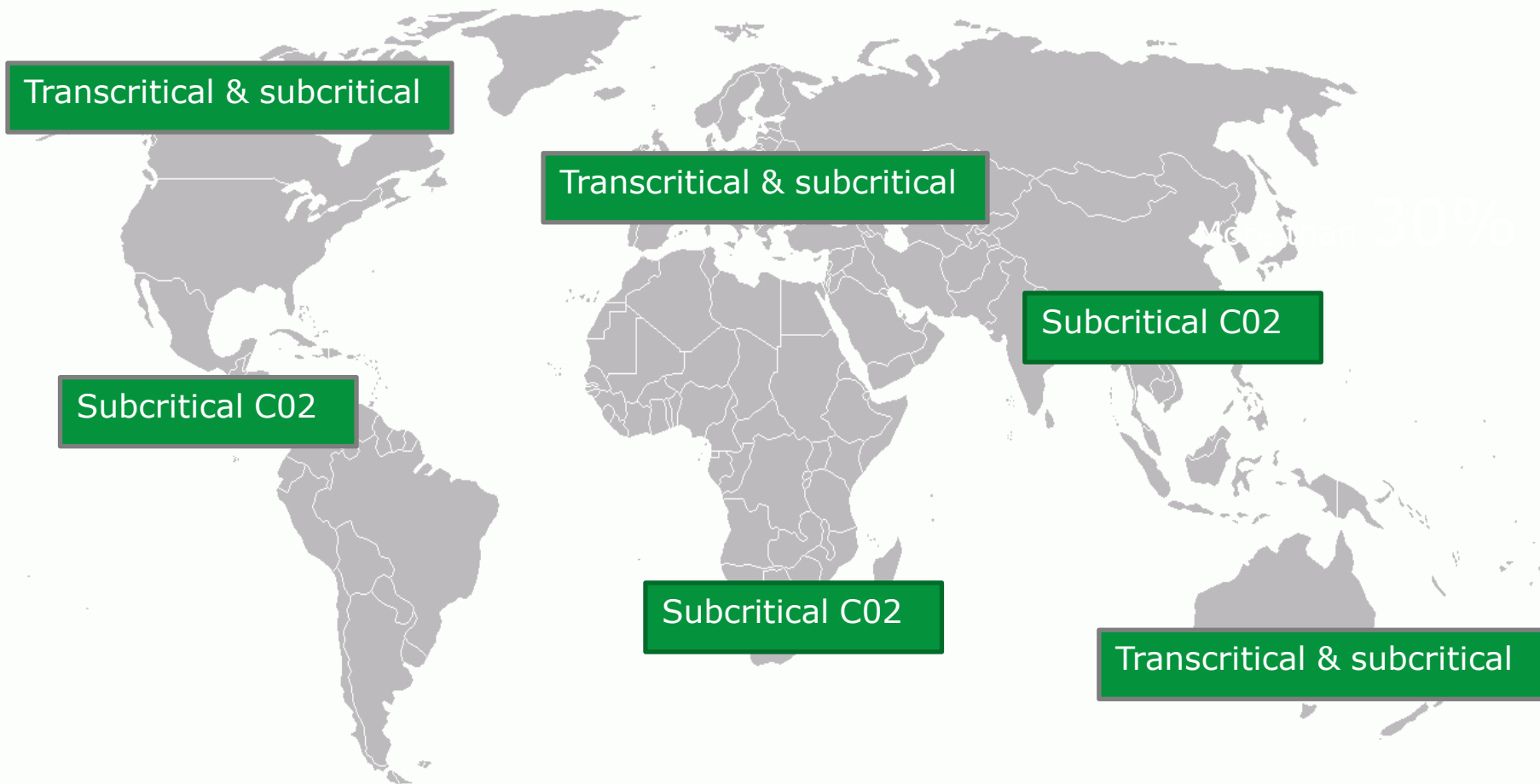


System type	R404A state of the art	R134a/CO ₂ cascade	R404A /CO ₂ cascade	Ammonia chiller	Transcritical CO ₂ booster
Medium Temp: Low Temp:	R404A DX R404A DX	R134A DX CO ₂ DX	R404A DX CO ₂ DX	Pumped CO ₂ CO ₂ DX	CO ₂ DX CO ₂ DX

More information including the Pack Calculation II software can be found at <http://co2facts.danfoss.com>

Global > Local

Worldwide presence of CO2 solutions

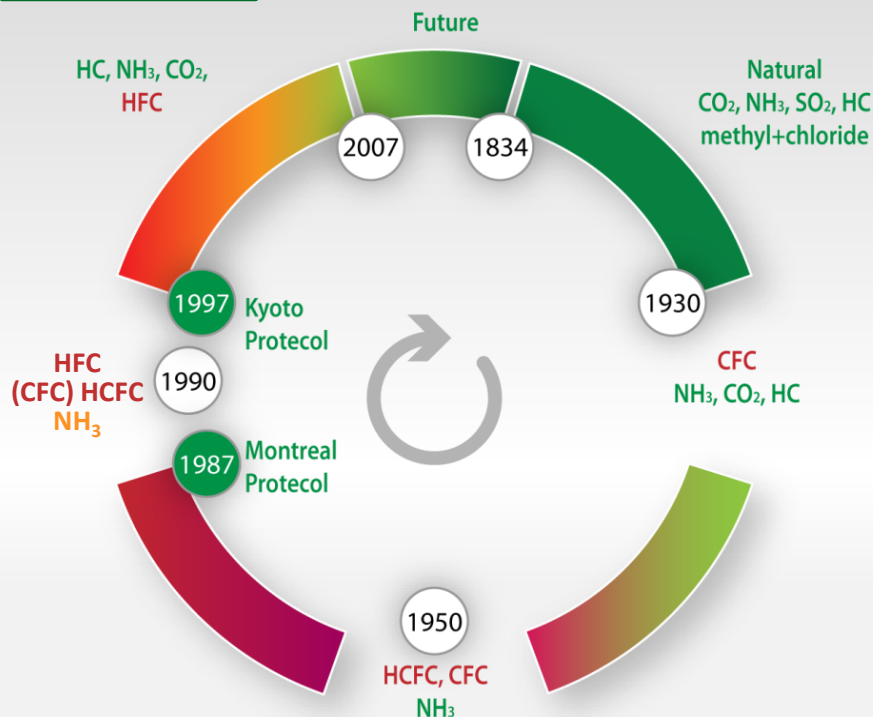
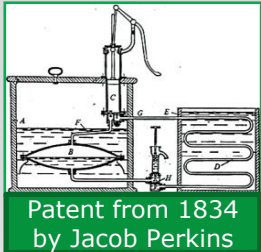


CO2 an increasingly important refrigerant – cuts energy consumption by up to 20% globally



4,000
CO2 Solutions
around the world

The History of Refrigerants

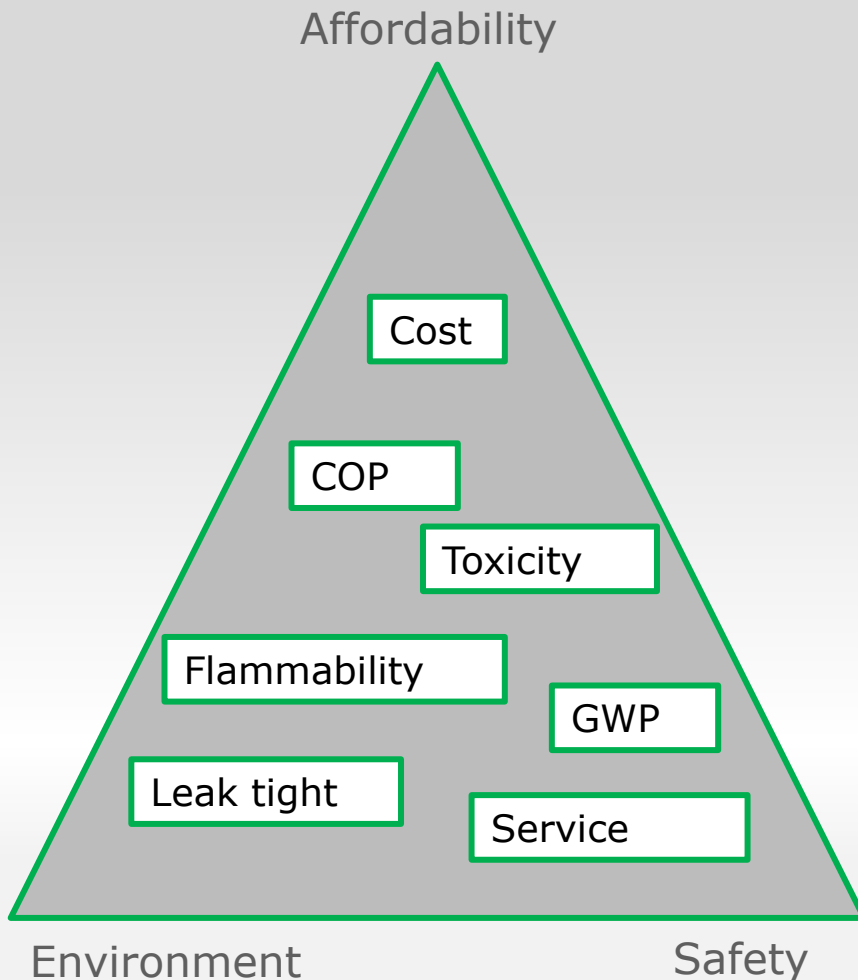


- The Danfoss process to ensure low risk
- Building safety into our offering:
 - IECex approvals on all hydrocarbon products to ensure safety
 - 90 bar standstill security on CO₂ systems

The sustainable balance

Real sustainable solutions are only made ensuring all three parameters

- **Safety** during installation and usage
- Minimised **environmental** impact
- **Affordable** design and application



Controls for Natural Refrigerants are now becoming global available



Refrigerant	Availability
CO2	Global
NH3	Global
Hydrocarbons	Global**

All products sold by Danfoss for use with Hydrocarbon refrigerants (flammable) are IECex Zone II approved

** In North America only below 150 g of charge

For some countries special agreements have to signed with customers to ensure safe use

45 bar

Commercial range for subcritical CO₂

52 bar

Components for industrial systems allowing hot gas defrosting

90 bar

Standstill capable range for CO₂ systems

140 bar

Supercritical components

90bar

Maximum working pressure

Components enable standstill capable, intrinsically safe CO₂ systems

ICF



AKVH



ICMTS



ICS



CCM



CCMT



ICM



EVUL



DMT



Raising awareness of safety practices - through Danfoss Learning platform

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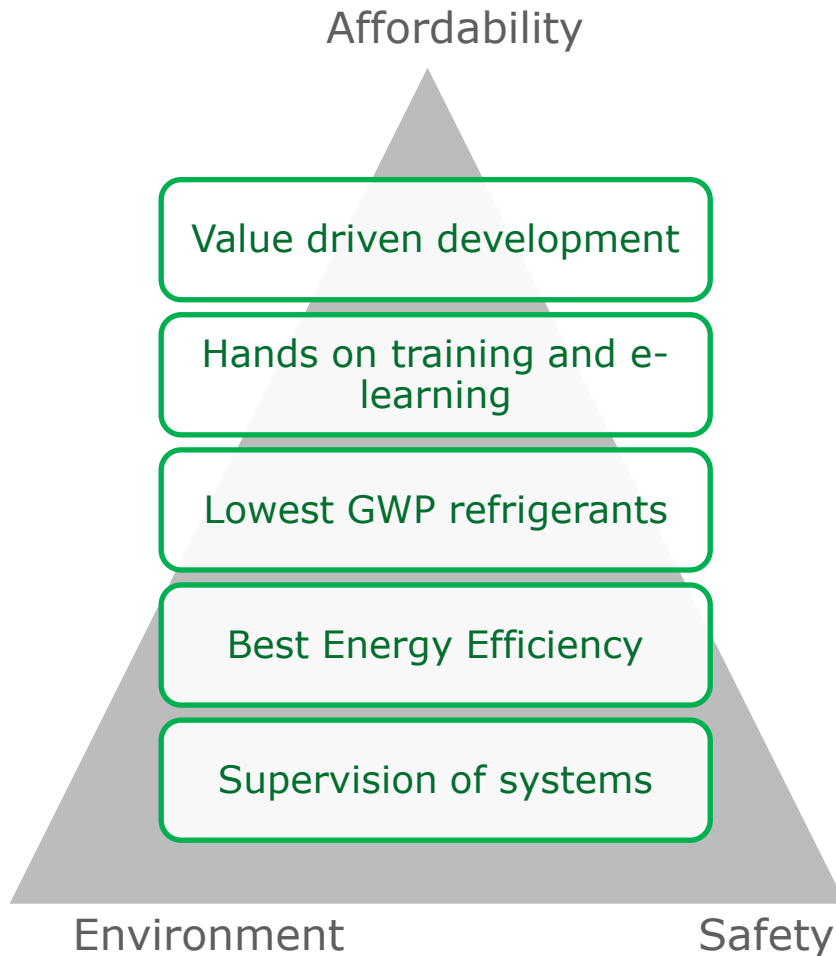
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Classroom and Laboratory Training in Brazil



Addressing sustainability



- **Product development** must address main market needs
- **Educational back up** is the main driver for new technology implementation
- **Improved Energy efficiency** is proved using the new combined R134a/CO2 system
- **Running cost** of the investment is in line with projections

Danfoss

MAKING MODERN LIVING POSSIBLE