



Business Case for  
Natural Refrigerants



**27/06/2022 - TOKYO**  
**28/06/2022 - ONLINE**



## **Nidec Global Appliance Cooling Solution for Vending Machine in R290 Variable speed**

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**#GoNatRefs**

**We are Nidec Global Appliance,** a global partner for home and commercial appliances industries



**HQs:** Joinville (Brazil) and Pordenone (Italy).



**12,000+** employees.



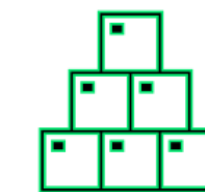
**80+ countries** served by our products.



**12** manufacturing plants and 4 business offices across 9 countries.



**7 R&D Centers** worldwide and **500+ engineers.**



Annual production capacity of **80 million** motors and compressors.

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**Scenario**

New Legislation on Commercial Systems: requires sustainable solutions with high energy efficiency

**Market Needs**

Highly efficient natural refrigerant solutions that achieve new regulations and sustainability goals

**Proposed  
Solution**



Current Portfolio  
Fixed Speed Solution



New Portfolio  
Variable Speed Solution

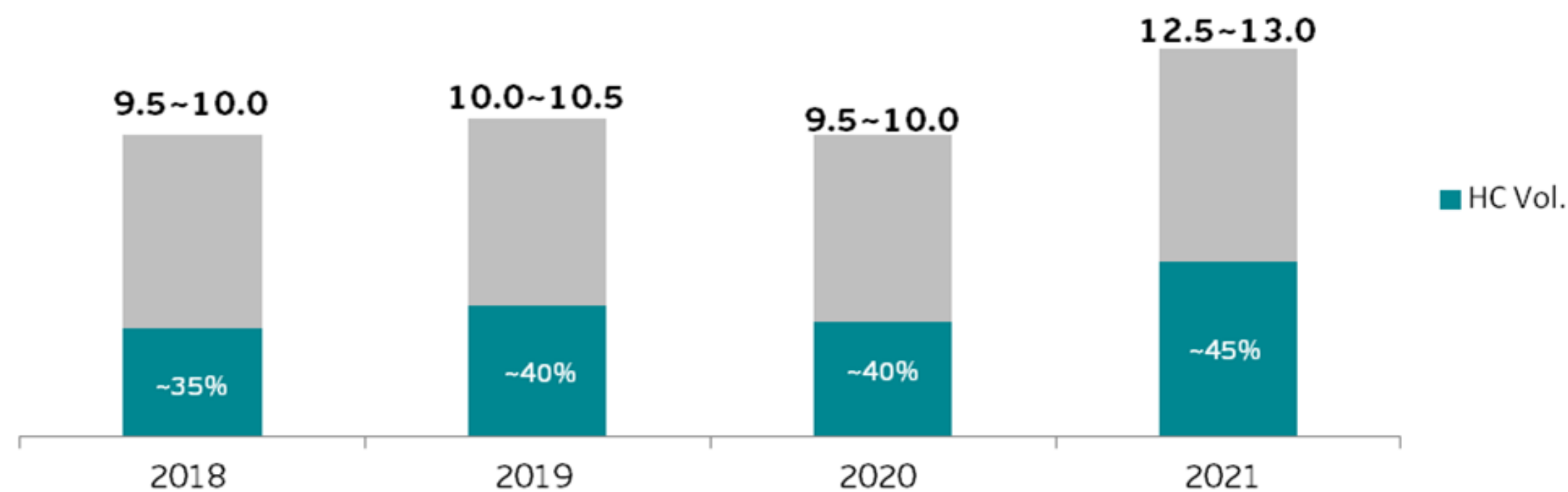
**embraco**  
*Nidec*



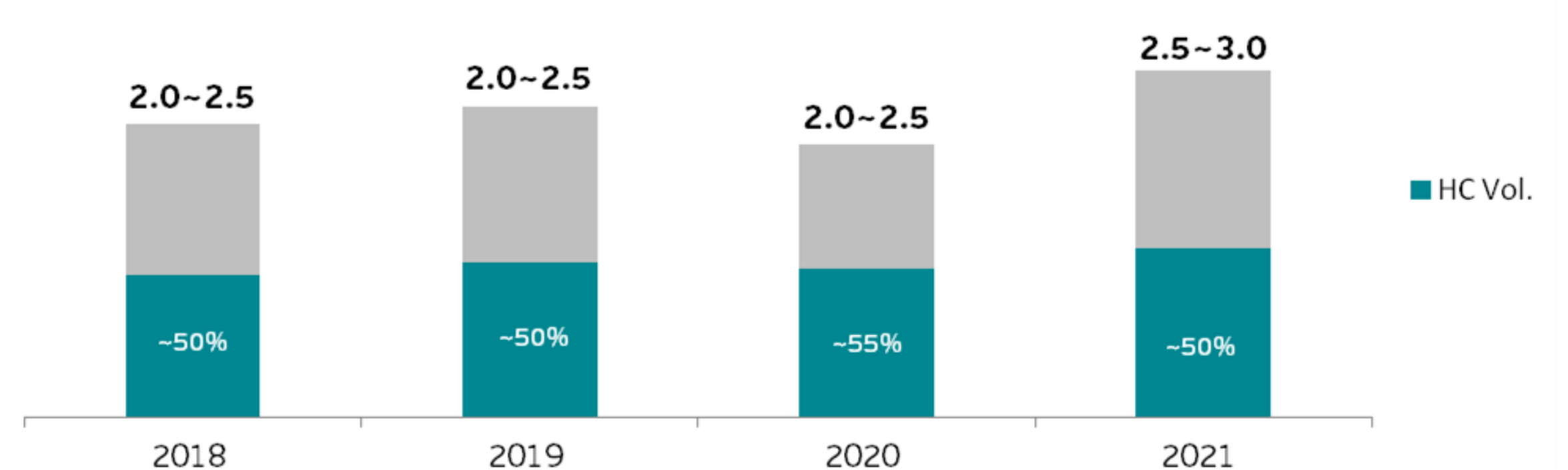
**LOW GWP  
SOLUTIONS**



Volume Global CO/AM [M Unit]



Volume APAC CO/AM [M Unit]



Overall market recovering from recent global crisis and supply disrapture (>20% growth) with HCs showing a faster reaction (>50%).

APAC was a main market under external crisis, but showing strong recovery in 2021. HCs already representing a strong portion of the commercial business.

## Market Context

- Expanding quantity of Vending Machine applications in the market
- High life cycle cost (high energy bills) requiring solution to lower it
- Significant global warming and environmental impact caused by cold chain

## Project Targets

- Convert to variable speed R290 system to meet requirements of international market
- System optimization for lower energy consumption without sacrificing cooling performance
- Reduce operating cost for the applications to enable more applications in the field

## Current System information

### Application

510L Vending machine, for Beverages & snacks

### Target market

China and export SEA.



Fixed Speed Solution  
Model: FFI12HBK  
Refrigerant: R134a

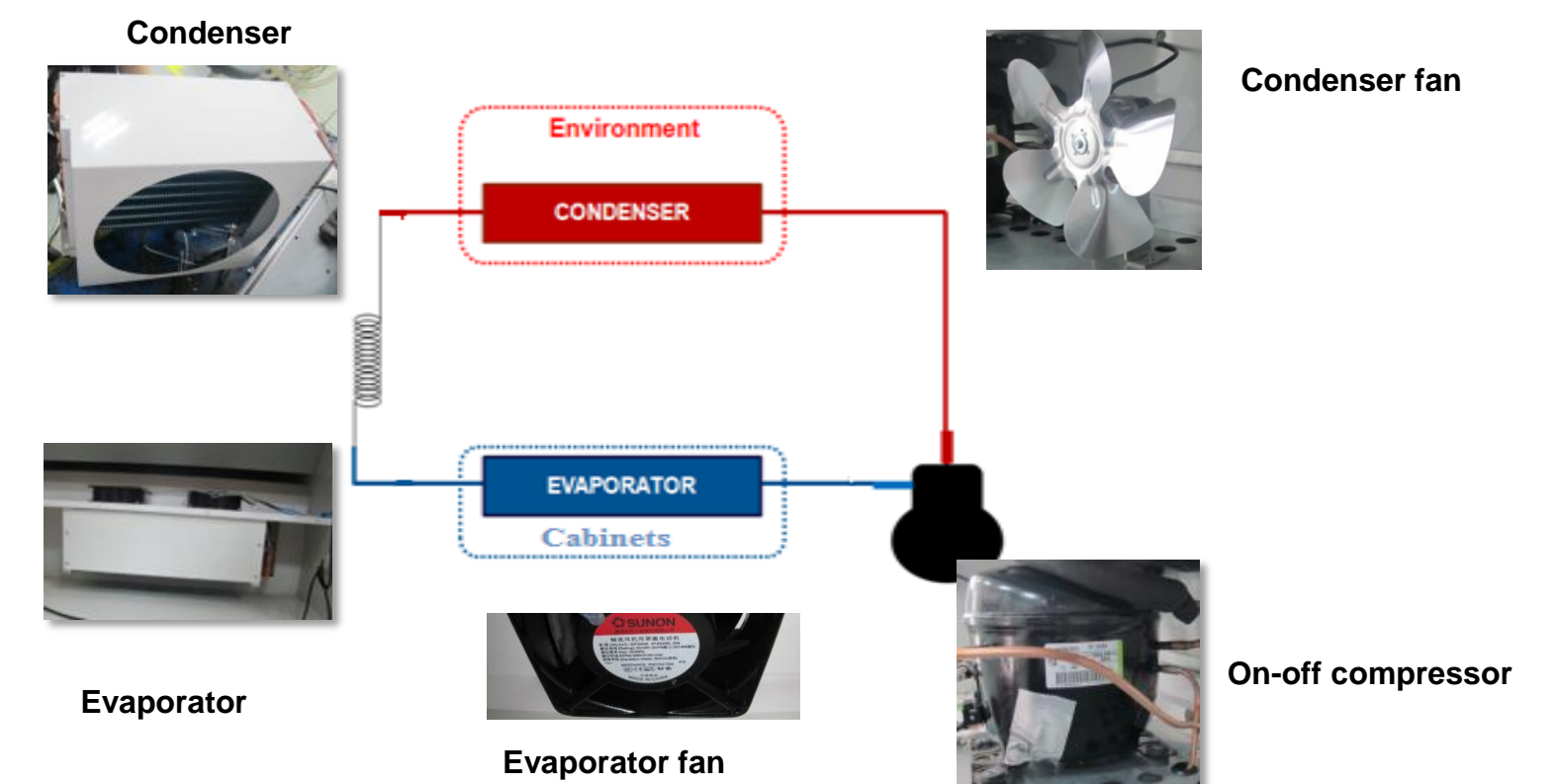
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## Refrigeration system containing

Item	Qty	Type
Fan motor	2	Condenser / Evaporator
Heat Exch.	2	Finned tube (Condenser / Evaporator)
Lighting	1	LED
Door heater	1	Resistance
Controller	1	
Display screen	1	

- 220V / 50Hz circuit
- Expansion via capillary tube

## System flow



Proposal

Evaluate alternative solutions to **reduce the energy consumption** for the vending machine and apply HC solution to **comply with regional requirements**.

Possible solutions:

**1** Trial a Variable speed R290 compressor (Inverter tech.)

**2** Re-design system adopting more efficient parts  
(ex: convert AC motors to DC, reduce heating cycle)



Current Portfolio  
Fixed Speed Solution



New Portfolio  
Variable Speed  
Solution



Previous



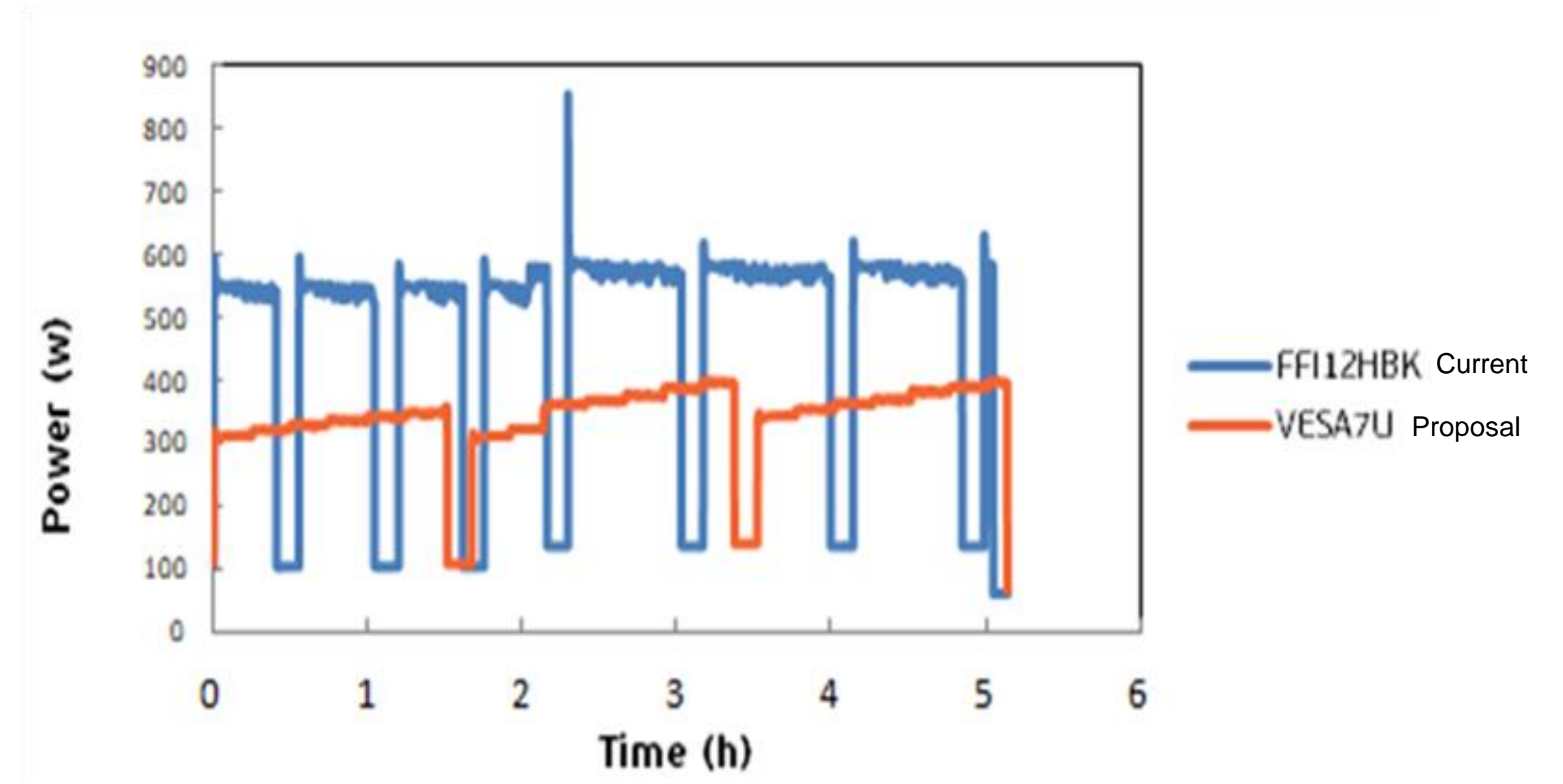
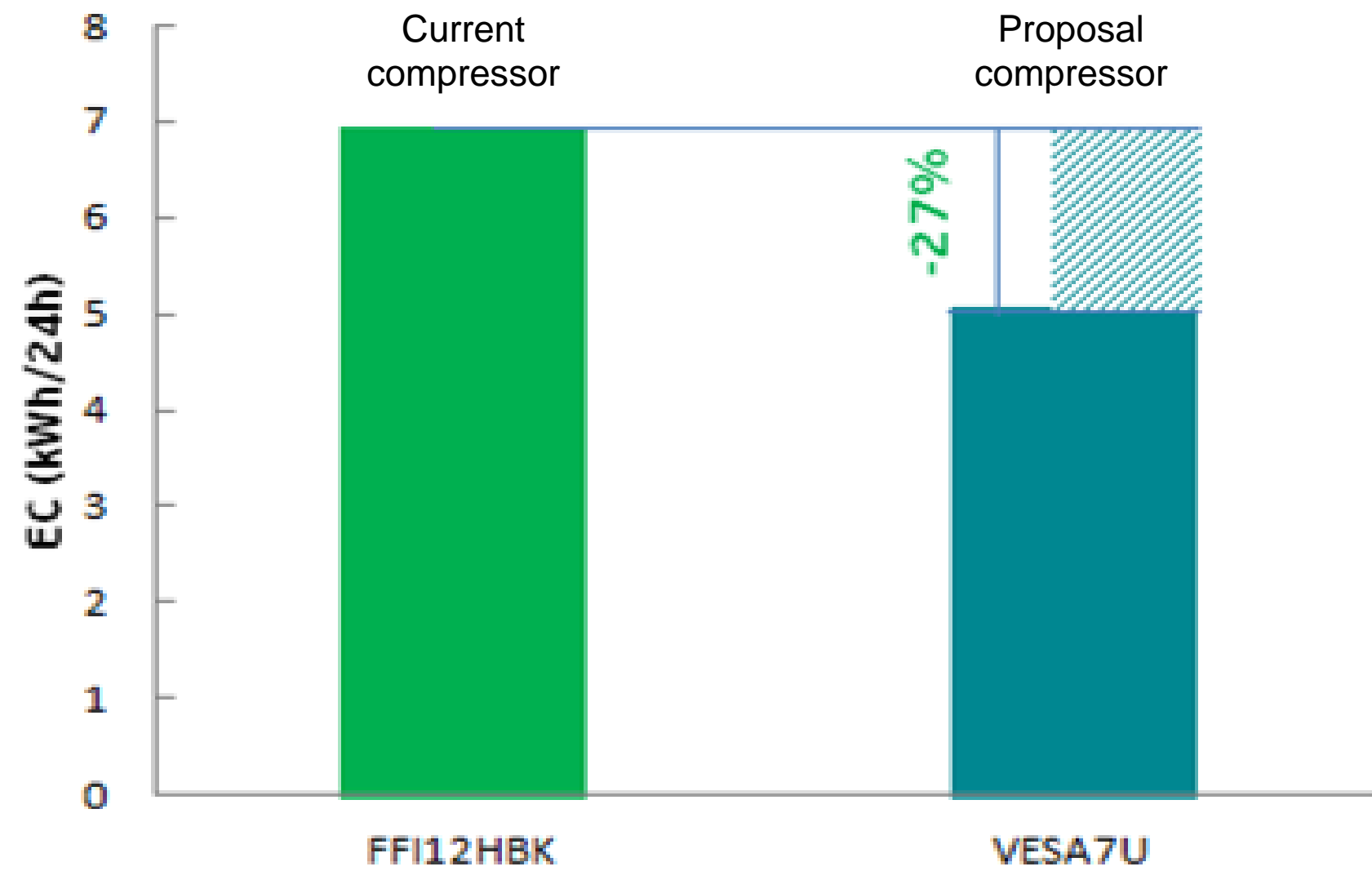
New

Evaluate benefits of different solutions to select the best one.

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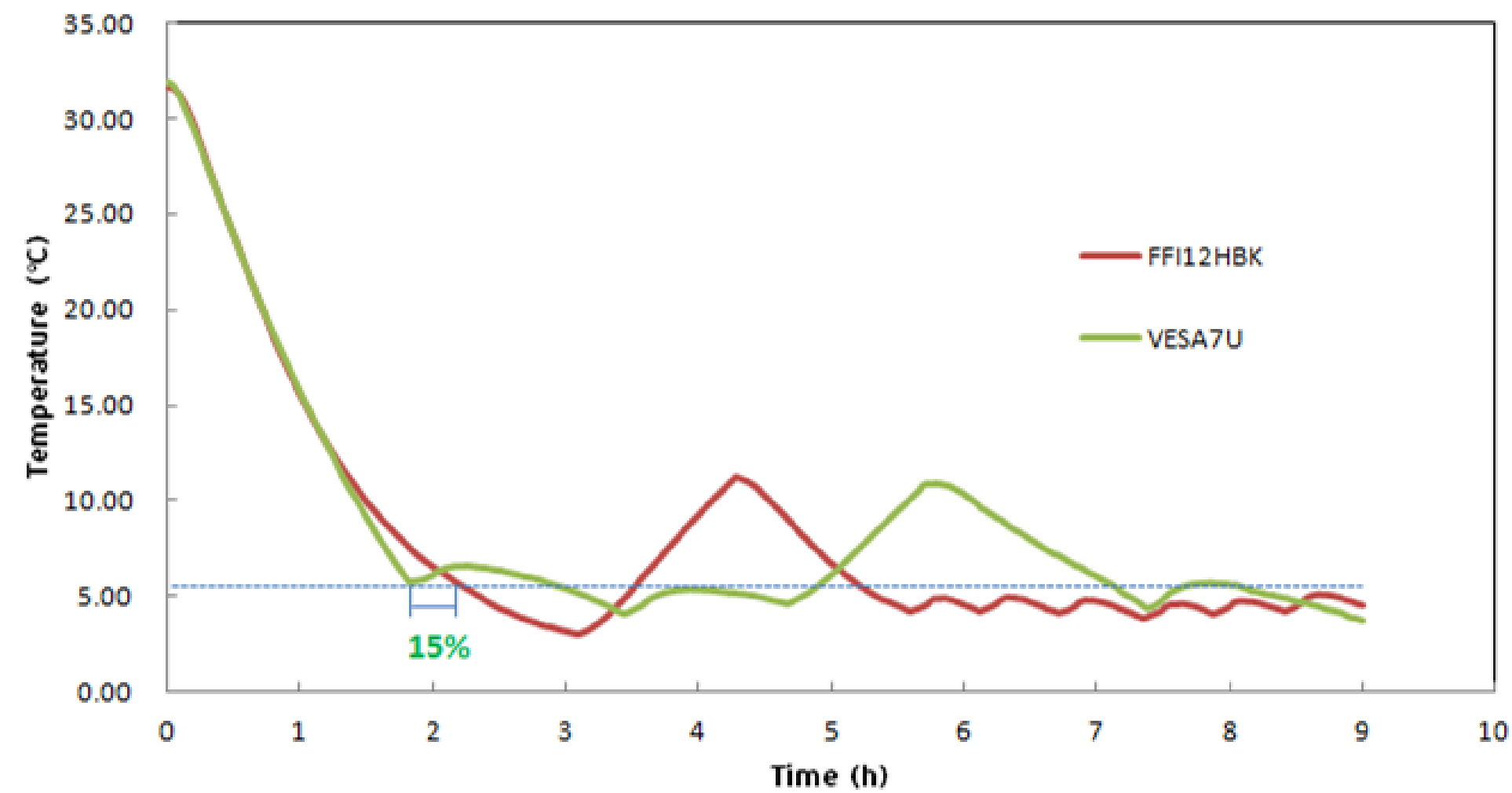


## Energy Consumption test (32°C)



Compressor Model	Refrigerant (g)	Ambient Temp. (°C)	Energy Consump. (kwh/day)	Improvem.
FFI12HBK	R134a	32(65%)	6.934	Baseline
VESA7U	R290/125g	32(65%)	<b>5.067</b>	<b>-27%</b>

## Pull Down test (32°C)

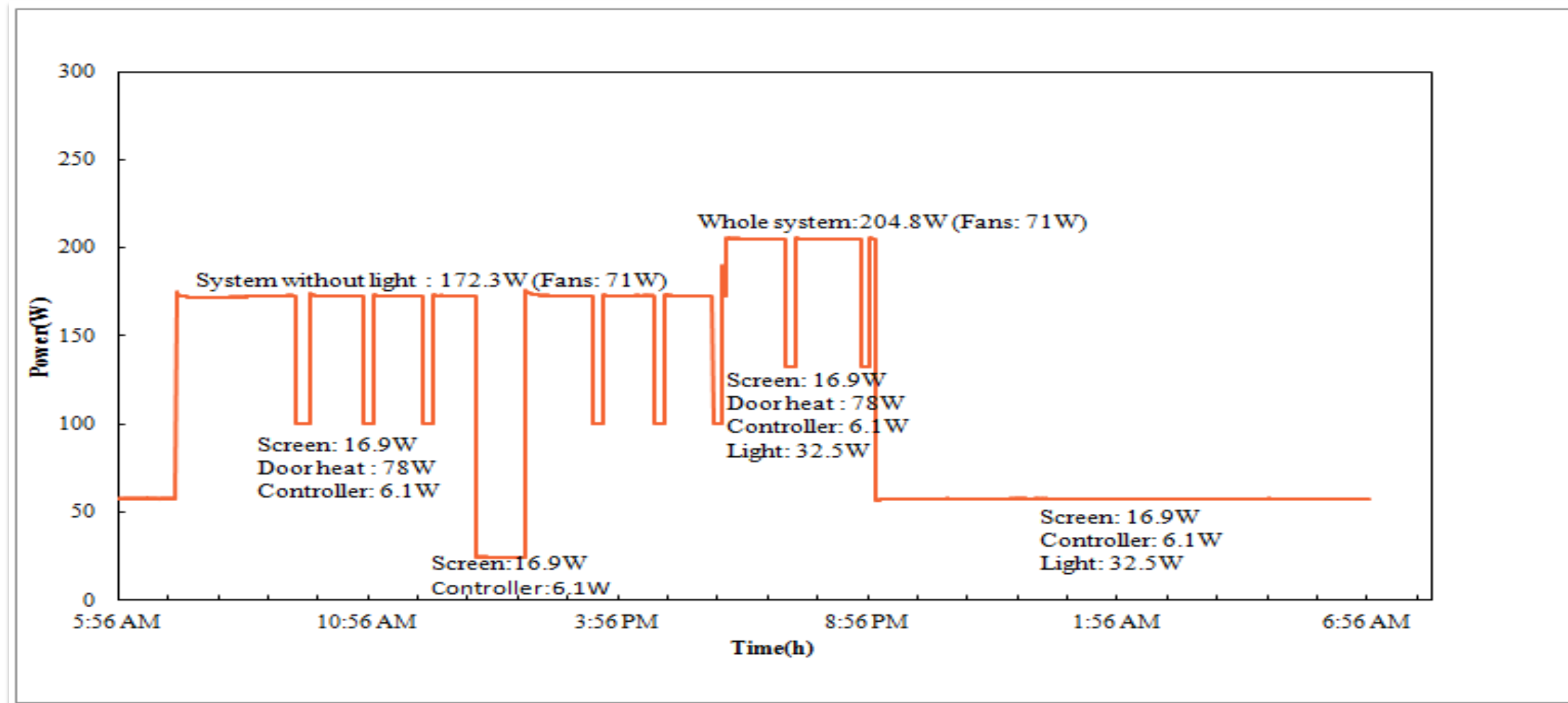


Compressor Model	Refrigerant (g)	Ambient Temp. (°C)	Power (W)	Cabinet Avg temp (°C)	Time to reach Cabinet temp 6 °C (min)
(OLD) FFI12HBK	R134a	32(65%)	478.5	5.0	130
(NEW) VESA7U	R290/125g	32(65%)	327.4	5.8	110

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VESA7U compressor has a **higher cooling rate** than FFI12HBK, **15% faster** to reach <6 °C cabinet internal temperature.

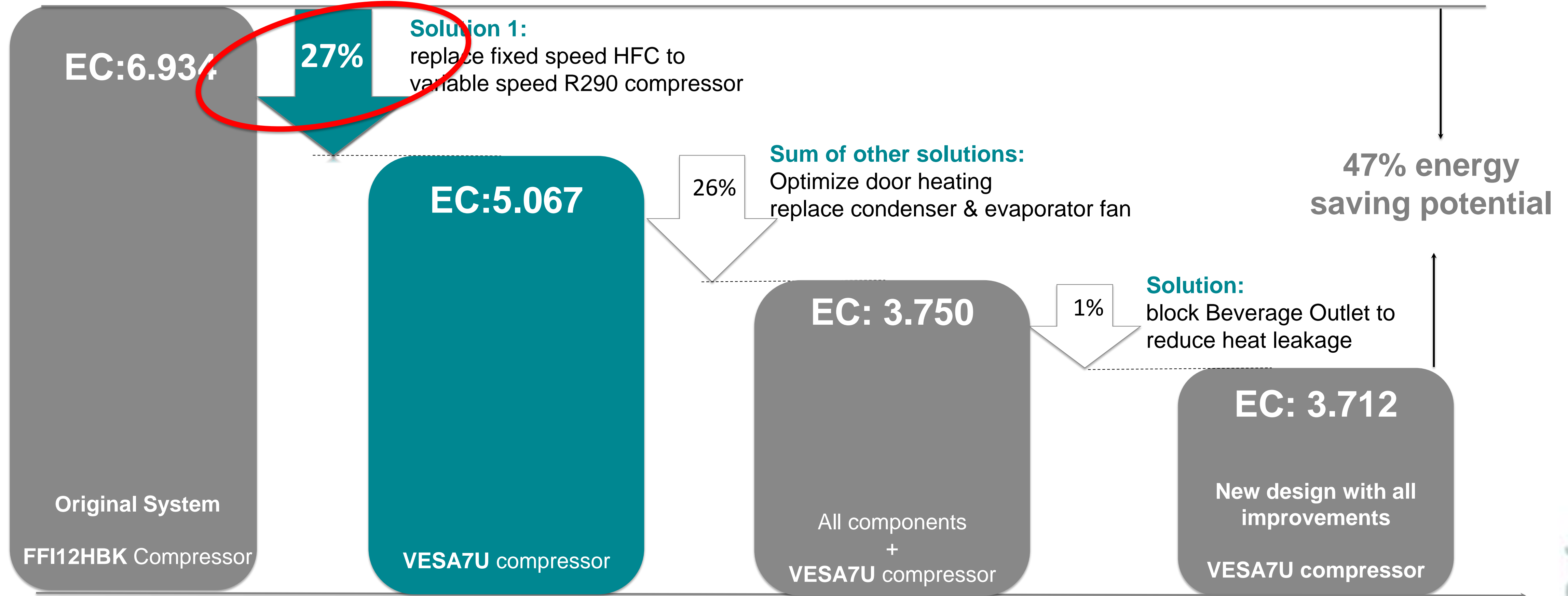
## Power consumption distribution of electrical devices



- Already applying LED light, so no significant improvement potential.
- Door heater, Evaporator and Condenser fan account for majority of the power consumption in the refrigeration circuit after the compressor.

### Alternative opportunities:

1. Replace AC fans (Condenser and Evaporator) for DC fans
2. Reduce run time of door heater to optimize cabinets power consumption



- Compressor still accounting for the main opportunity for energy consumption reduction, covering several changes in different subsystems.
- With combined actions, potential to reach almost half of the energy consumption!

Significant savings considering only compressor technology change

**Less than 1 year of payback by adopting Embaco  
Variable speed solution based on energy savings**



After implement the  
improvements

**\$ 74\***

saving per unit/year

After implement the  
improvements

**24%**

TEWI Reduction per unit/year

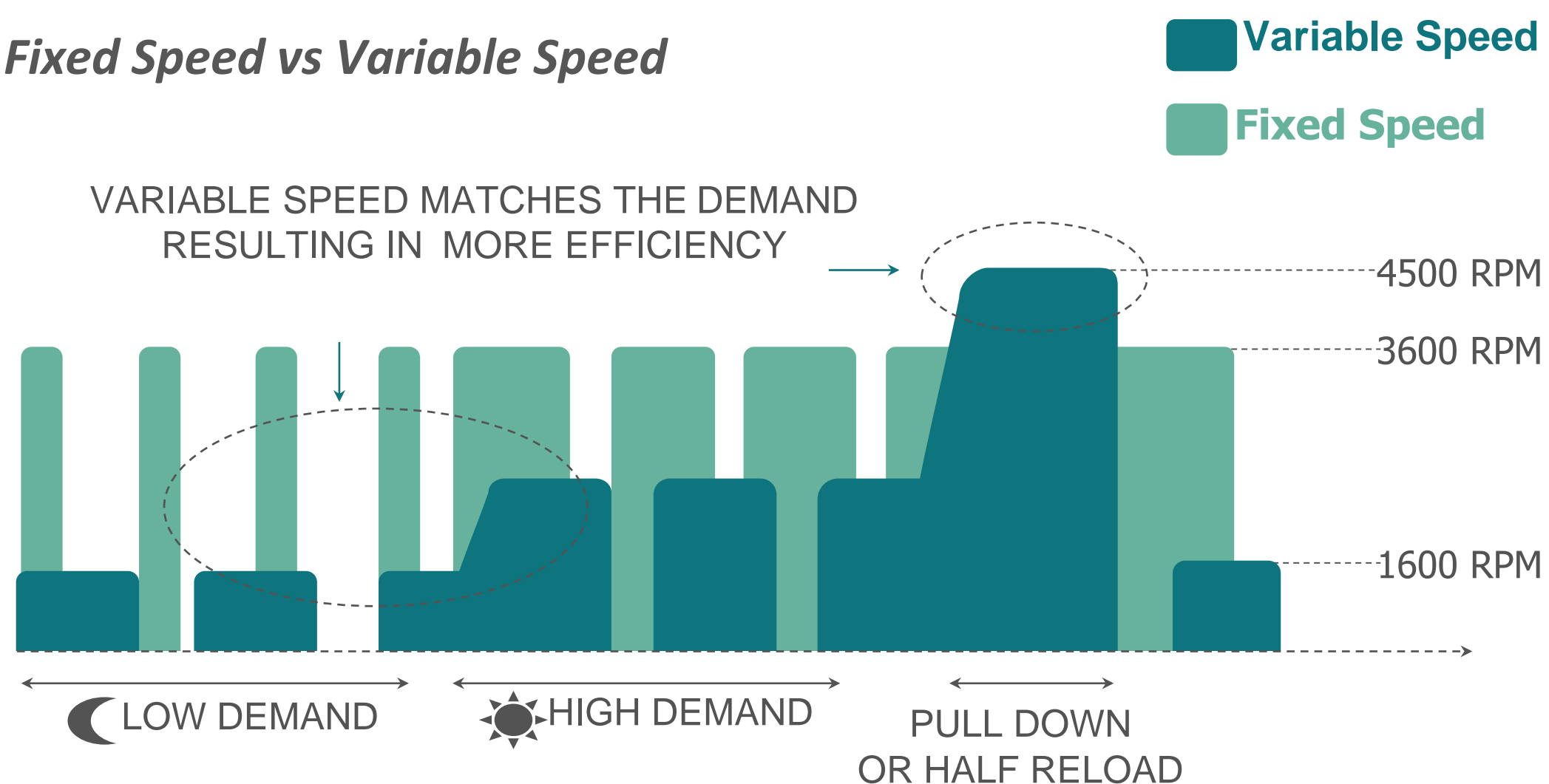
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\*Thailand, September 2021: The price of electricity is 0.109 USD/kWh for businesses which includes all components of the electricity bill such as the cost of power, distribution and taxes.

## Benefits

The variable speed technology adjusts to the demand required by the refrigerator, resulting in considerable energy consumption reduction compared to single speed compressors

*Fixed Speed vs Variable Speed*



Energy Efficiency



Low noise & vibration



Wide Voltage range



Food Freshness



Temperature Stability

# Benefits Of VCC & Natural Refrigerants In Vending Machine applications

The right tool to leverage migration from fixed to variable speed technology



## EMBRACO Smart Drop-In

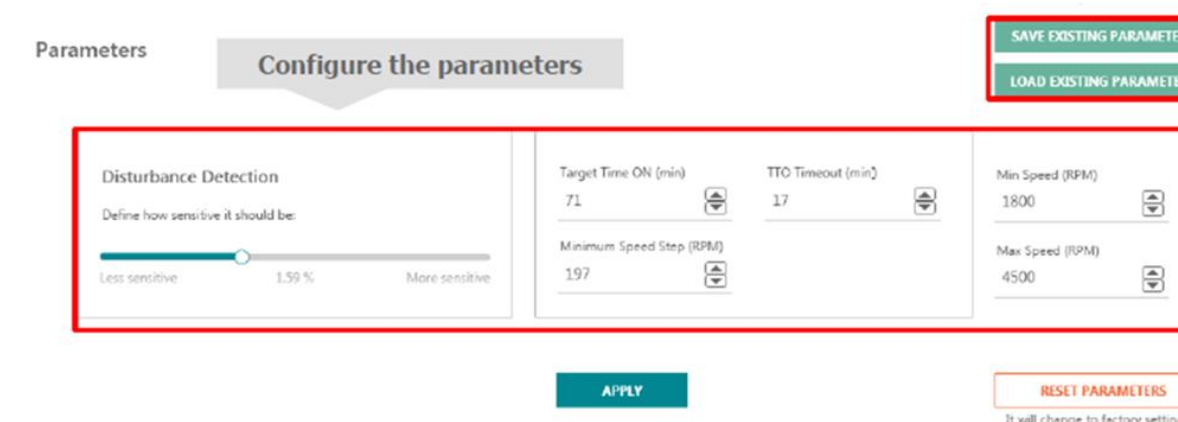
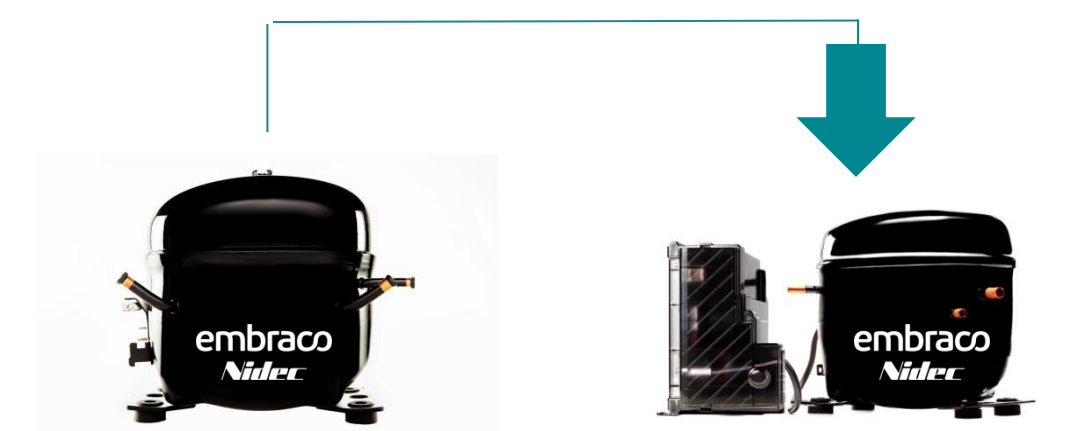
Smart Drop-in is an advanced inverter control logic which allows:

- Customization of the control routine according to the cabinet
- Specific parameters according to your needs
- Optimization of performance and energy saving
- Use of standard ON/OFF thermostats

Update your compressor

Use the standard Fixed Speed thermostats

Adjust the parameters according to your needs



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**THANK YOU  
FOR LISTENING!**