Hall 7A

Chillventa Specialist Forums 2024
Chillventa Fachforen 2024

CONNECTING EXPERTS.

ENGINEERED FOR EXCELLENCE

IMPLEMENTING HONEYWELL'S R-455A IN A CORSICAN SUPERMARKET: A CASE STUDY IN LOW GWP REFRIGERANTS & ENERGY EFFICIENCY

MOHAMMED YOUBI IDRISSI | TECHNICAL LEADER

Honeywell

Mohammed Youbi Idrissi

Europe & MEA
Technical Leader
Honeywell

Mohammed graduated at INPG "Institut National Polytechnique de Grenoble" and holds a PhD in Energetics from the CNAM in Paris.
He began his career in 2000 at the French Institute of Industrial Refrigeration (IFFI) as a Teacher-Researcher before joining the INRAE in 2005 where he managed numerous projects focusing on the cold chain, eco-design of cooling production systems and energy efficiency of heat exchangers.
In 2008, he joined Air Liquide Group as R&D project manager, overseeing innovations in cryogenic equipment dedicated to food and cold chain applications.
From 2013 to 2019, Mohammed was Head of the Life Sciences R&D group, leading a team of 20 researchers working on cold chain applications, energy storage, biochemical processes using gases supplied by Air Liquide. He was recognized as an Air Liquide Group International Expert in 2015, and in 2018 was awarded the Group's Innovation Prize.
From 2020 to August 2023, Mohammed was Director of Expertise and Innovation at Cemafroid, the World Expert in the Cold Chain. During his time at Cemafroid, he developed numerous collaborations with manufacturers, institutions and OEMs in commercial refrigeration, industrial refrigeration and mobile refrigeration applications, heat pumps and air conditioning.
Mohammed holds 36 patents and is the author of more than 100 scientific and technical publications.

SOLSTICE® ENGINEERED SOLUTIONS IN FOOD RETAIL STORES

Refrigeration

- **Solstice helps improve the environmental footprint & reduce CO2 emissions by up to 15% at a total cost of ownership up to 20% lower than with the industrial gas R-744.**
- Reduces the energy bill of refrigeration assets by up to 16%, protecting retailers' margin and consumers from inflation.
- Reduces the investment (CapEx) for greenfield stores by up to 35%, while improving ESG results by up to 15% vs. systems using the industrial gas R-744.

Insulation

- **Roof:** Solstice helps improve the insulation value by up to 4% vs. HFCs.
- **Warehouse & cold room walls:** Solstice helps increase the insulation performance by up to 20% vs. iso-pentane (or get similar performance at 20% lower panel thickness).
- **Display cabinets:** Increase of insulation performance by up to 20% vs. water-based foam.

Heating & Air-Conditioning

- **Solstice helps recover the heat from refrigeration systems** and reduce hot water & heating bill by up to 62% vs. separate gas boiler heating system.
- **Solstice can help decarbonize heating & AC energy consumption** by using an integrated heating & cooling chiller system.

FOOD RETAIL STORES | RETROFIT / REMODELLING

Solstice® Refrigerant Solutions		Food Service & Small Indep. Stores	Convenience Stores (<600 sqm.)	Small & Med.-Size Stores (600-2000 sqm.)	Large Stores (>2000 sqm.)	
						
Solstice (R-515b)	GWP = 288	Condensing Units, Integral Systems (Medium)		Semi-Centralized Systems (Medium)	Chillers, DX Racks (Medium)	A1
Solstice L40X (R-455A)	GWP = 146	Condensing Units, Integral Systems (Medium + Low Temp)		Semi-Centralized Systems* (Medium + Low Temp)	Chillers, DX Racks* (Medium + Low Temp)	A2L

*Possible but complex
*Circuit size dependent

FOOD RETAIL STORES | NEW SYSTEMS

Long-Term Solstice® Refrigerant Solutions		Food Service & Small Indep. Stores	Convenience Stores (<600 sqm.)	Small & Med.-Size Stores (600-2000 sqm.)	Large Stores (>2000 sqm.)	
						
Solstice L40X (R-455A)	GWP = 146	Condensing Units, Integral Systems (Medium + Low Temp)		Semi-Centralized Systems (Medium + Low Temp)	Chillers, DX Racks (Medium + Low Temp)	A2L
Solstice ze (R-1234ze)	GWP = 1.37	Condensing Units (Medium Temp)		Semi-Centralized Systems (Medium Temp)	Chillers, DX Racks (Medium Temp)	

CASE STUDY OF A CORSICAN SUPERMARKET

Baseline

- **Hypermarket of 4200 m²**
- **20 years old central units with R-404A**
- **Display cabinets with open doors**

Remodeling project goals

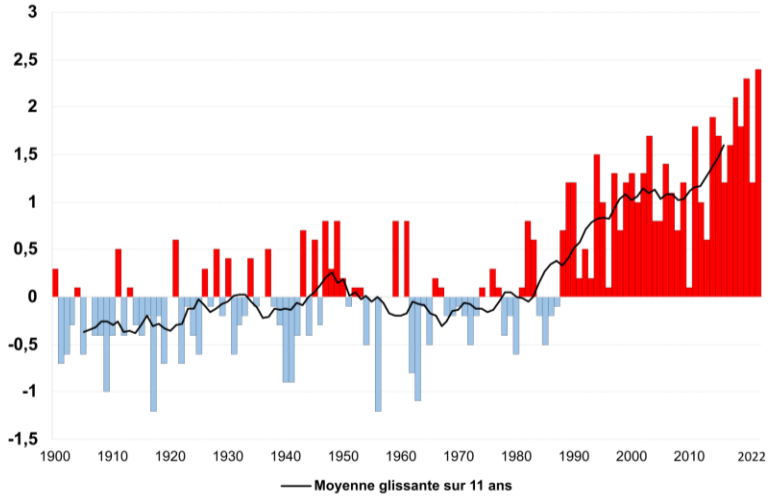
1. **Completely refurbishing the store and meeting the new customer expectations:** ++ local products, ++ fresh products, ++ fruits & vegetables
2. **Optimized CAPEX**
3. **Minimum energy consumption:** HRVAC is responsible of up to 80% energy consumption (50% refrigeration + 20-30% AC)
4. **Operation excellence:** financial loss of a claim related to refrigeration installations malfunction for one day is the equivalent of the yearly operating margin
5. **Compliance with UE regulation:** F-gas, PED-Pressure Equipment Directive

CASE STUDY OF A CORSICAN SUPERMARKET

CO2 based solution: quickly rejected!

- For several reasons linked to Corsica specifications
  - High temperature in summer
  - Difficulty in responding quickly to an emergency (technician availability and access)
  - Poor quality of the electrical network especially in summer corresponding to high energy demand for the supermarket
- But also, because the CO2 based solution presents:
  - High CAPEX
  - High TCO
  - Risks for the maintenance

R-455A based solution appeared obvious as it meets all customer's requirements



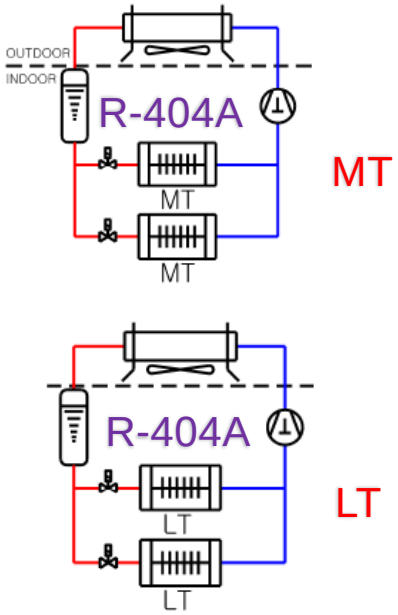
CASE STUDY OF A CORSICAN SUPERMARKET

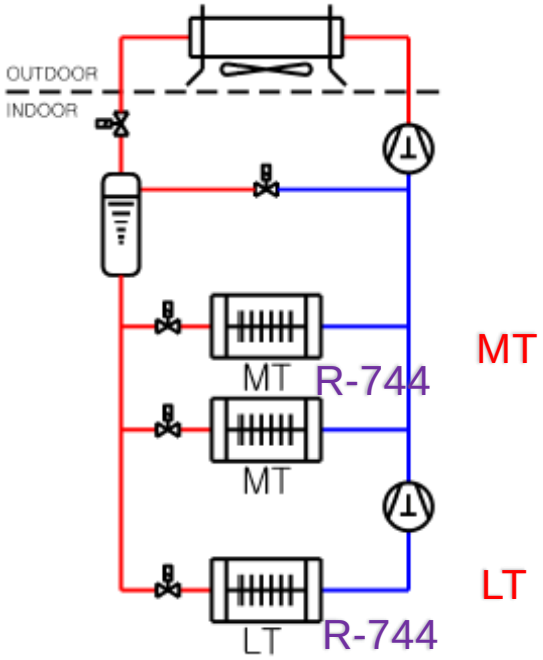
Eco-Efficiency study

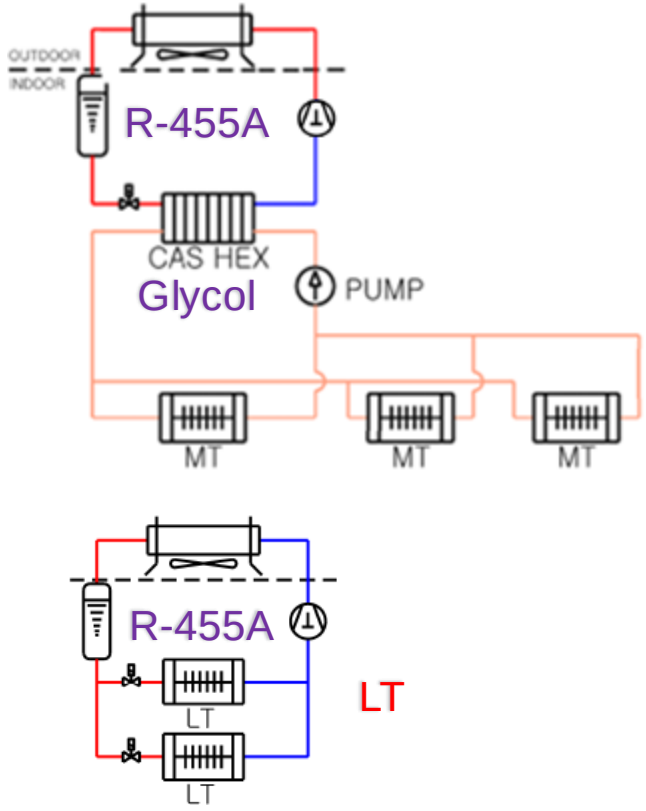
- Three solutions have been compared (including CAPEX, direct and indirect CO2 emissions, electricity consumption, service cost for 10 years of operation):
  - Baseline: high-GWP refrigerant R-404A working in direct expansion mode for MT and LT
  - R-744 working in direct expansion mode for MT and booster LT
  - Low GWP refrigerant R-455A working in indirect cooling system for MT and direct expansion mode for LT

MT cooling capacity is 314 kW

LT cooling capacity is 52 kW



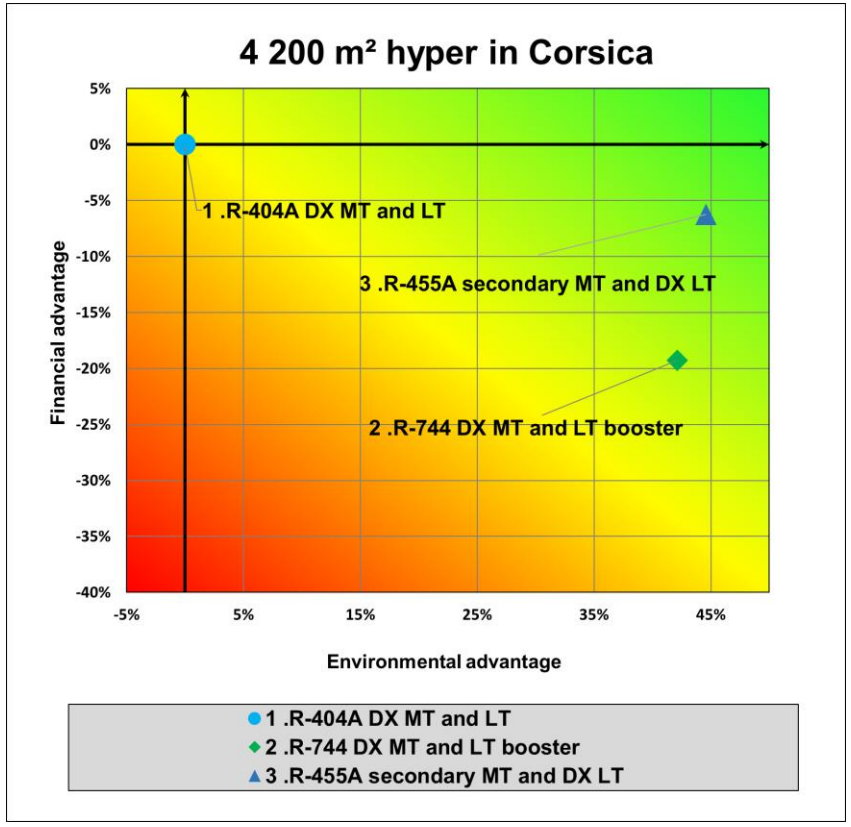




CASE STUDY OF A CORSICAN SUPERMARKET

Eco-Efficiency results

ARCHITECTURE	CAPEX	CAPEX vs. BASELINE	OPEX ELECTR.	OPEX ELECTR. vs. BASELINE	OPEX SERVICE	OPEX TOPPING OFF	Σ OPEX	CAPEX + OPEX	CO2 EMISSIONS ELECTR.	CO2 EMISSIONS LEAKS	Σ CO2 EMISSIONS
[-]	[€]	[%]	[€]	[%]	[€]	[€]	[€]	[€]	[t CO2]	[t CO2]	[t CO2]
1 .R-404A DX MT and LT	**240,000**	**100.0%**	1,044,236	**100.0%**	28,704	93,345	**1,166,285**	**1,406,285**	5,952	5,952.15	**11,904**
2 .R-744 DX MT and LT booster	**390,000**	**162.5%**	1,208,285	**115.7%**	47,834	31,238	**1,287,357**	**1,677,357**	6,887	1.56	**6,889**
3 .R-455A secondary MT and DX LT	**300,000**	**125.0%**	1,152,879	**110.4%**	29,784	11,470	**1,194,132**	**1,494,132**	6,571	24	**6,595**



R-455A based solution vs. CO2 provide:

- ✓ 30% CAPEX saving
- ✓ 10% TCO reduction
- ✓ 4% Total CO2 emission reduction

CASE STUDY OF A CORSICAN SUPERMARKET

Implementation

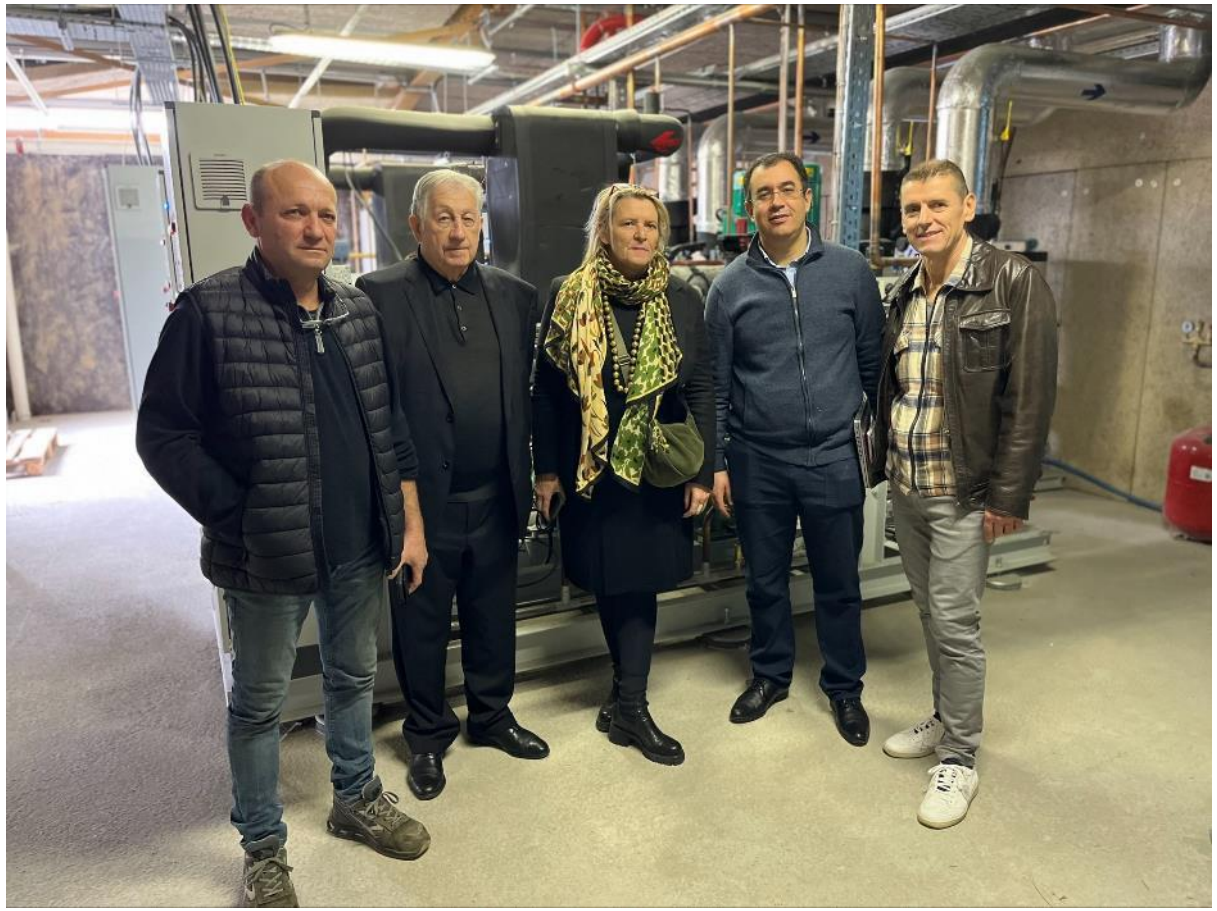
- 2 MT Chiller (300 kW) with an R-455A chiller producing cooled water (-8°C/ -4°C)
  - A glycol water-loop with Friogel Neo to distribute medium temp. refrigerated displays
  - Another water-loop for cold rooms and preparation rooms
- 1 LT (60kW) DX unit working with R-455A from -30°C to + 42°C
- 2000L water tank + 2 pumps by circuit
- Overall charge of refrigerant: 2x108kg (MT) + 215kg (LT) ➔ 431kg

CASE STUDY OF A CORSICAN SUPERMARKET

Implementation

- MT display cabinets (Exkal): 160kW – 210m
- LT display cabinets (Carrier): 28kW – 48m
- 35 MT cold rooms: 134kW
- 3 LT cold rooms: 24kW
- 1 condenser 5 fans 700 rpm dt= 8 °C with LCE battery treatment for MT
- 1 condenser 3 fans 700 rpm dt= 8 °C with LCE battery treatment for LT

THANKS TO



THANK YOU

October 2024

Honeywell