



Business Case for  
Natural Refrigerants



# EMBRACO PLUG N' COOL

## A SUPERMARKET CASE STUDY

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### About Mig Supermarket:

A family owned supermarket chain with **7 stores** and 4 distribution centers

Located in the south of Brazil

More than 40 years of tradition

In a 1600 m<sup>2</sup> store, **Mig** decided to retrofit its refrigerated area with environmentally-friendly cabinets.



“When you install a green solution, it is less impactful on the environment. When a company has this consciousness, it reflects on to the consumers’ perception, which impact on business”



– **Josué Cesar Miguel, co-owner of Mig Group**

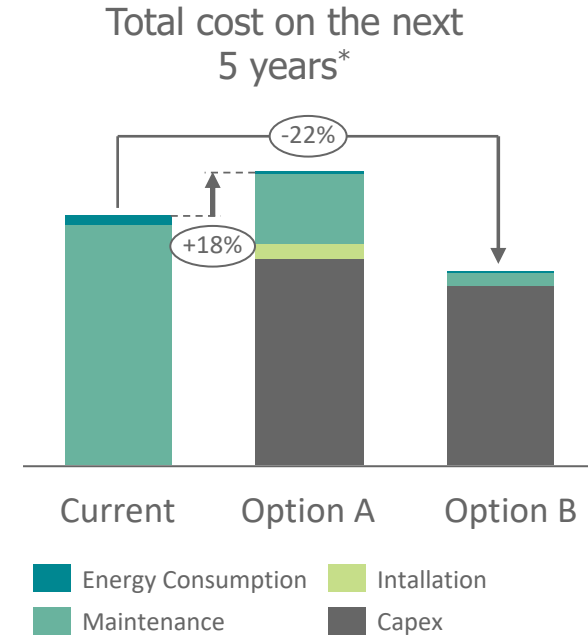
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# MIG Grocery Store Requirements

## Qualitative Analysis

<b>Needs</b>	<i>Solution Config.</i> <i>Refrigerant</i>	<b>Current</b> <b>Semi-herm.</b> <b>R22</b>	<b>Option A</b> <b>Semi-herm.</b> <b>CO2</b>	<b>Option B</b> <b>Plug n' Cool</b> <b>R290</b>
<b>Improve store's aesthetics</b> new stores = more sales		✗	✓	✓
<b>Be greener</b>		✗	✓	✓
<b>Increase merchandizing area</b> desirable		✗	✗	✓

## Financial Viability



\*

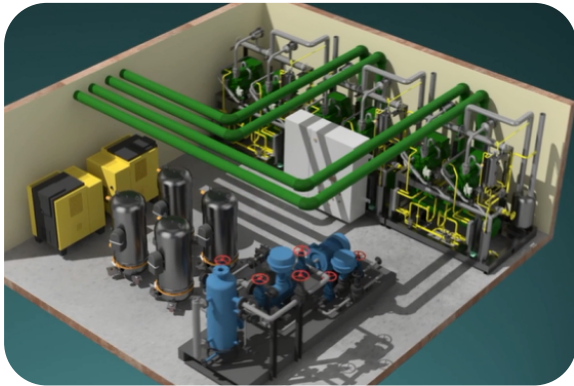
Embraco Plug n' Cool Air Cooled Was The Chosen Option

# EMBRACO PLUG N' COOL

## A SUPERMARKET CASE STUDY

How it was:

Reach-ins and islands **without doors**, with remote refrigeration



The solution:

Eletrofrio "Green Line" cabinets **with doors**, refrigerated by Embraco **Plug n' Cool**



# EMBRACO PLUG N' COOL

## A SUPERMARKET CASE STUDY



	REMOTE SYSTEM	PLUG N'COOL
Number of compressors	2	26
Refrigerant	R22	R290
Technology	Semi-hermetic	Hermetic reciprocating
Energy Consumption* <i>kWh/day</i>	425	270
Display Area <i>m<sup>2</sup></i>	58	73
Doors	No	Yes

\* Energy calculation considering only refrigeration system.

## Results

### Food Preservation



#### Improved food preservation

Due to the doors and the Plug n' Cool mechanism, an important improvement in food preservation was perceived by the end-user. Not only the products can last longer on the shelves, but also the supermarket can provide a better experience to their customers.



“We are now using this self-contained refrigeration system, and also doors. So, we perceived a significant increase in the quality of the cold inside the cabinet.

- Josué Miguel explains.

# Results

## Installation Process



Installation time  
up to **70% faster**



No need of **specialized labor**



## Results

### Maintenance costs



No gas Leak



No need of labor (specialized technicians)



No oil management



**Possible saving of  
¥200K / month**

## Results

# Total Cost of Ownership



¥ 2,5M possible **maintenance** savings in 1 year



**37%** less energy consumption



Payback in **4 years\***

35 %  
reduction of  
TCO\*

\*Considering only maintenance and energy consumption costs.

## Results

# Heat and Noise Perception

“We feared that migrating to a self-contained refrigeration solution would **increase the heat inside the store and increase the noise as well...**



...but thanks to the air flow and the position of the Plug n' Cool system on top of the equipment, **this didn't happen.**”

– Josué Miguel

## Results

### Peace of mind



“One of the most perceived benefits of Plug n’ Cool was the **maintenance and peace of mind**. Me and the store managers had to be always alert because something could happen to the refrigeration system anytime.”

- Josué says.



“The success of this project has now convinced us to use this **green technology** in the other stores.”

- Josué Miguel.



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# Results

## Environmental Impact



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

	REMOTE SYSTEM	CABINET WITH P&C
<b>GWP</b> - Global Warming Potential	1760	3
<b>L</b> - Leakage rate (kg/year)	80	0.08
<b>N</b> - Life time (years)	10	10
<b>M</b> - Refrigerant charge (kg)	400	3.3
<b>a</b> - Recycling factor (%)	0	0
<b>E</b> - Energy consumption (kWh/year)	155,287	98,392
<b>β</b> - Emission from energy gen. (kgCO2/kWh)	0.064	0.064
<b>TEWI (ton)</b>	<b>2211</b>	<b>63</b>



**~97%**  
of reduction on  
the environmental  
impact due to  
CO2 emissions

$$TEWI = GWP \cdot L \cdot n + GWP \cdot m \cdot (1-a) + n \cdot E \cdot \beta$$

# Plug & Cool in Japan

## Environmental Impact



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

	REMOTE SYSTEM	CABINET WITH P&C
<b>GWP</b> - Global Warming Potential	<b>1760</b>	<b>3</b>
<b>L</b> - Leakage rate (kg/year)	<b>80</b>	<b>0.08</b>
<b>N</b> - Life time (years)	<b>10</b>	<b>10</b>
<b>M</b> - Refrigerant charge (kg)	<b>400</b>	<b>3.3</b>
<b>a</b> - Recycling factor (%)*	<b>0,95</b>	<b>0</b>
<b>E</b> - Energy consumption (kWh/year)	<b>155,287</b>	<b>98,392</b>
<b>β</b> - Emission from energy gen. (kgCO2/kWh)	<b>0.415</b>	<b>0.415</b>
<b>TEWI (ton)</b>	<b>2088</b>	<b>406</b>



**~80%**  
of reduction on  
the environmental  
impact due to  
CO2 emissions

$$TEWI = GWP \cdot L \cdot n + GWP \cdot m \cdot (1 - a) + n \cdot E \cdot \beta$$

\*Considering recycling factor of developed countries.

# Plug & Cool in Japan

## Safety Concerns



- Plug & Cool uses a very low propane charge for each circuit (below 150g), millions of similar systems installed worldwide have shown an excellent safety record since 20 years
- Commercial refrigeration systems with hydrocarbons have to follow safety rules as described in IEC60335-2-89
- Japan is part of an international effort (with IEC61C/WG4), to raise single sealed system charge limits while keeping the same safety level of 150g systems
- Local legislation update and service technician trainings to deal with flammable refrigerants should be a priority for Japanese stakeholders to address climate change issues



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Thank  
you



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