MIGROS

CO_2 as standard refrigerant: Obstacles and lessons learnt

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Migros, the company

Industrial undertakings

MIDOR
JOWA
MICARNA
Ein gutes Stück besser - Simplement meilleur
FREY
MIFROMA
mibelle
ELSA
Bischofszell
la riseria
DELICA
mifa
ihre marke im mittelpunkt.
aproz
Sources Minérales
MIGROL

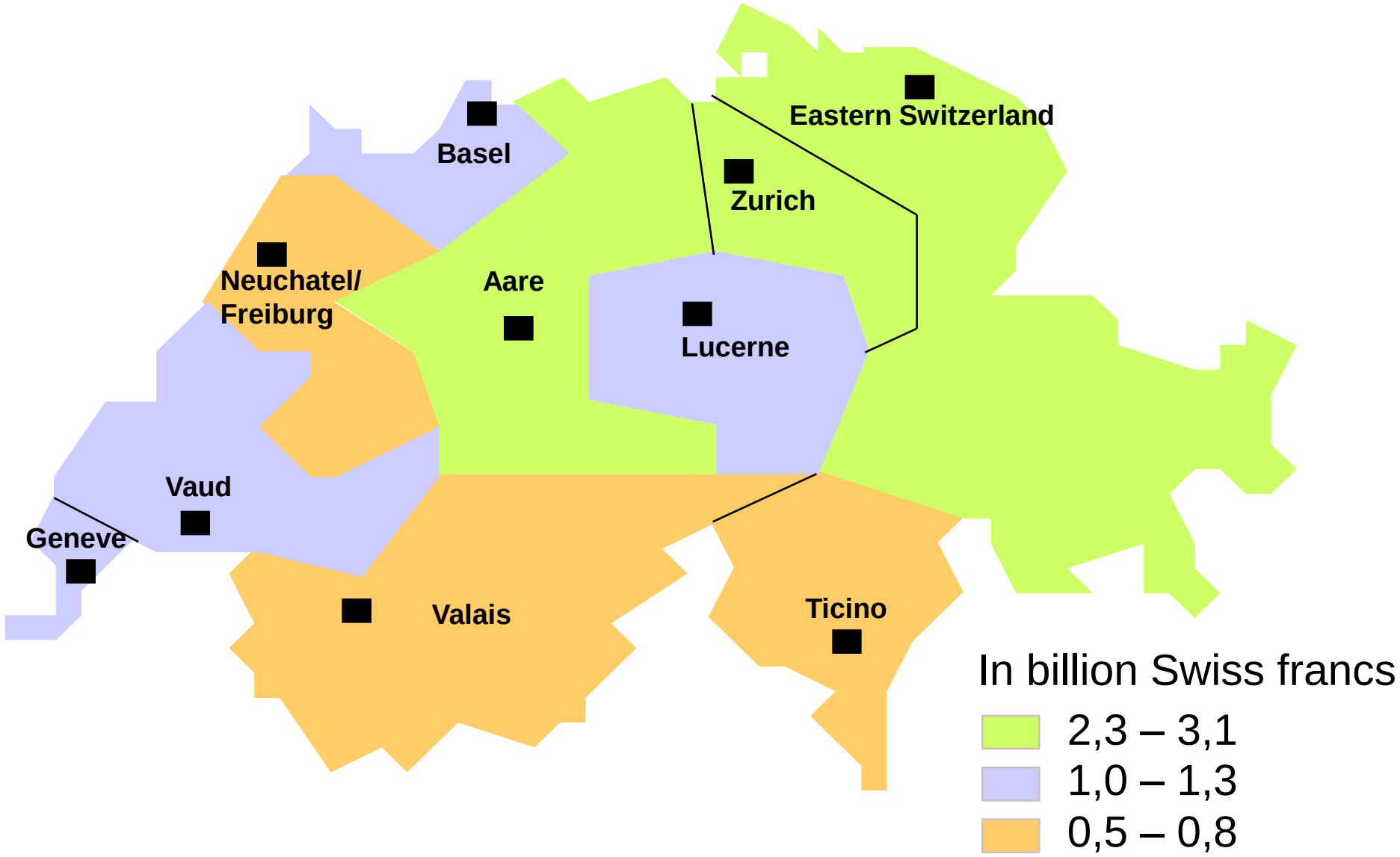
Logistics, service providers

MIGROS
Suhr Distribution Centre AG
LIMMATDRUCK AG
MVN Migros-Verteilbetrieb Neuendorf AG
Scana
MIGROSBANK
Hotelplan

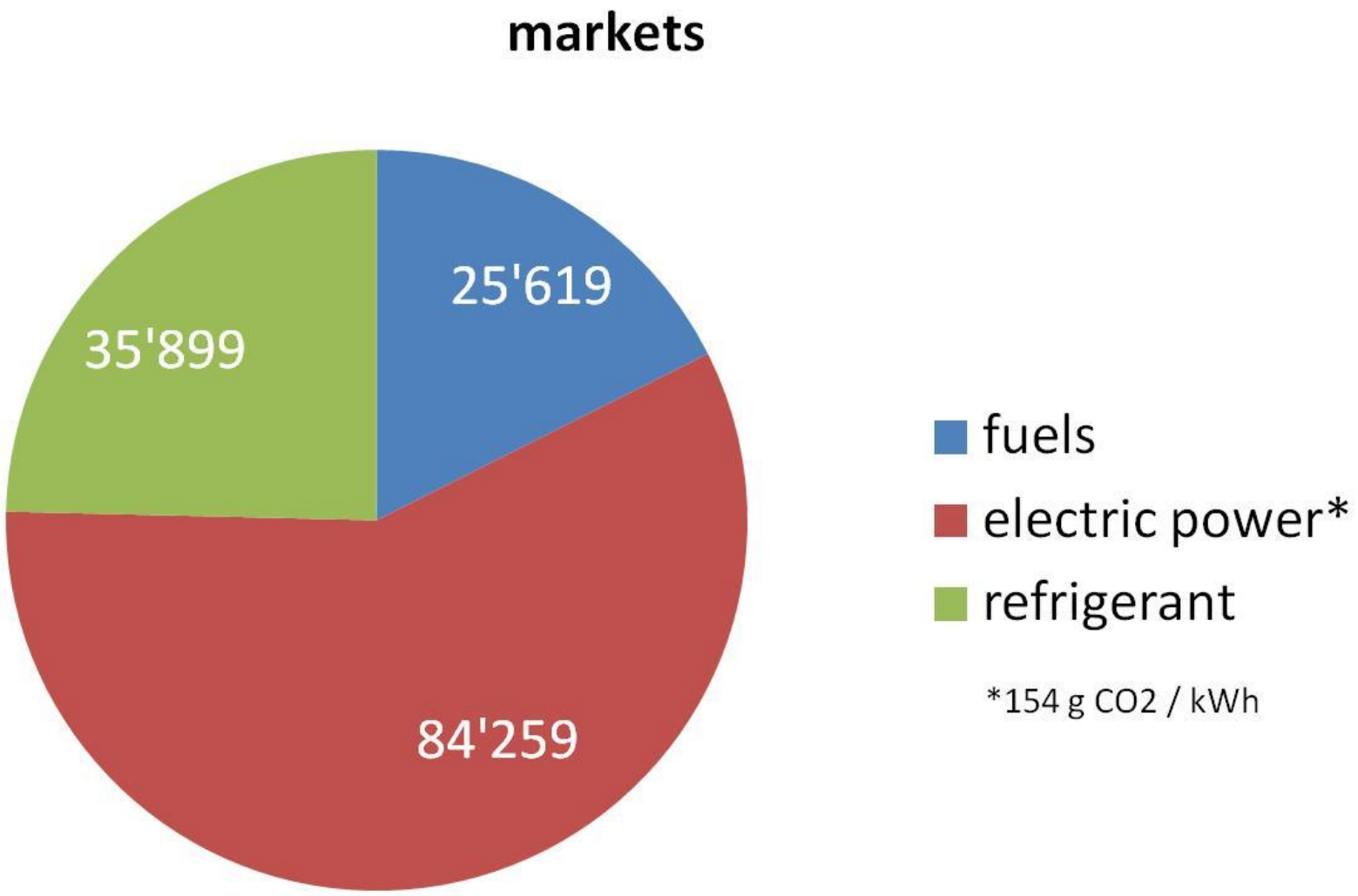
Retail trade

MIGROS
cooperatives
Office World
m electronics MIGROS
GLOBUS
SPORTXX MIGROS
migrolino
DO IT+GARDEN
DENNER
LeShop.ch MIGROS
micasa MIGROS
interio
OBI
ex libris
DEPOT interio

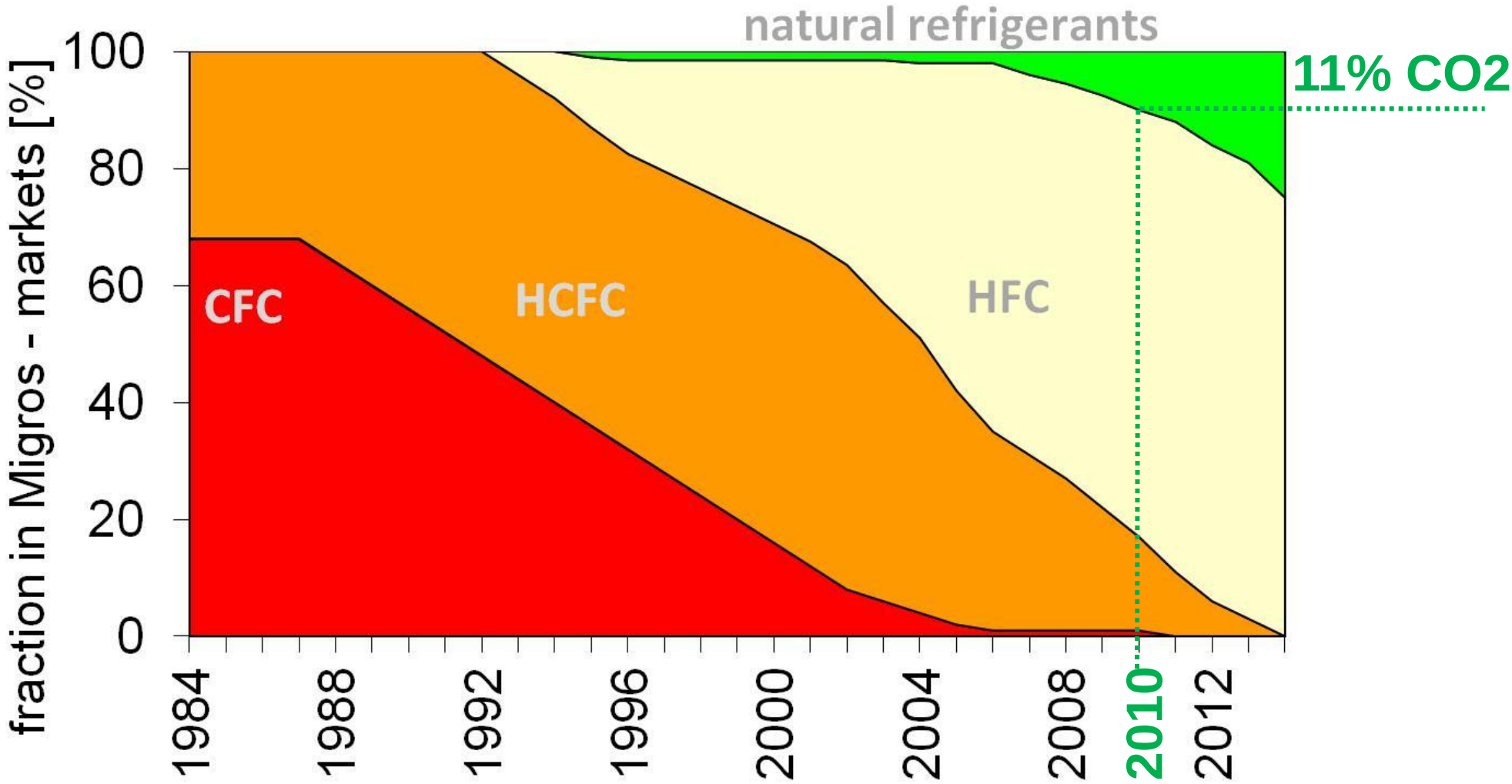
The 10 regional Migros cooperatives



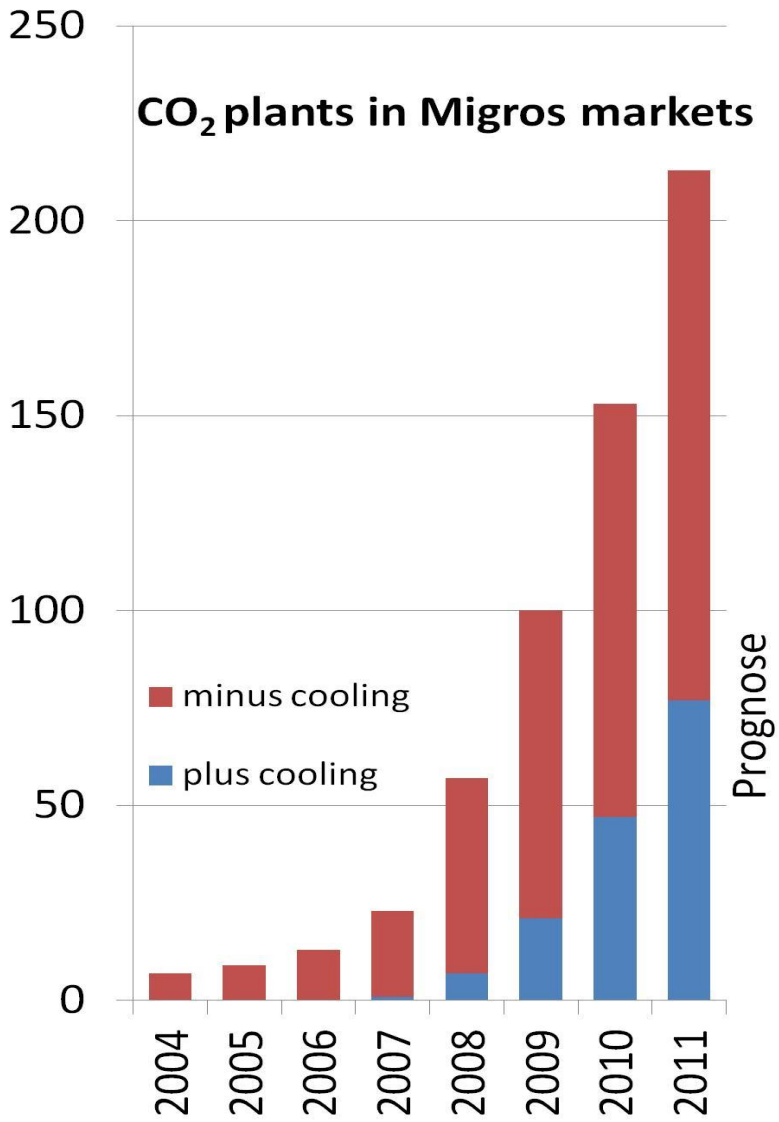
CO_2 – equivalent emissions 2010 (tons CO_2)



Development of refrigerants in Migros stores



2. CO2 as standard refrigerant for Migros



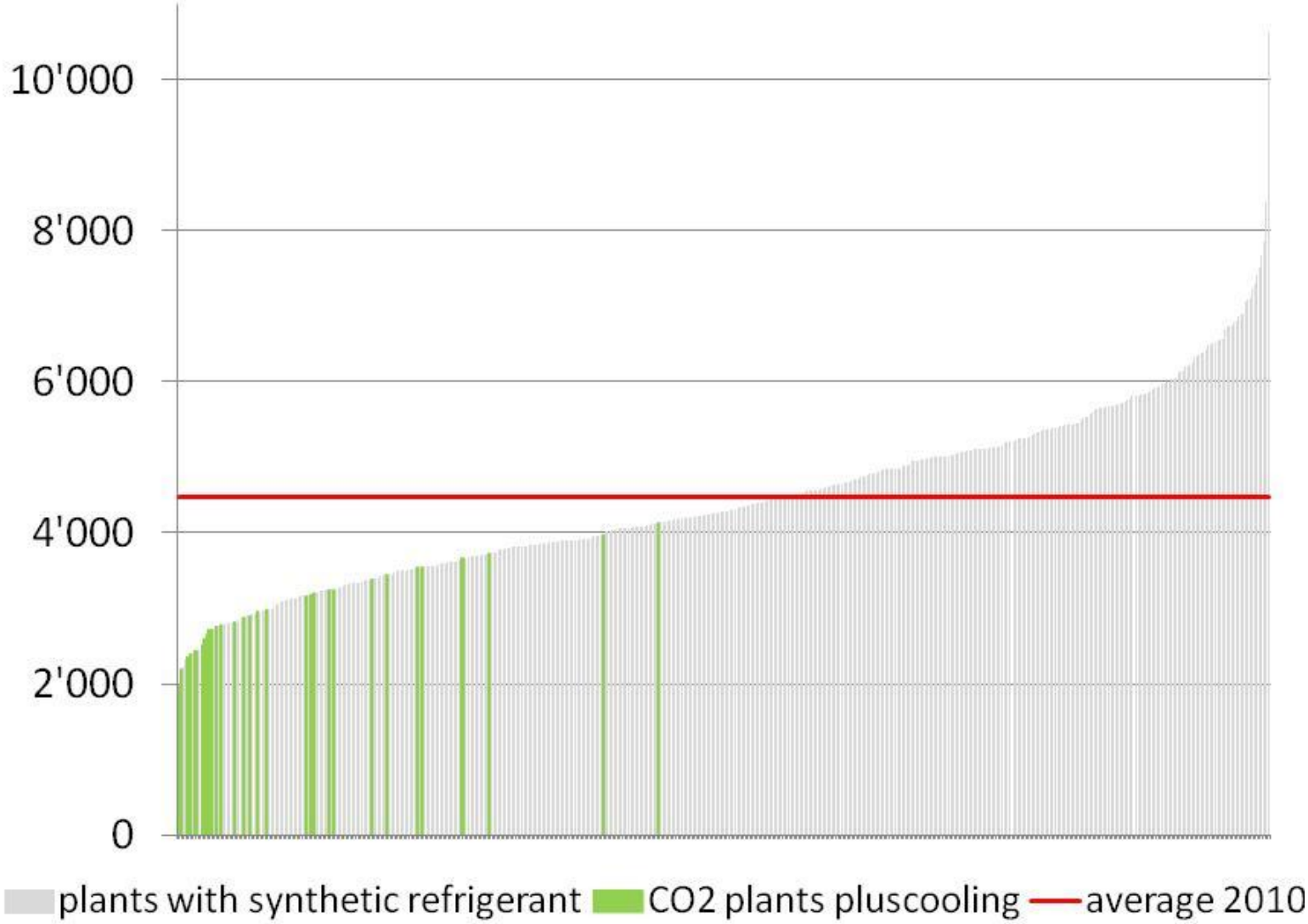
First low temperature CO_2 plants in 2002

Continued set-up of experience in planning, executing, and service

CO_2 has been the standard Migros refrigerant since 2010 because:

- **It is more sustainable than low-GWPs**
- **It is energy efficient**
- **It is cost neutral compared with traditional systems**

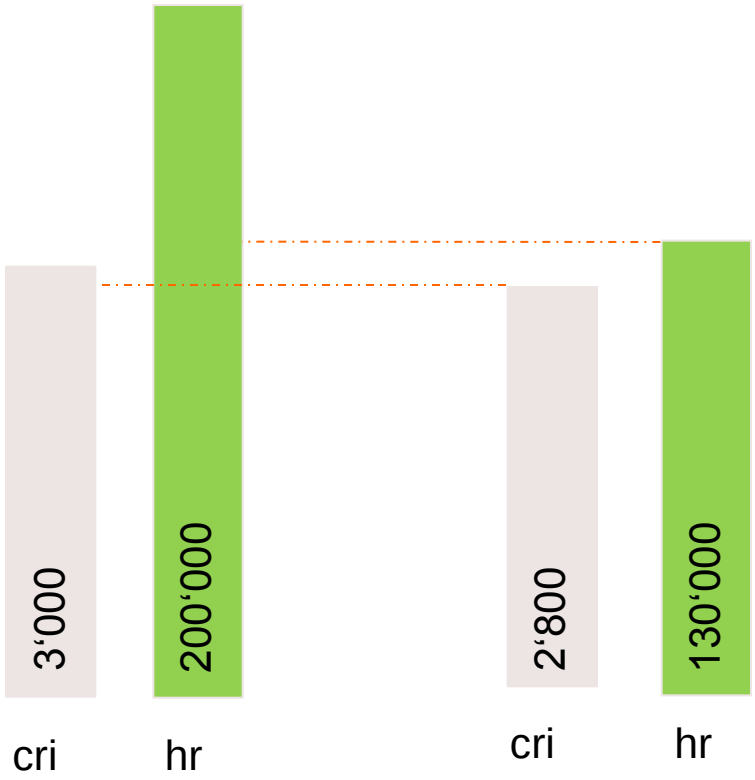
Comparative refrigeration indicator 2010 [kWh/(m·a)]



CO_2 plants offer effective heat reclaim, too!

Migros Wiedikon
CO_2/CO2
Old building standard

Migros Rüschlikon
R134a/CO2
New building standard



1. Setpoint of condensation to be dependent on ambient temperature

2. Inlet temperature (air or water) into heat recovery exchanger must be < +28°C

3. Raising high pressure into the trans-critical region in order to increase heat recovery is effective only if No.2 is ensured.

cri: Comparative refrigeration indicator [kWh/(m·a)]
hr: Heat recovery [kWh] (winter period 2010/2011)

5. Safety of CO_2 plants

Incident: CO_2 leakage, October 23, 2010

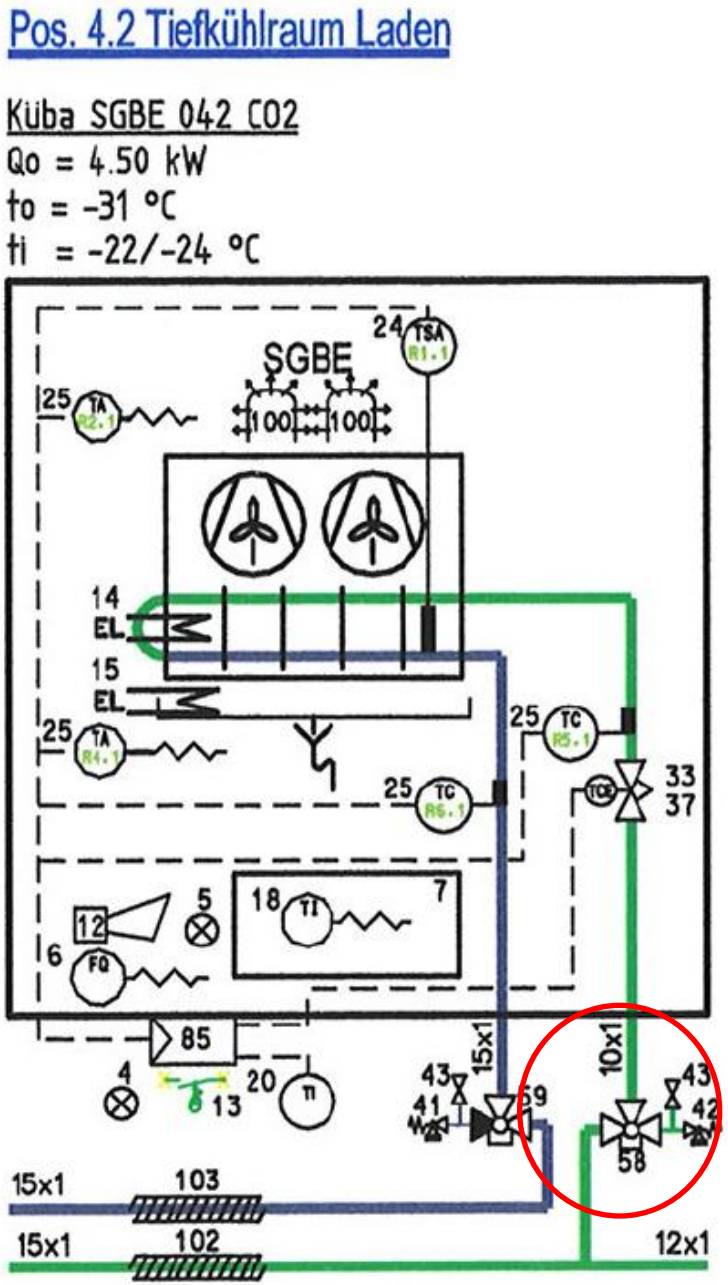
1. Service safety valve not entirely deactivated
2. Due to a short pressure peak, safety valve opens; does not return to closed position by itself:

➢ Leakage of 150 kg CO_2, evacuation of customers and personnel, supermarket closes for 3 hours

No damage to humans, environment, plant

Lessons learnt:

1. Removal of unnecessary components, adaptation of safety concept
2. Improved instruction of storepersonnel and public authorities
3. Training of skilled refrigeration personnel must be improved



6. Lessons learnt (1/2)

- There are chances and risks inherent in any new technology.
- CO_2 energy efficiency is slightly better than that of traditional systems.
- There is a high potential for heat reclaim. Due to the remarkably higher rise in temperature, investments for heat reclaim can be reduced. Important requirement: Low return temperature from heating system.
- In order to properly benefit from the entire CO_2 potential, developments in systems, components and materials must take place. Thermodynamic properties of CO_2 allow for compact components. A near-sighted reduction of manufacturing expenses of components to save on the cost of energy efficiency is not acceptable. Example: Evaporator size in cooling cabinets!

6. Lessons learnt (2/2)

- Energy efficiency of consumed power and heat reclaim must be supported for every new development and every single system. Only in this way can we achieve interesting results.
- Professional competence of refrigeration companies must be supported. It is for this reason that Migros has collaborated with the Swiss refrigeration sector to produce specific training material and opportunities.

Using CO_2 as our standard refrigerant means:

•Even more energy-efficient cooling systems than before

•Efficient heat reclaim at lower investment cost

•Significant reduction in greenhouse gas balance

•No further refrigerant retrofits!