

CO₂ Coolers development achievements

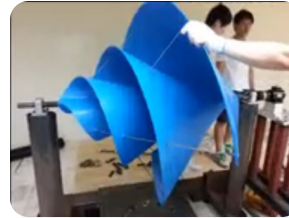
Light Commercial Panel

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#1

We live in a world of perceptions

Low efficiency



Wind turbines for low wind speeds defy Betz limit efficiency

Noisy



Acceleration (0–100 km/h): 20.44 sone

High cost



**One Michelin star...
At a budget price**

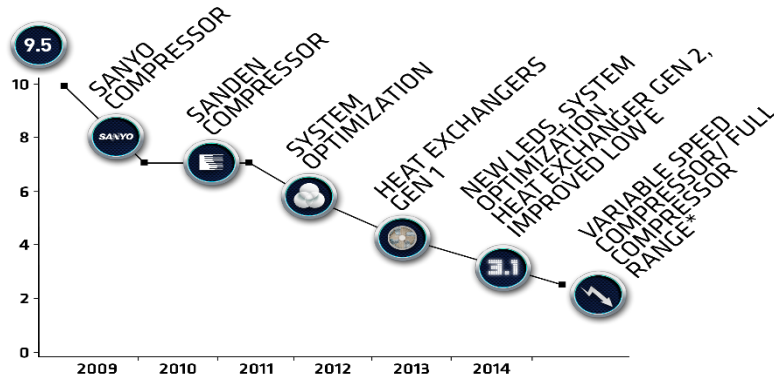
Hard maintenance



!!!!!!!!!!!!

#2 It's been a long journey, but we made it!

REDUCTION IN ENERGY CONSUMPTION



By 2014, we have been able to reduce energy consumption by 67%.

*2009 BASE YEAR

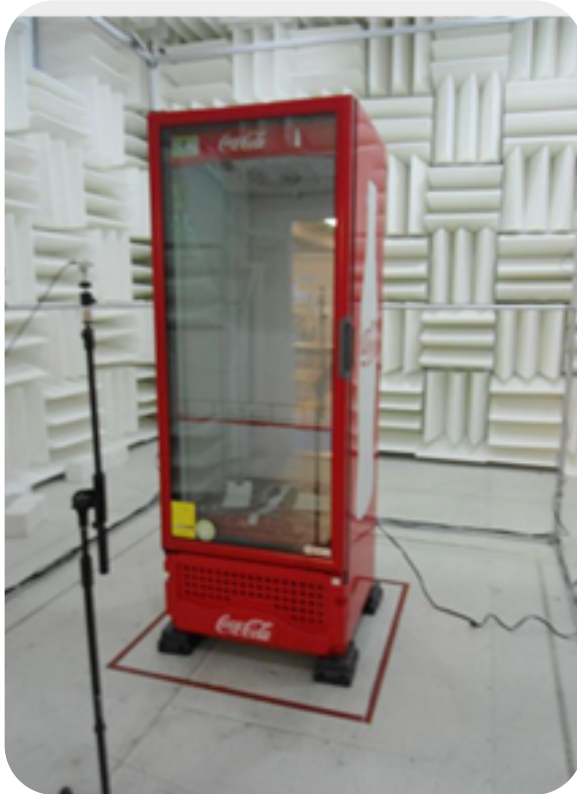
**BASE ON G3-19 C CONDITION.

Energy Star 3.0 (mandatory from October 2014) for CCNA Authorized CO₂ models

CO ₂ Model	ASHRAE Energy Usage Co ₂ (kWh/24h)	EnergyStar 3.0 Compliant Limit (kWh/24h)	Meets Requirements
VR10	1.740	1.970	Yes
VR12	1.980	2.230	Yes
G319	3.020	3.200	Yes
VRD37	5.190	5.270	Yes
VRD37	5.160	5.360	Yes

#3 Is it on?

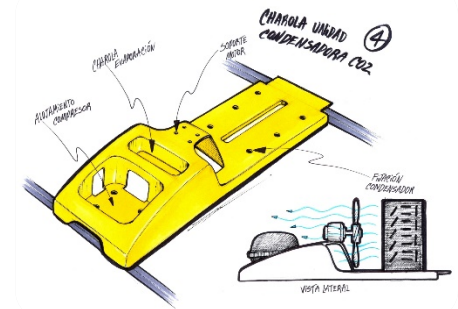
With 10 times the pressure, vibration becomes an issue



COMPARATIVE, NOISE LEVEL EVOLUTION

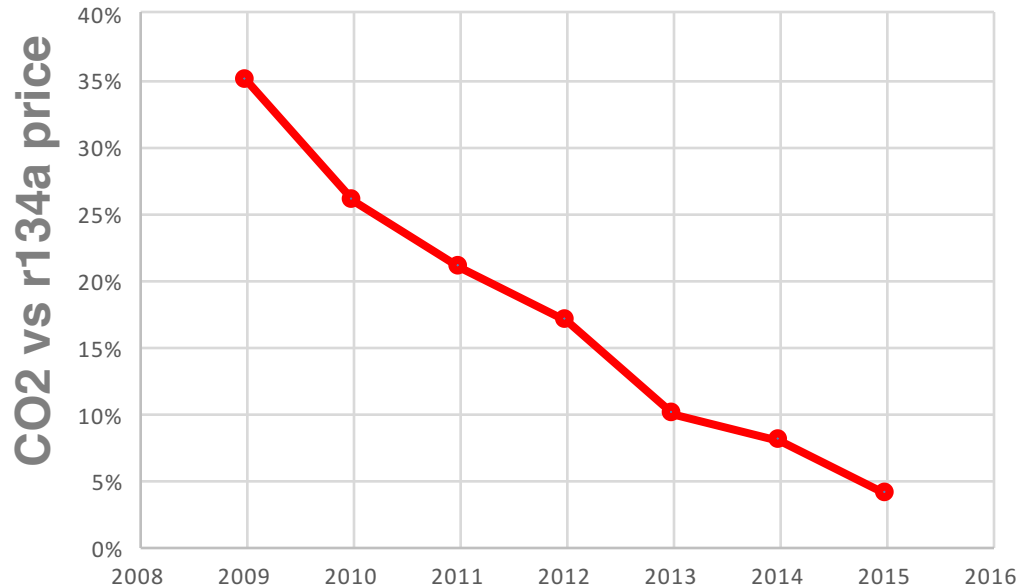
	Generation I CO2 Sanden compressors				Generation II CO2 Sanden compressors	
	1st version (dBa)	Test Report	2nd Version (dBa)	Test Report	Actual Version (dBa)	Test Report
G319 CO2 UL	64.8	EC-13-737	60.5	EC-14-001	58.0	EC-14-542
VR12 CO2 UL	63.7	EC-12-400	61.7	EC-14-306	58.5	EC-13-544
VR10 CO2 4L UL	63.8	EC-14-541	59.6	EC-14-634	N.A.	

We've come a long way..
 But there's room for improvement



#4 Not much different

As we've optimized the system and learned from it, we closed the gap vs r134a



#5 Biggest hurdles

- **Coca-Cola is still alone spearheading the CO2 effort**
- **There's not as much variety in components compared to other technologies [DOE 2017]**
- **A lot of the first impressions still reign on customers minds**

#6 The good news

- After we crossed the 100,000 units in the field we have a very good knowledge of the technology
- Our entire Coca-Cola lineup will be ready for the 2016 full CO2 initiative



ATMO
sphere
business case
natural refrigerants
25 & 26 June - Atlanta, Georgia

Thank you

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