

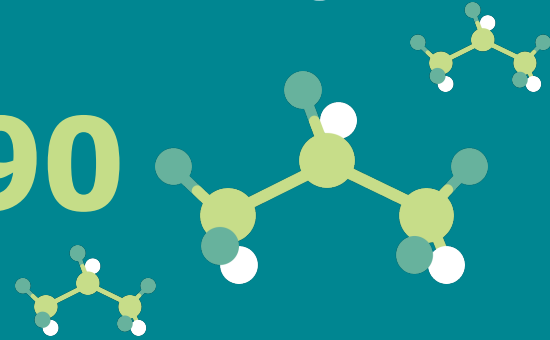


ATMO
sphere

Business Case for
Natural Refrigerants

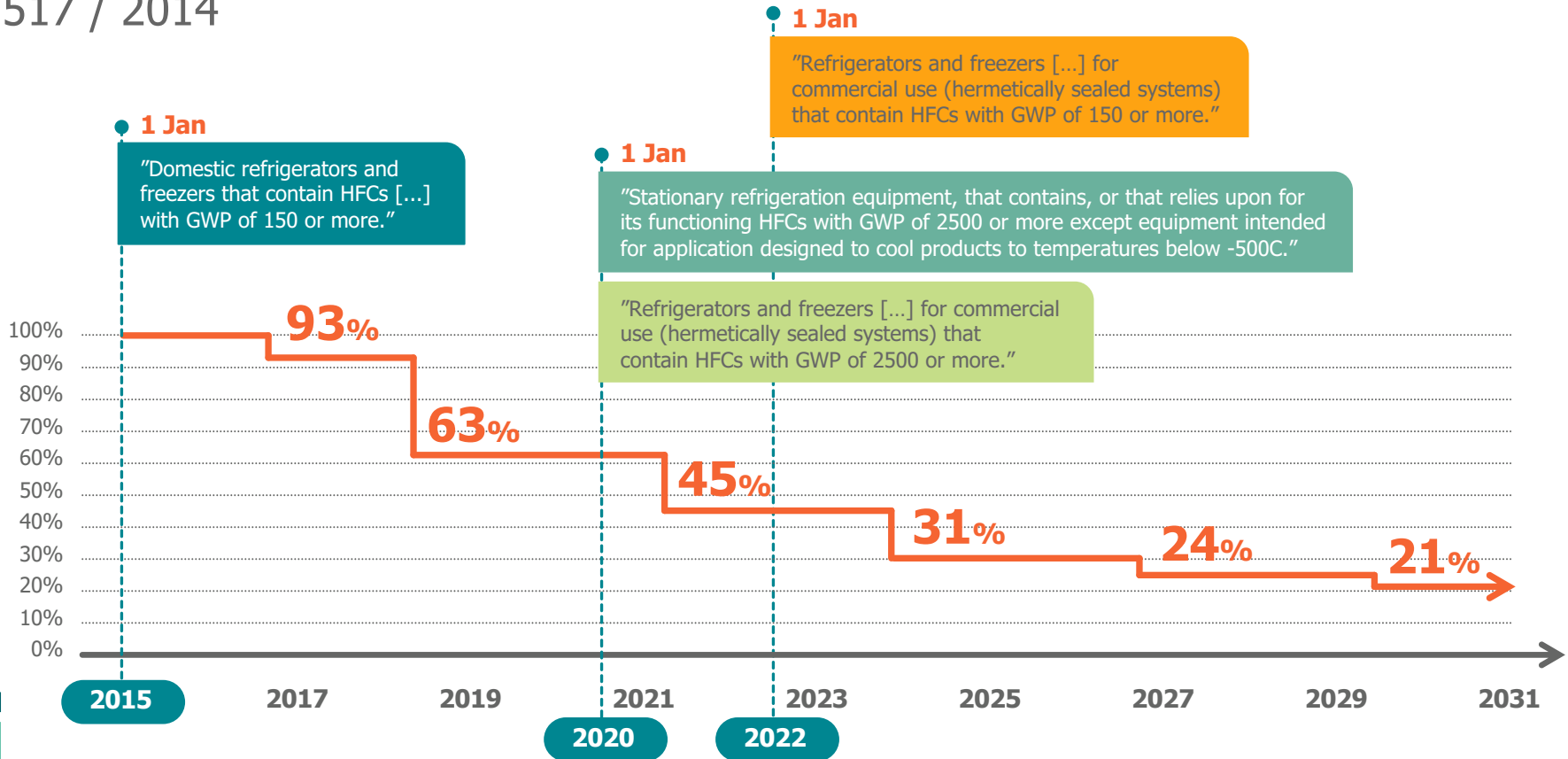
NJX

CASE STUDY: NEXT GENERATION
OF 2HP COMPRESSOR
OPTIMISED FOR **R290**



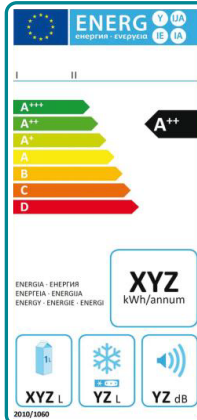
EU F-Gas Regulation

517 / 2014



EU Ecodesign Regulation

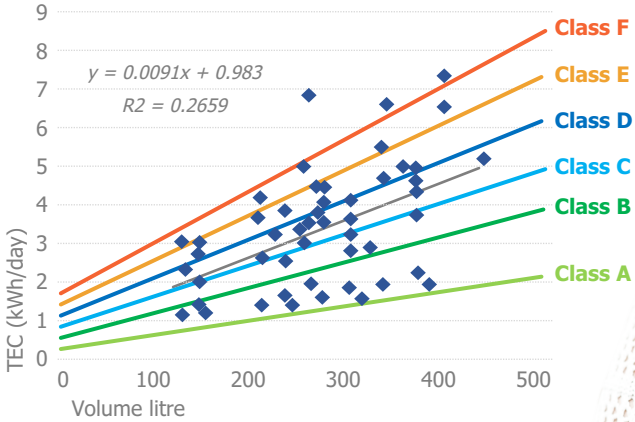
Lot 1 & Lot 12



Energy labelling


A preliminary indication of energy labelling has been prepared for small ice-cream freezers. The metric used to define the energy consumption is volume (compared to TDA, used for supermarket freezers).

◆ Small ice-cream freezer — Linear (small ice-cream freezers)



What is
the best option
for Household and Light Commercial
systems in low GWP future ?

Final Solution to Meet EU F-Gas Regulation

	HIGH GWP HFC's	LOW GWP HFC's	HC's	
SAFETY CLASS	A1 Not flammable	A2L Mildly flammable	A3 Highly flammable	 <p>Hydrocarbons are the most sustainable choice for future</p>
ENVIRONMENTAL IMPACT	Bad	Good	Excellent	
REFRIGERANT COST	Ref	Very high*	Normal	
COMPRESSOR THERMAL REGIME	Ref	Higher	Lower	
INVESTMENTS FOR SAFETY	Ref	Yes	Yes	
SYSTEM EFFICIENCY	Ref	Higher	Much higher	
CHARGE LIMIT (IEC, EN60335-2-89)	No	150 g	150 g	

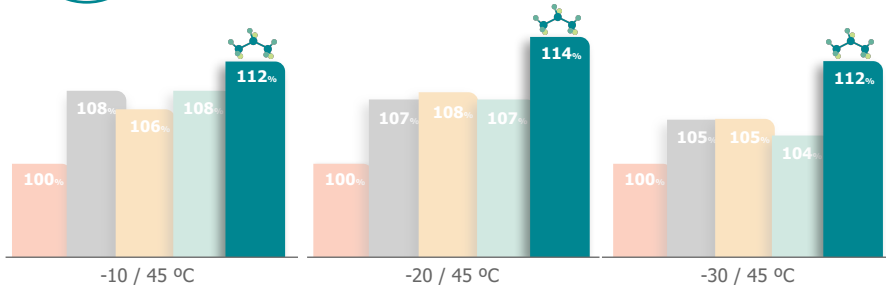
* Not yet in mass production



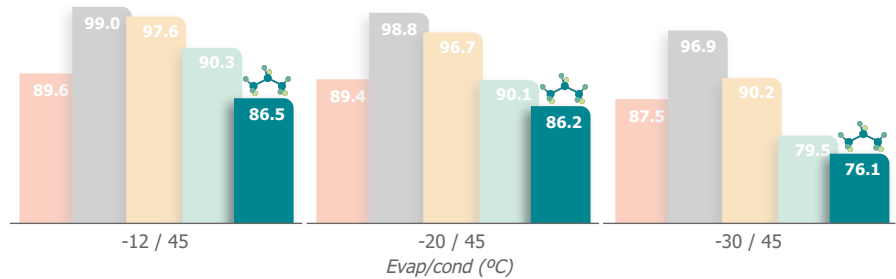
Final Solutions Comparison



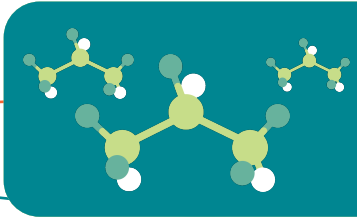
EFFICIENCY COMPARISON
% / Superheating 22.2 °C / Middle point based



THERMAL REGIME EVALUATION
°C / Superheating 22.2 °C / Dew point based



■ R404A
 ■ A2L #1
 ■ A2L #2
 ■ A2L #3
 ■ R290



Propane (R290) is the best in efficiency and in thermal level



There are still legislative barriers for larger use of HC's and A2L's.

Charge limit in HH
UL

Increment of HH limit to 150g in US

Charge limit in CO
IEC and UL

IEC/SC61C/WG4 is working on CO charge limit to be published in 2018



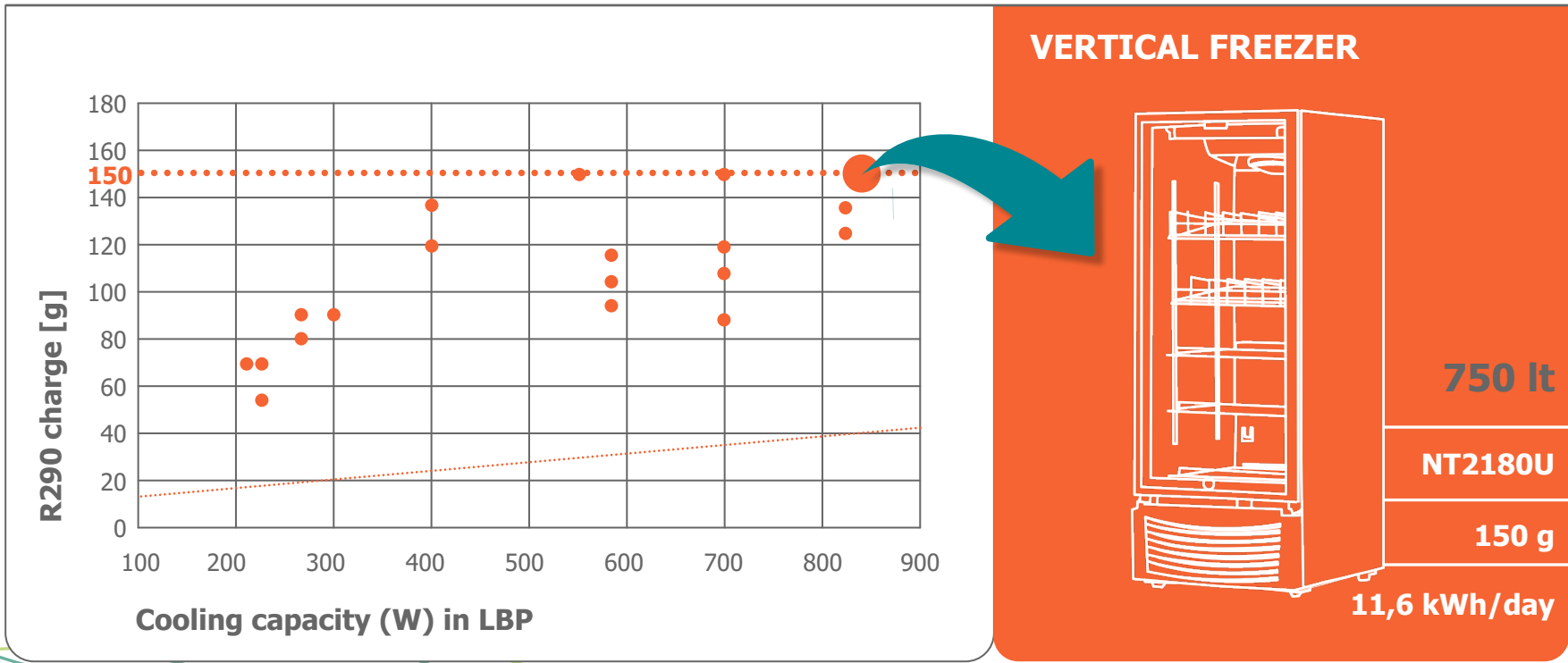
Relevant international & standards and flammable refrigerants limits

STANDARD	TITLE	APPLICATION	CHARGE LIMIT	
EN IEC 60335-2-24	Particular requirements for refrigerating appliances, ice-cream appliances and ice-makers	Domestic refrigeration	Up to 150g of flammable refrigerant per circuit	150g OK
EN IEC 60335-2-89	Particular requirements for commercial refrigerating appliances with an incorporated or remote condensing unit or compressor	Any refrigeration appliances used in commercial situations	Up to 150g of flammable refrigerant per circuit	150g ? NOK
EN IEC 60335-2-40	Particular requirements for electrical heat pumps, air conditioners and dehumidifiers	Any air conditioning and heat pump applications	Up to 1kg and 5kg depending upon application	1 kg or + OK
EN378	Mechanical refrigeration systems used for cooling and heating - safety requirement	Any refrigeration, air conditioning and heat pumps: domestic, commercial and industrial	Variable, depending upon application	



150g (5,3 oz) CHARGE LIMIT

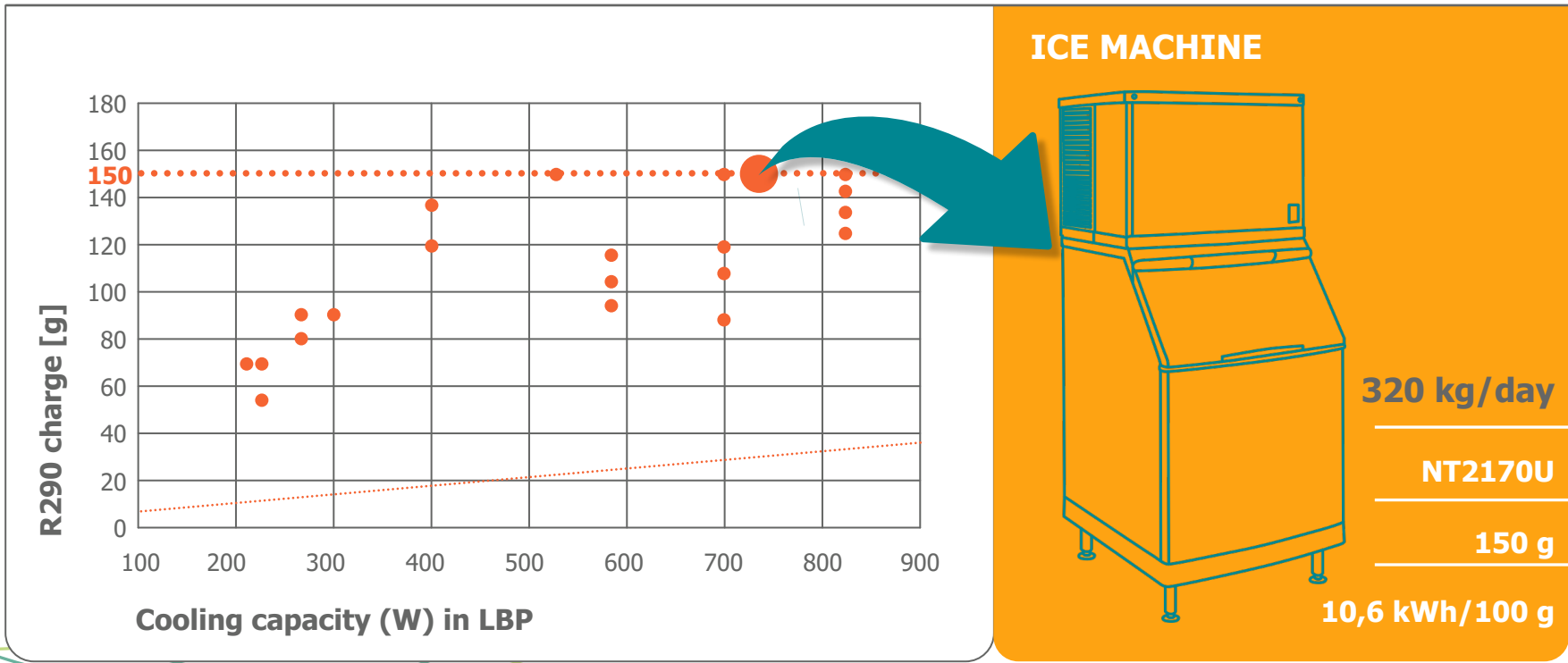
LT PROPANE CABINETS CHARGE





150g (5,3 oz) CHARGE LIMIT

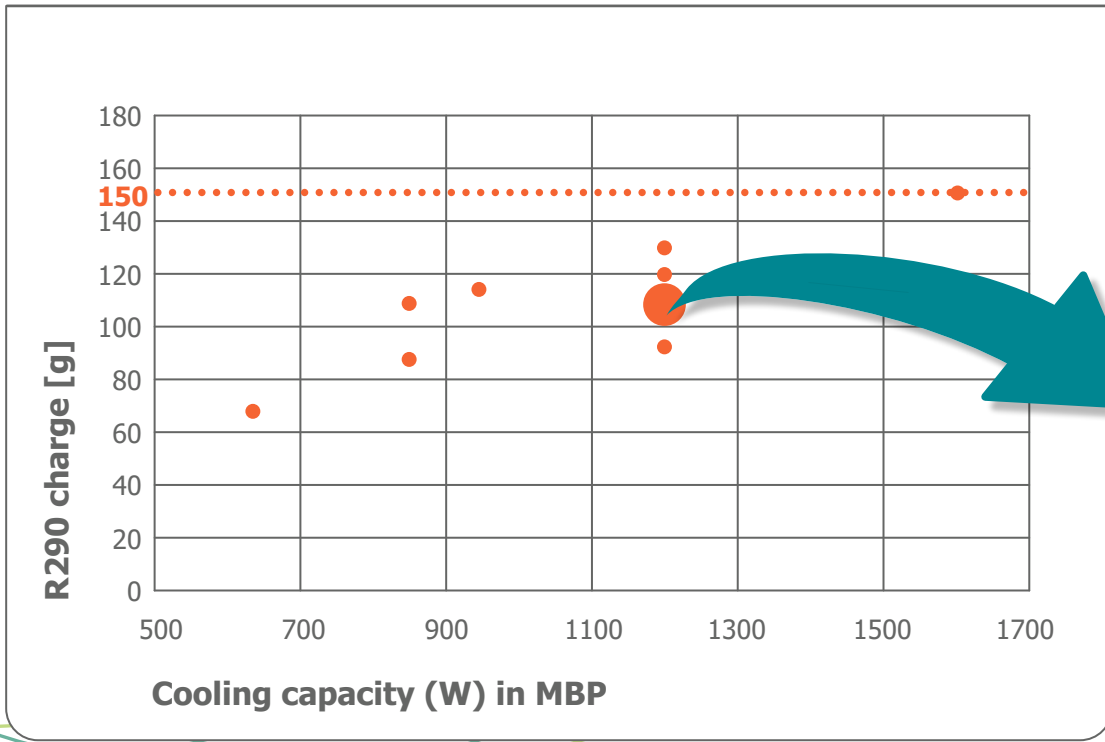
LT PROPANE CABINETS CHARGE



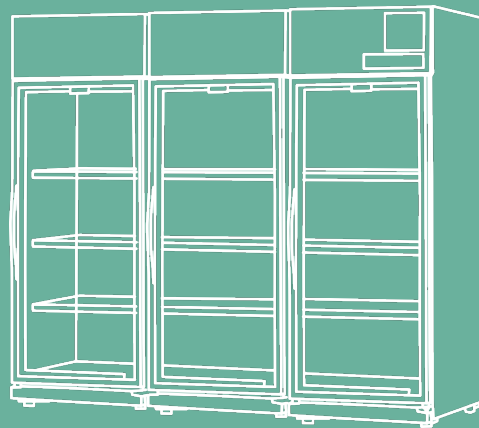


150g (5,3 oz) CHARGE LIMIT

MT PROPANE CABINETS CHARGE



GLASS DOOR MERCHANDIZER



2000 lt

NEK6213U

114 g X 2

7.2kWh/day



IEC 61C WG4 Task: Amend IEC60335-2-89 to allow higher limit of charge of flammable refrigerant with necessary additional requirements to keep the risk the same as with the current limit of 150 g

- 1** Last Draft for Comments (DC) document that considers **500 g** limit for propane charges and which will also allow the use of A2L safety class refrigerant alternatives, **was discussed in August 2017 meeting in Mainz.**
- 2** Outcomes of Mainz meeting **will be submitted to the SC61C committee** during Plenary Meeting of the SC61C in **October 2017** in Vladivostok to go for first official vote as a **Committee Draft (CDV). Positive Vote** on CDV/FDIS will allow new charge limits introduction still in **2018.**
- 3** Experts in the Working Group 4 are representing major global manufacturers like **AHT, Daikin, Electrolux Professional, Emerson, Epta, Hussmann, Panasonic, Porkka, Sanden, True Manufacturing, Mitsubishi Electric, United Technologies, Whirlpool, etc**
- 4** A new IEC standard for the maximum allowable flammable refrigerant charge **would influence the adoption of the same standard in all regions.** "This would be a reference, the global standard."





**F-Gas
regulation**



Ecodesign



**New IEC EN
Charge Limit**



**High
Efficiency**



**Single Piston
Platform**

New 2+ HP

NJX

Product for R290



NJX

Main futures



New displacement 38cc to stretch cooling capacity above 2HP for LBP

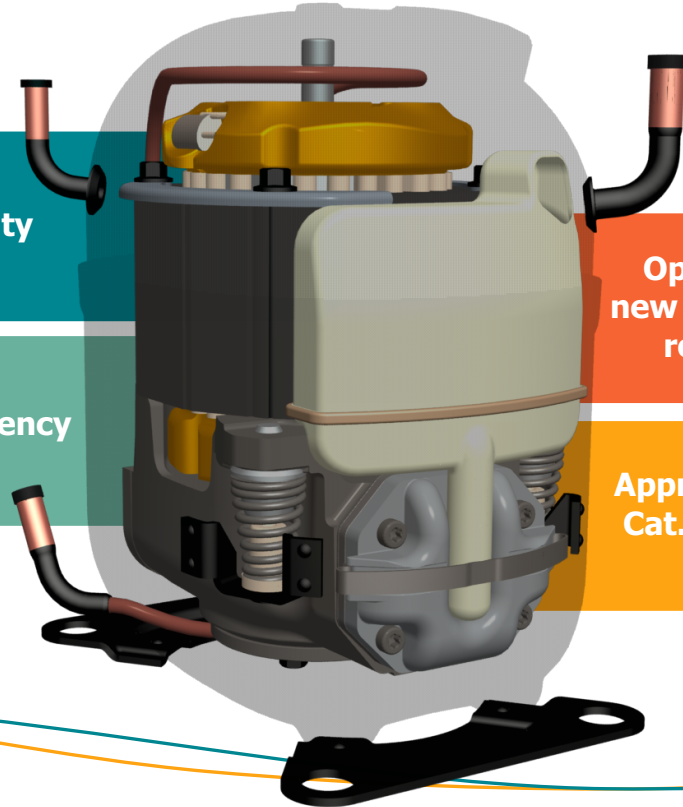


New suction muffler optimized for high efficiency and liquid handling

Optimised motor and new valving system for robust performance



Approved for Cat.2 of PED



NJX

Preliminary Performance with R290



MODEL	ELECTRICAL MOTOR	DISPLACEMENT (CC)	HP	APPLICATION	TORQUE	COOLING TYPE	COOLING CAPACITY (W)	COP (W/W)
NJX2215U	1 phase	37.9	2 1/4	LBP	HST	Fan	840	1.13
NJX2215U	3 phase	37.9	2 1/4	LBP	HST	Fan	870	1.2
NJX9250U	1 phase	37.9	2 1/4	MBP/HBP	HST	Fan	2619	2.06
NJX9250U	3 phase	37.9	2 1/4	MBP/HBP	HST	Fan	2653	1.97

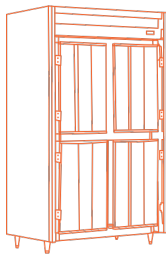
NJX

Ideal solution for all commercial application

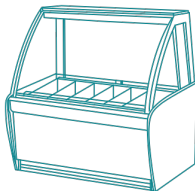


*EN12900

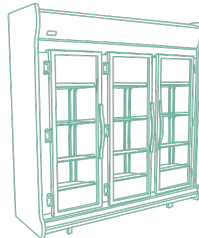
REACH-IN



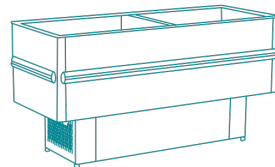
ICE CREAM CABINET



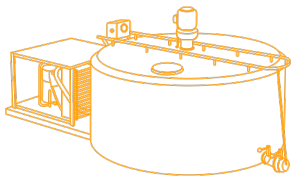
GLASS DOOR MERCHANDISER



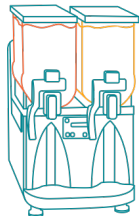
REFRIGERATED ISLAND



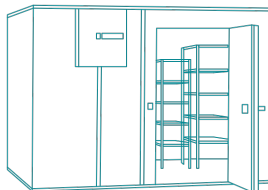
MILK COOLER



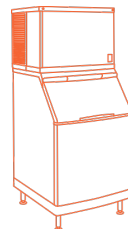
ICE CREAM MAKER



WALK-IN COOLER



ICE MAKER



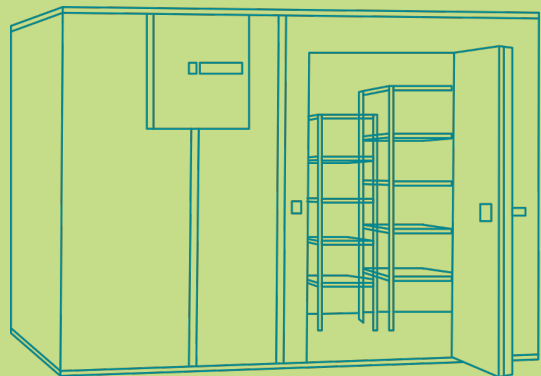
NJX

CASE STUDY
WITH RIVACOLD



NJX

Case study with Rivacold



Walk-in rooms

RIVACOLD
MASTERING COLD

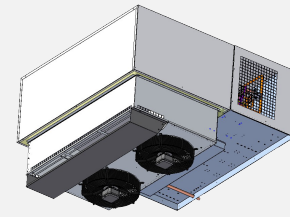
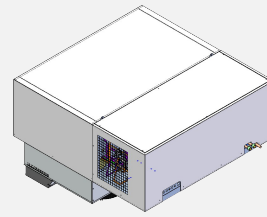
embraco



NJX

Case study with Rivacold

RIVACOLD
MASTERING COLD



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Testing Details

REFRIGERANT
CONDENSER TYPE

DISPLACEMENT [CC]
SYSTEM CHARGE [KG]
COOLING CAPACITY [W]
POWER INPUT [W]
COP [W/W]
% OF RUNNING TIME
WATER INLET TEMPERATURE [°C]
AMBIENT TEMP [°C]
INTERNAL AVG TEMP [°C]
EVAPORATING TEMP [°C]
CONDENSING TEMP [°C]

TEWI [KG CO2 EQUIV]

EMISSION REDUCTION IN
TONS OF CO2 IN 10 YEARS
ANNUAL ENERGY COST SAVING [EURO]
w/ 0.1 – 0.3 euro(kWh)

SMALL BLOCK SYSTEM

R404A
Air Cooled
Single compressor

68
1.7
1755
2406
0.73
75
-
24.4
-18.4
-28.8
33.1

61517

MEDIUM BLOCK SYSTEM

R290
Water Cooled
Two compressor

2*38
2*0.145
2165
2015
1.07
75
20
31.2
-19.3
-30.5
23.3

44880

27.8
541- 1624

LARGE BLOCK SYSTEM

R404A
Air Cooled
Single compressor

108
2.35
2614
3316
0.79
75
-
25.5
-19.5
-29.9
36.6

84909

NJX

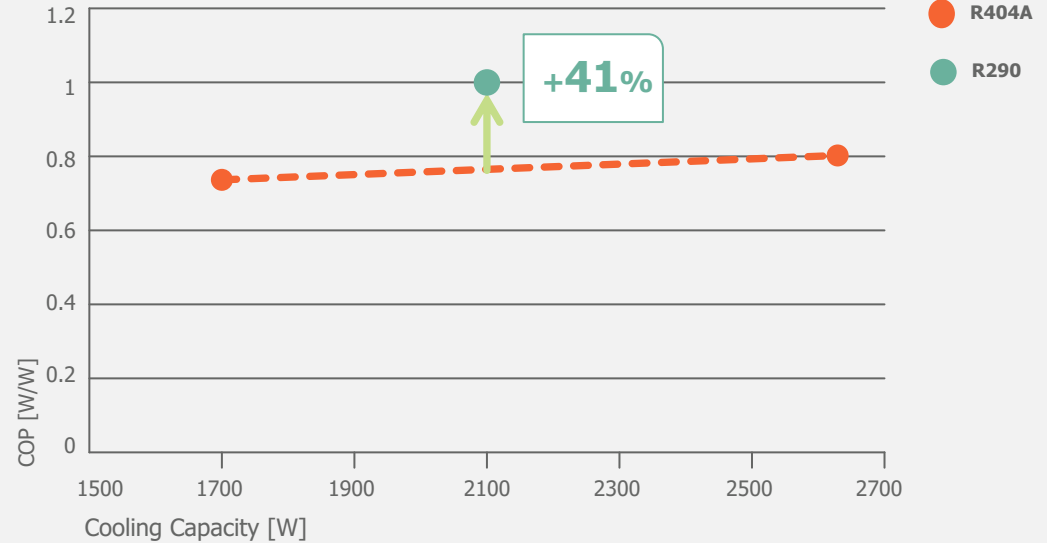
Case study with Rivacold



RIVACOLD
MASTERING COLD

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COP vs Cooling Capacity



Rivacold System
with NJX presented

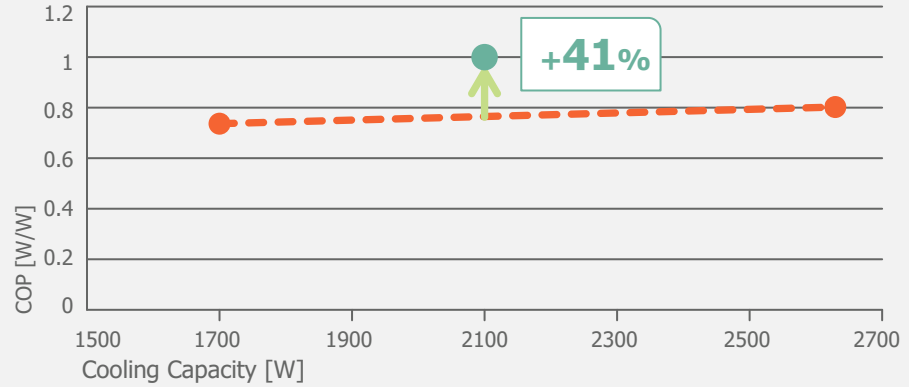
41% of efficiency improvement

NJX

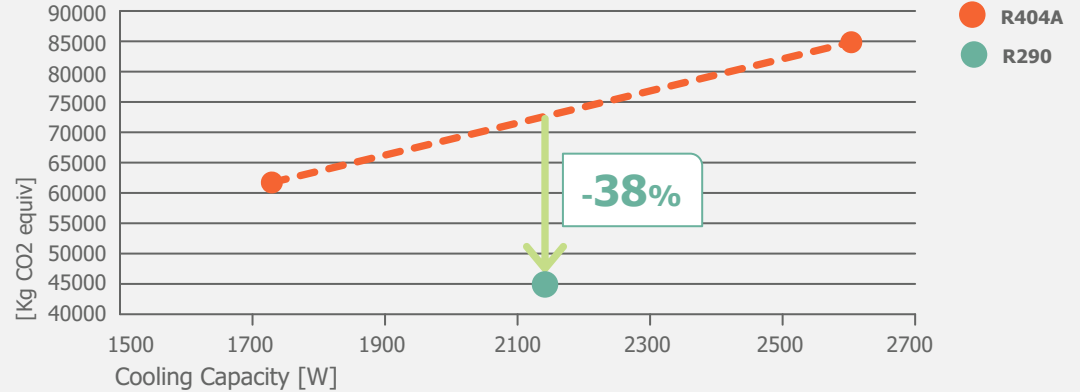
Case study with Rivacold COP & TEWI Benefits



COP vs Cooling Capacity



TEWI vs Cooling Capacity



CONCLUSIONS

We support use of natural refrigerants, considering them as a best option to meet EU regulations (f-gas & ecodesign) supporting global effort of climate change mitigation.

Expected charge limit change will allow use of propane with larger number of appliances in light commercial segment.

New high efficiency NJX product was designed for larger cooling capacity (2HP+) systems using flammable refrigerants.

Clear benefits in efficiency can be achieved with use of liquid cooled condensers lowering condensing temp.

R290 is outperforming R404A in terms of environmental impact.



Thank you

A decorative graphic consisting of two wavy lines, one white and one yellow, that cross each other and extend across the width of the slide.

embraco



ATMO
sphere

Business Case for
Natural Refrigerants