



ATMO
sphere

Business Case for
Natural Refrigerants

Continental[®]
Refrigerator

embraco

Continental®
Refrigerator

embraco



CONTINENTAL CABINET & EMBRACO EMC COMPRESSOR



REACH UNPRECEDENTED
LEVELS OF ENERGY EFFICIENCY

Overview

Embraco

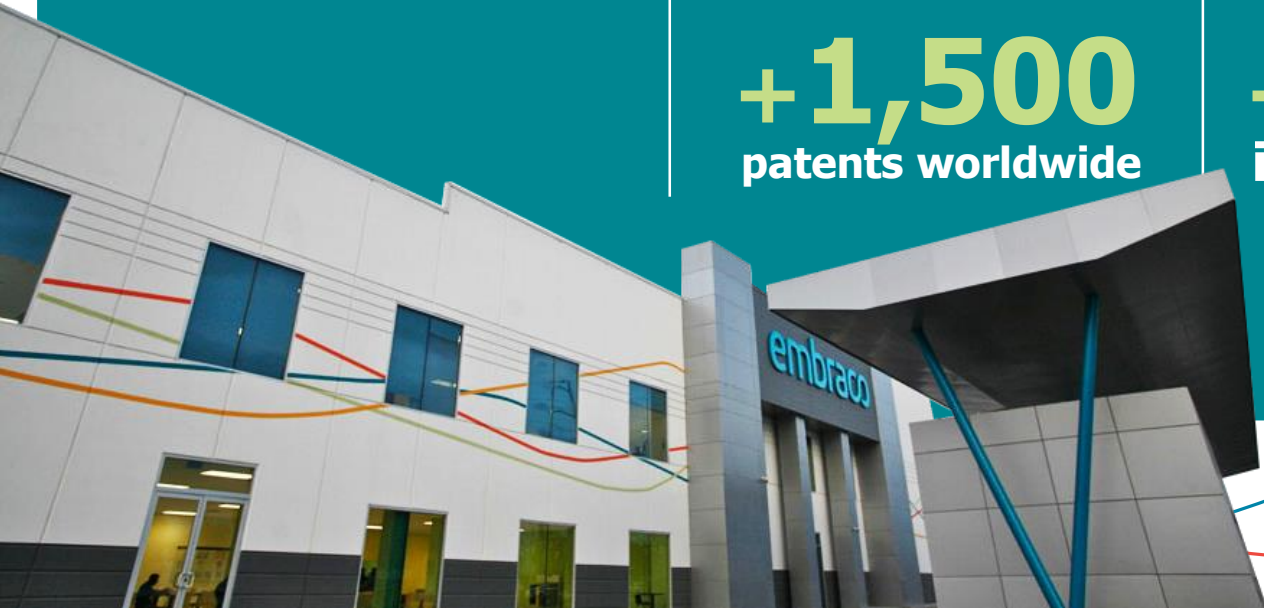
+11,000
employees

Plants/sales
offices in
countries **7**

Production capacity of
40 million
compressors per year

+1,500
patents worldwide

+500 professionals
in R&D in 4 continents



Overview

Continental Refrigerator

Privately
held company

2 facilities

On hand inventory

+250
employees

Nationwide warehouses

Non-proprietary parts

Provider solutions





CHALLENGES FOR OEMS

Commercial Refrigerator & Freezers



CHALLENGES FOR OEMS

Commercial Refrigerator & Freezers

1

DOE 2017

Strict Energy Standards in place this year

2

NSF

Food Safety Requirements must still be met

3

HFC Phase Outs

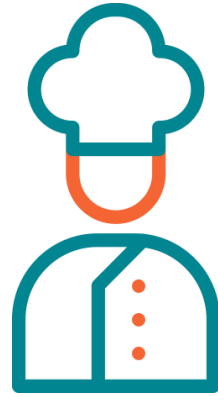
Ban on R-404A and R-134a in 2018-2020

4

Energy Star 4.0

Voluntary Energy Standard in place this year





CHALLENGES FOR END USERS

Professional Kitchen Cabinet



CHALLENGES FOR END USERS

Professional Kitchen Cabinet

- 1 High energy bills
- 2 Maintain product temperature
- 3 Complexity in serviceability
- 4 Operation in high ambient temperature





CONTINENTAL REFRIGERATOR'S CHALLENGES

Case study



CONTINENTAL REFRIGERATOR'S CHALLENGES

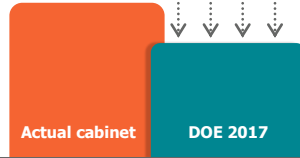
Case Study

1

Meet DOE 2017

*Stop sale on current product
March 27th deadline*

ENERGY CONSUMPTION LEVEL



2

Find a long term solution

Do a single step to handle HFC phase outs

3

Maintain robustness and meet NSF requirements

Food Safety Requirements must still be met

4

Limited Resources to meet DOE 2017 & EPA

CABINET TYPE
7 cu.ft. Worktop Freezer

REPLACEMENT COMPRESSOR
FFU130HAX

REFRIGERANT
R-134a





CONTINENTAL



EMBRACO



3rd PARTY LAB

WHAT CHANGES DID WE MAKE TO MEET DOE?

1

New compressor

2

New refrigerant

3

Changes to expansion device



FFU130HAX

EMC3130U

Capacity
Btu/h

1250



1475

Efficiency
Btu/Wh

4.80



5.81

Displacement
cc

10.61



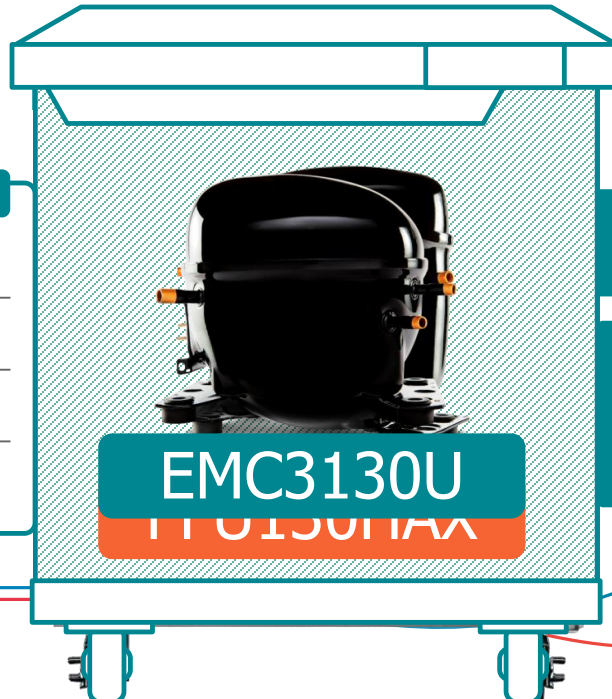
6.92

Weight
lb

25



17



EMC3130U

FFU130HAX

R134a >>> R290



No changes in
any other component
in the cabinet



Case Study Results



FFU130HAX R-134a

Refrigerant	R-134a
Charge	370g
Energy consumption <i>kW/24hrs</i>	3.2
× DOE Allowance <i>2.79 kW/24hrs</i>	115%
× E-Star Allowance <i>2.25 kW/24hrs</i>	142%



EMC3130U R-290

Refrigerant	R-290
Charge	90g
Energy consumption <i>kW/24hrs</i>	2.19
DOE Allowance <i>2.79 kW/24hrs</i>	78%
E-Star Allowance <i>2.25 kW/24hrs</i>	97%





Case Study Results



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



	BASELINE	CABINET WITH EMC
GWP - Global Warming Potential	1430	3
L - Leakage rate (kg/year)	0.007	0.007
N - Life time (years)	8	8
M - Refrigerant charge (kg)	0.81 lbs	0.33 lbs
a - Recycling factor (%)	0.95	0
E - Energy consumption (kWh/year)	3.20 kWh	2.19 kWh
β - Emission from energy gen. (kgCO2/kWh)	1.50	1.50
TEWI	182	27

85%
of reduction on
the environmental
impact due to
CO2 emissions

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

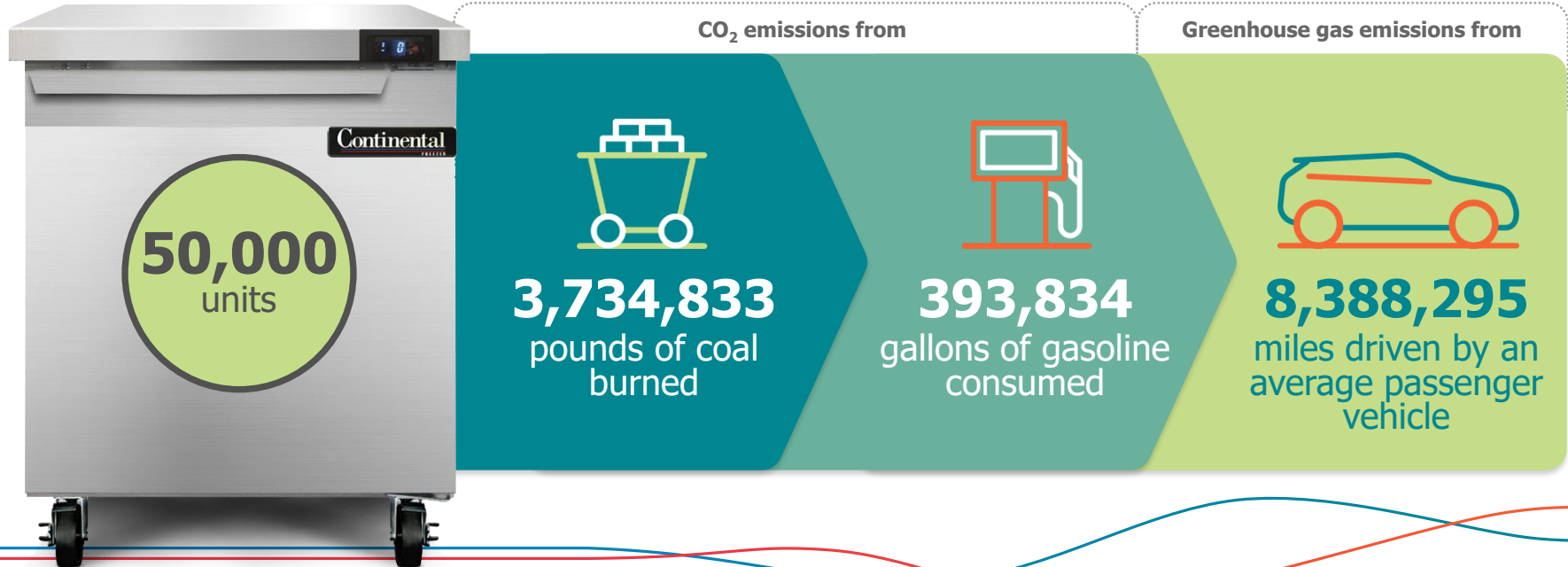


Case Study

Results | Considering direct and indirect emissions



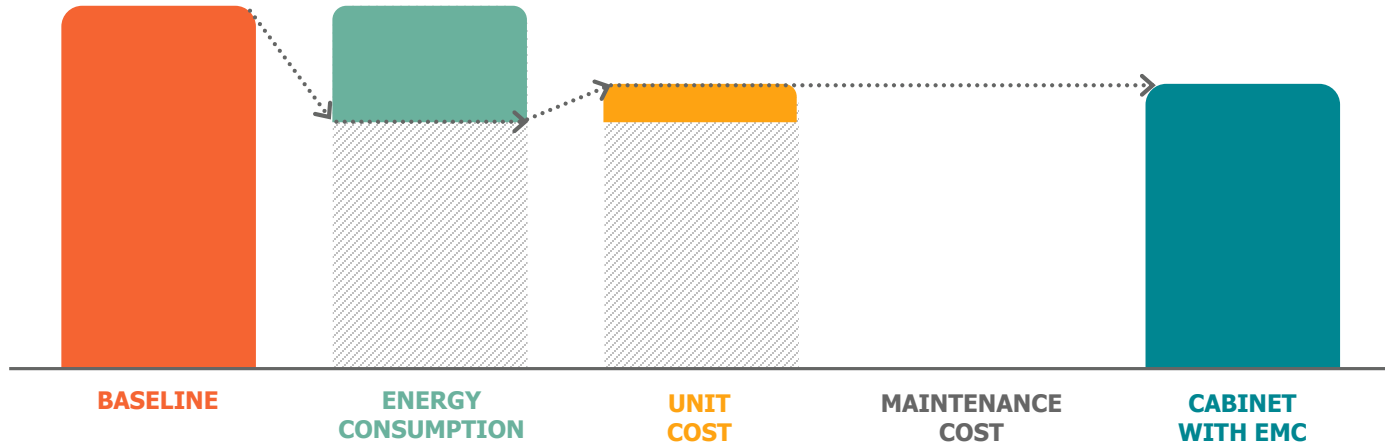
The savings in carbon emissions generated by the new equipment with EMC are equivalent to:





Case Study

TCO Breakdown



Thank you

Questions

