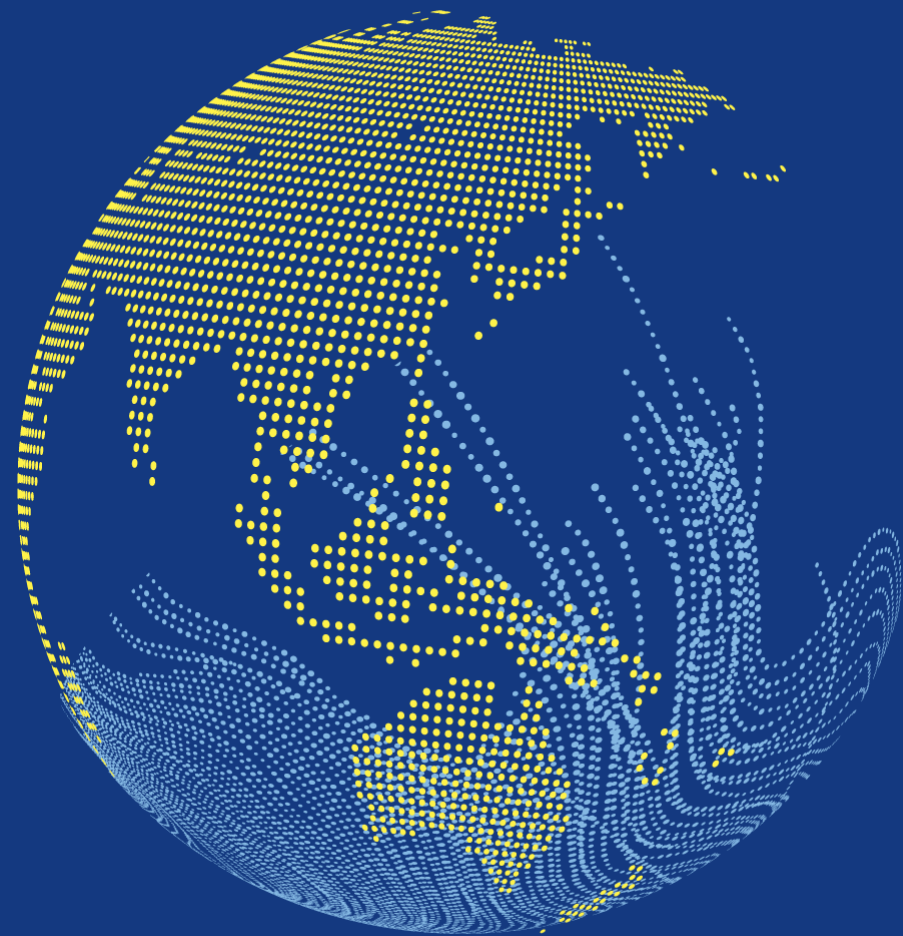




Business Case for  
Natural Refrigerants



12/02/2019

TOKYO

A smiling woman with blonde hair is holding a vanilla ice cream cone with blueberries. The background is a light-colored wall with horizontal lines. A dark grey banner is overlaid on the left side of the image, containing text.

## EMBRACO FMFD

INCREASING EFFICIENCY IN FULLMOTION INVERTER R290  
ICE CREAM FREEZER CASE STUDY

embraco

# ABOUT EMBRACO



Present in  
**80** countries



More than  
**11,000**  
employees



**11** business units



Production capacity:  
**37 million**  
compressors/year



**MORE THAN 20 YEARS GLOBAL LEADER IN NATURAL REFRIGERANTS**

## CASE STUDY | MOTIVATIONS & REQUIREMENTS

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### CUSTOMER'S MOTIVATION

Provide an  
**ice cream freezer**  
**compliant**  
with the specifier's  
**requirement** for local  
market.



### END USER REQUIREMENTS

- ✓ Low **energy** consumption;
- ✓ Low **temperature** variation;
- ✓ Capacity to work perfectly even  
with **voltage fluctuations**;
- ✓ Low **noise**.



**Embraco embraced  
the customer's  
challenge**

## CASE STUDY | SYSTEM & SUGGESTIONS

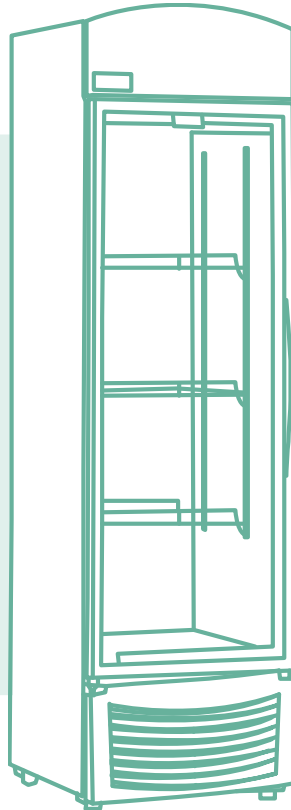
### ABOUT THE APPLICATION

**Application:** Vertical Ice-cream cabinet

**Internal volume:** 327L

**Original compressor:** NEU2168U

Compressors are a critical part of the system on Ice Cream cabinets, representing most of the energy consumption in this kind of application.



### ALTERNATIVES TO IMPROVE ENERGY EFFICIENCY

- Change to the most efficient R290 Fullmotion **inverter compressor**;
- **Glass door** could be exchanged (double glass > triple glass);
- **Evaporator** and **condenser** could be replaced;
- Replacement and adjustment of **expansion valve** could be done.

# FMFD



LOW ENERGY  
CONSUMPTION

**21** %

More efficient  
vs. on-off (NEU<sup>1</sup>)

**14** %

More efficient  
vs. FM (VNEU<sup>2</sup>)



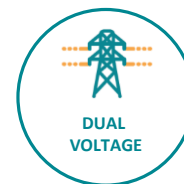
LESS  
VIBRATION

VNE Family ~3,0 mm/s  
FMF Family ~1,4 mm/s



LOW NOISE

quieter  
than VNEU  
quieter  
than NEU



DUAL  
VOLTAGE

Reduces  
SKUs Complexity

<sup>1</sup>@ EN12900\_HH / @ ASHRAE\_LBP

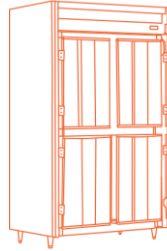
<sup>2</sup> VNE was the most efficient Fullmotion inverter compressor before FMF launch in commercial applications

# FMFD

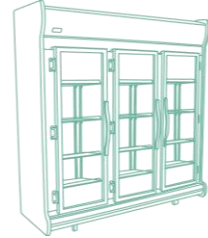
*Main applications*



REACH-IN



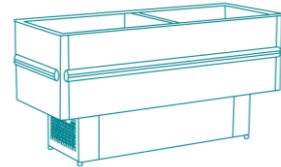
GLASS DOOR  
MERCHANTISER



BOTTLE COOLER



REFRIGERATED/FROZEN  
ISLAND



# CASE STUDY RESULTS



Energy  
Saving



Higher  
Maximum Cooling  
Capacity



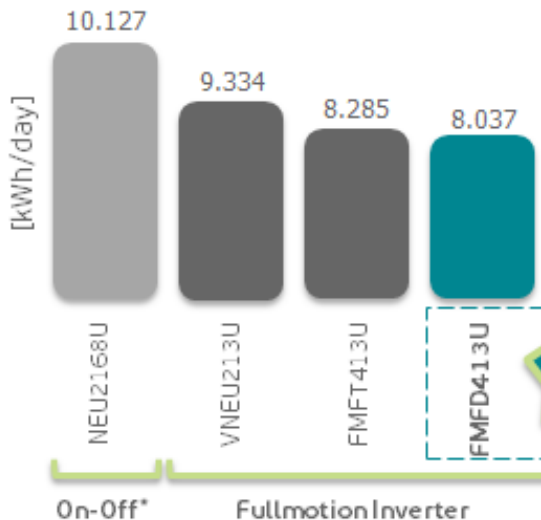
Environmental  
Impact





Energy Saving

## Power Consumption Comparison



New launch

21%  
Less energy consumption<sup>1</sup>

Savings<sup>2</sup> above  
JP¥  
22k  
per year

\*Original compressor

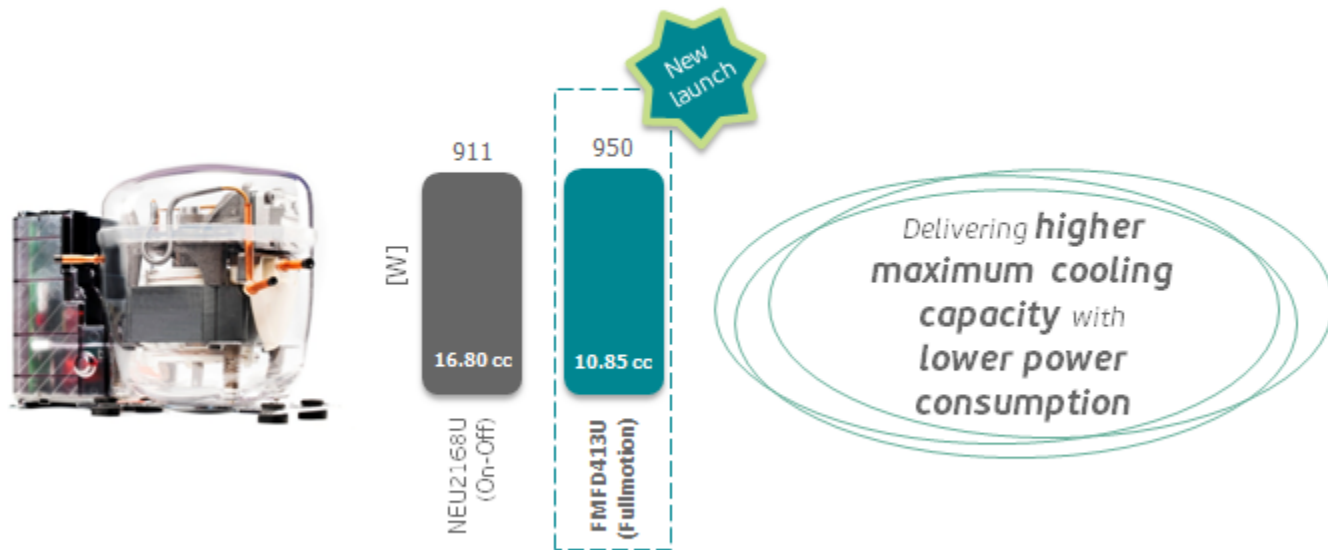
<sup>1</sup> Comparison vs. on-off model

<sup>2</sup> Considering one equipment and a simplified energy rate of JP¥ 30 per kWh



Higher  
Maximum Cooling  
Capacity

## Maximum Capacity Comparison

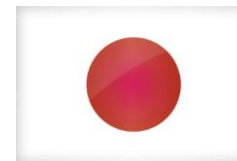


### Case Study Details

#### Testing Conditions:

- ASHRAE (-23.3°C/54.4°C)

- FMFD @Maximum Speed



## Environmental Impact | CO2 Emissions



	ON-OFF (NEU2168U)	FULLMOTION INVERTER (FMFD413U)
<b>GWP - Global Warming Potential</b>	<b>3</b>	<b>3</b>
<b>L - Leakage rate (kg/year)</b>	<b>0.003</b>	<b>0.003</b>
<b>N - Life time (years)</b>	<b>10</b>	<b>10</b>
<b>M - Refrigerant charge (kg)</b>	<b>0.12</b>	<b>0.12</b>
<b>a - Recycling factor (%)</b>	<b>0</b>	<b>0</b>
<b>E - Energy consumption (kWh/year)</b>	<b>3,70</b>	<b>2,93</b>
<b>β - Emission from energy gen. (kgCO2/kWh)</b>	<b>0.415</b>	<b>0.415</b>
<b>TEWI<sup>1</sup></b>	<b>15,338</b>	<b>12,174</b>

# 21%

of reduction on the environmental impact due to CO2 emissions



## Environmental Impact

### Case Study details

TEWI (Total Equivalent Warming Impact) is a measurement of the total CO2 emissions from an equipment during its operating lifetime

<sup>1</sup>Calculation according to the equation:  $TEWI = (GWP \cdot L \cdot N) + (GWP \cdot m \cdot (1-a)) + (E \cdot \beta \cdot N)$

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Thank  
you



[www.embraco.com](http://www.embraco.com)

EMBRACO'S PROPRIETARY INFORMATION