
EUROPE
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19 & 20 April, 2016 – Barcelona

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"Low energy consumption in a R290 Bottle cooler with variable speed compressor"

Vicente Guilabert
HUAYI COMPRESSOR BARCELONA, S.L

The Company

Huayi Compressor Barcelona, S.L.

The Product

Hermetic Compressors and Condensing units for Light Commercial Refrigeration

- For all types of applications
- High Efficiency Compressors
- Variable Speed Compressors
- DC Compressors
- Green Cooling Ranges

The advanced design of the Green Cooling Ranges allows:

- Efficiency improvement (up to 50% compared to standard versions).
- Lower CO2 emissions to the atmosphere.
- Use of natural refrigerants as R290 with no direct effect on global warming.
- Additional COP improvement because of moving from HFCs to HCs.

Efficiency improvement
up to
50%

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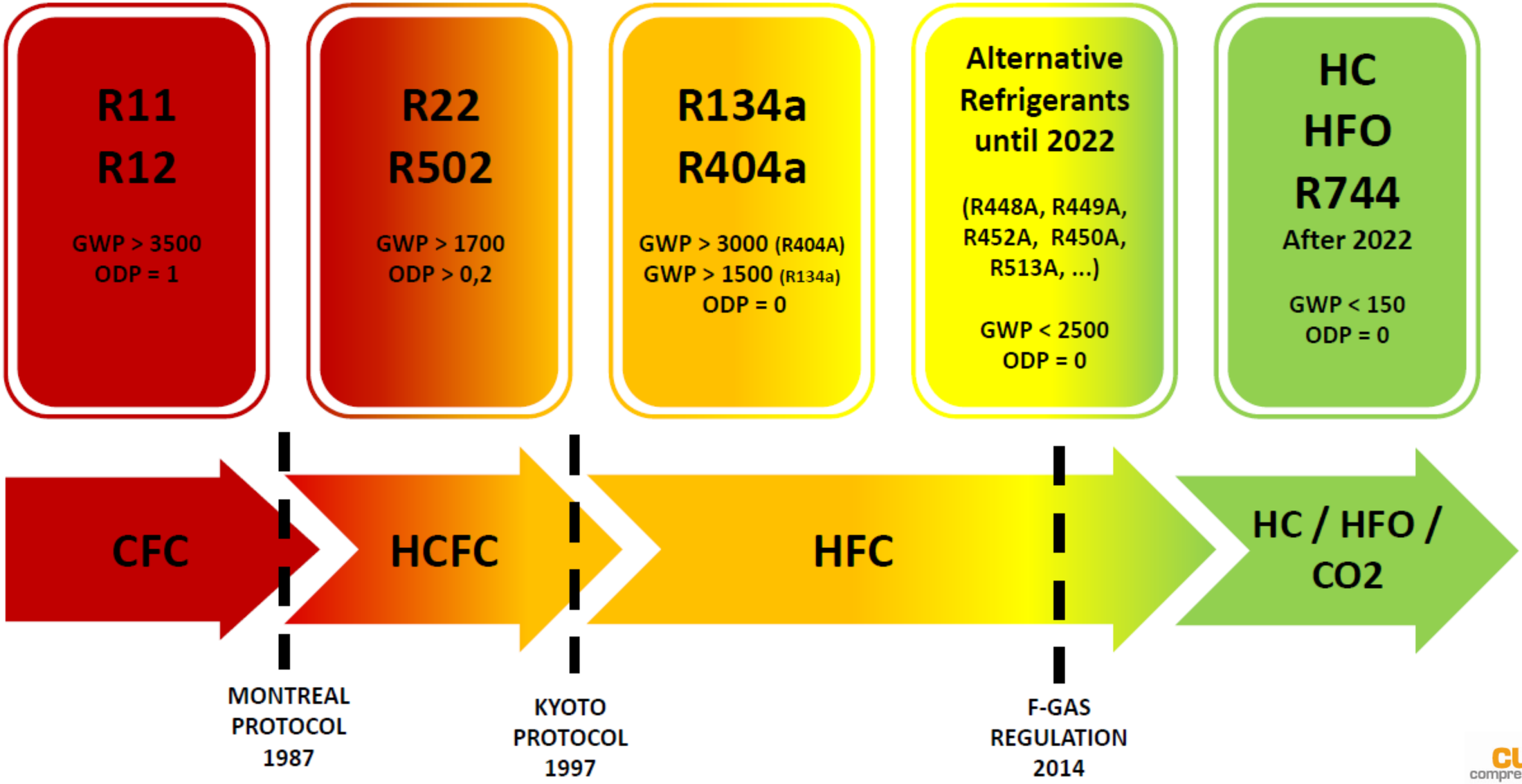
Refrigerant trends

Refrigerant trend



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Case of Study

Huayi Compressor Barcelona, S.L.

Objective of the Study

The objective of the study is to reduce the energy consumption on a bottle cooler conservator using an R290 HMBP variable speed compressor solution.

Natural Refrigerants

Low energy consumption

Methodology

- *The Compressor: NLT60FSN*
- *The appliance*
- *Test results*
- *Main advantages*
- *Conclusions*

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Case of Study

The compressor: NLT60FSN

Variable speed compressor NLT60FSN

Variable Speed Compressors are the solution for obtaining the maximum energy reduction, basically because full compressor capacity is not always needed, so this technology dynamically adapts the compressor's cooling capacity to the appliance's needs by adopting electronically-controlled running speed, optimizing the system's performance.

Model	Displacement (cm3)	Capacity (kcal/h)	COP (W/W)	Motor
NL60TB	5,68	620	2,40	CSIR
NLY60RAa	5,98	720	2,58	CSIR
NLY60RAb	5,98	720	2,79	CSR
NLT60FSN (*)	5,98	723	3,06	EMC

(*) At 2800 rpm

ASHRAE46 conditions

Benefits obtained by using Variable Speed Compressors:

- ❑ Compressor power consumption reduction up to 45% and 50% in comparison to standard compressors.
- ❑ Modifies the speed until the achieving the longest duty cycle possible. Reduces the pull-down time by means of running at a higher speed when it is needed.
- ❑ Reduces the number of start-ups/stops of the compressor.
- ❑ Lower noise level.
- ❑ Drop in electronic driver system for automatically self-adapting the compressor speed to the current thermal load by means of the "Smart Speed" programming option.

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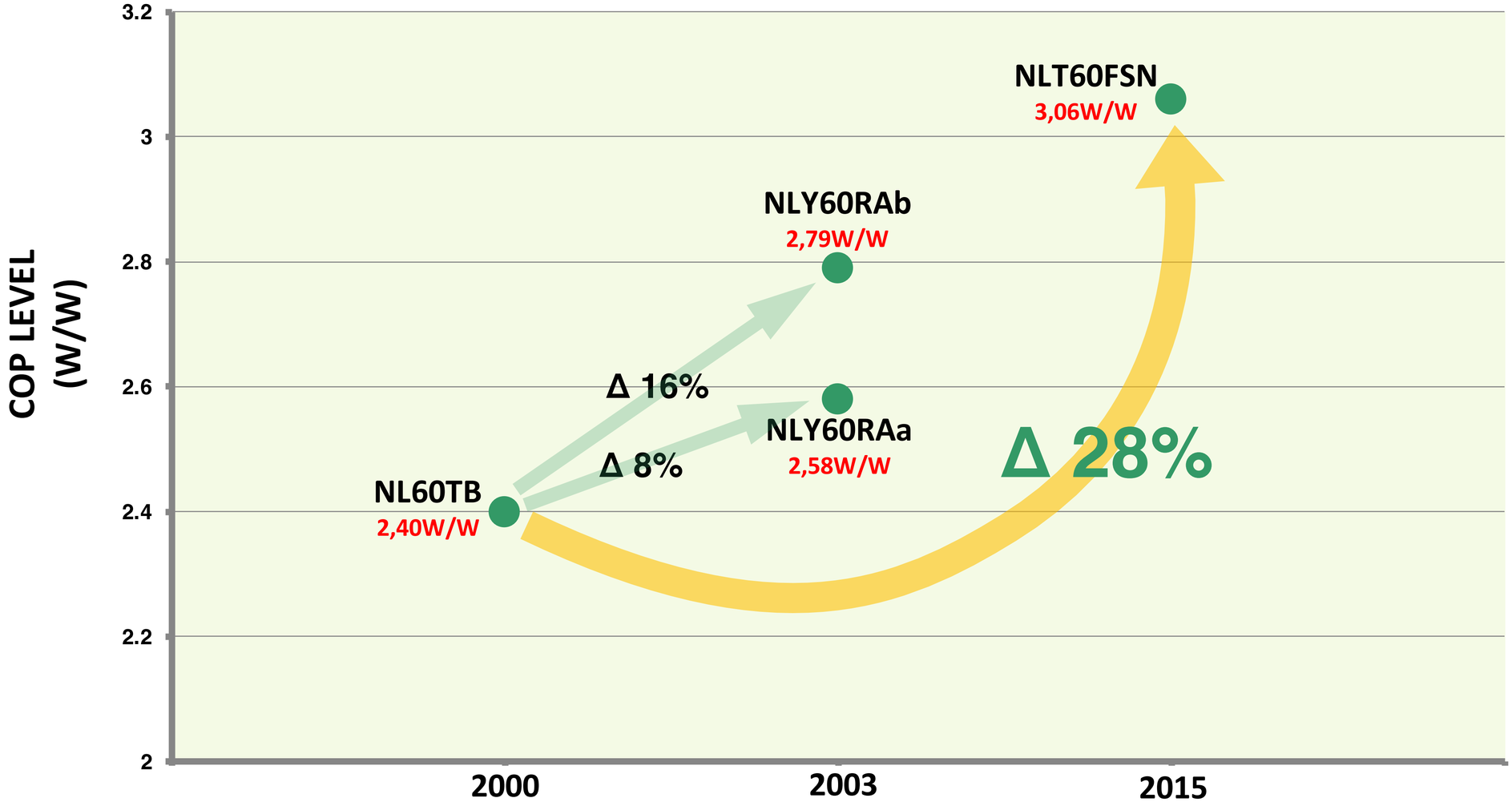
Case of Study

The compressor: NLT60FSN

Compressor efficiency evolution



Maximum Efficiency

green cooling

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Case of Study

The appliance

Tested appliance main characteristics

Application Characteristics and Test Conditions	
Type of cabinet	Bottle cooler
Refrigerant	R290
Internal net volume	350 Liters
Cabinet load	Fully loaded
Ambient temperature / RH	25ºC / 50%
Average internal temperature	+3,3ºC

Tested compressor main performance

COMPRESSOR DATA	NL60TB	NLY60RAa	NLY60RAb	NLT60FSN
Compressor type	Standard Eff.	High Eff.	Very High Eff.	Variable Speed
Cooling Capacity (kCal/h)	620	720	720	723
COP (W/W)	2,40	2,58	2,79	3,06
COP increase vs. Standard Efficiency	-	-8%	-16%	**-28%**

ASHRAE46 conditions

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Case of Study

The appliance

Appliance test results

Data	NL60TB	NLY60RAa	NLY60RAb	NLT60FSN
Evaporating temperature (ºC)	-9,5º	-9,6	-9,3	-9,2
Condensing temperature (ºC)	49,5	49,6	49,5	49,7
Duty cycle (%)	47	49	48,5	68
Energy consumption difference vs cabinet with std compressor (kWh/24h)	5,14	4,40	4,05	3,12
Energy consumption difference vs cabinet with std compressor	-	-14%	-21%	**-39%**

Accumulated in 5 years				
Data	**NL60TB**	**NLY60RAa**	**NLY60RAb**	**NLT60FSN**
Total energy consumption (kWh)	9.381	8.030	7.391	5.694
Total energy consumption savings vs std (kWh)	-	1.351	1.989	3.687
Total energy cost savings (*)	-	**132**	**195**	**361**
CO2 emissions (kg CO2) (***)	4.221	3.614	3.326	2.562
CO2 emissions reduction vs std (kg CO2)	-	**608**	**895**	**1.659**

(*) 0,098€/kWh average energy cost

(***) Supposing 0,45kg CO2 emissions for each kWh

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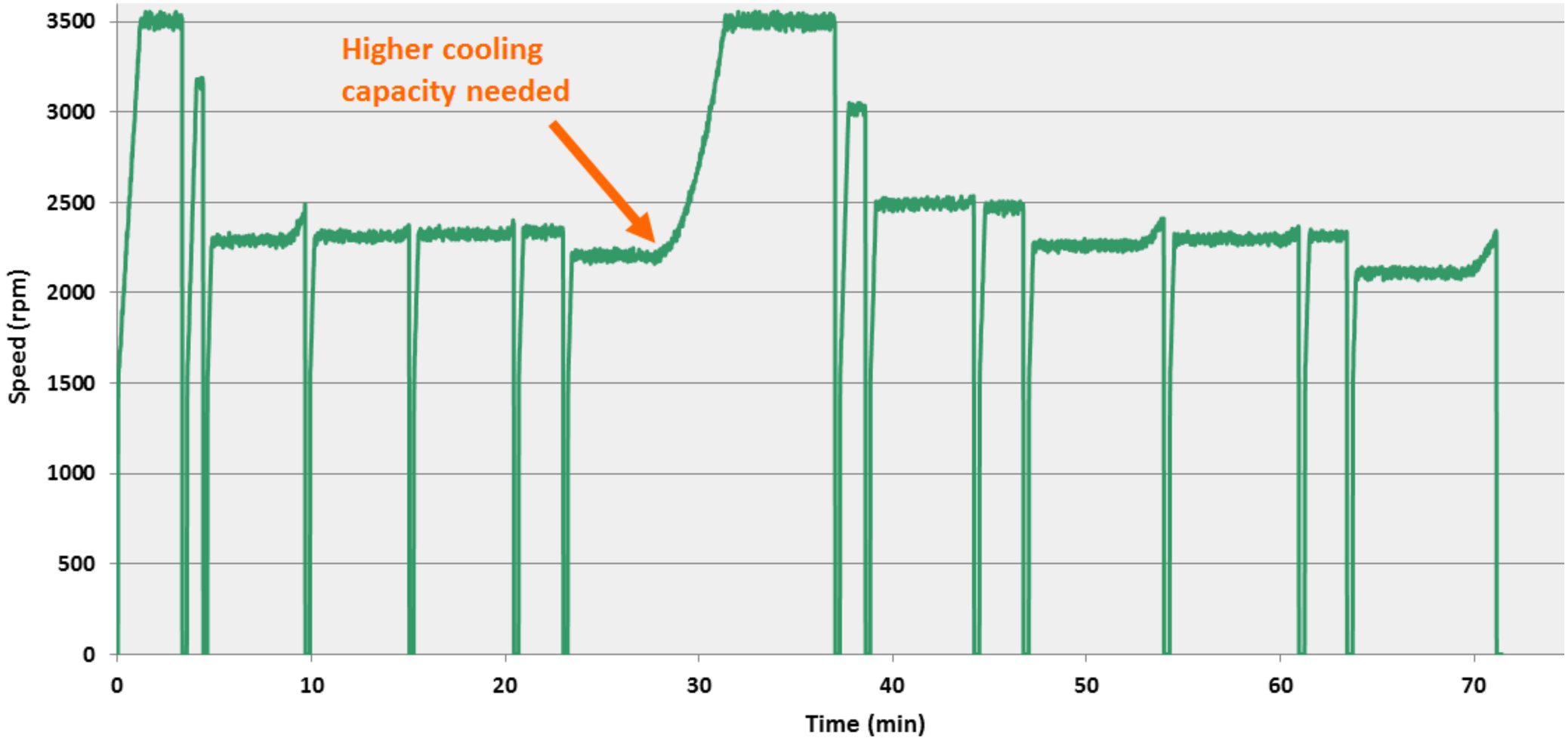
Smart Speed function



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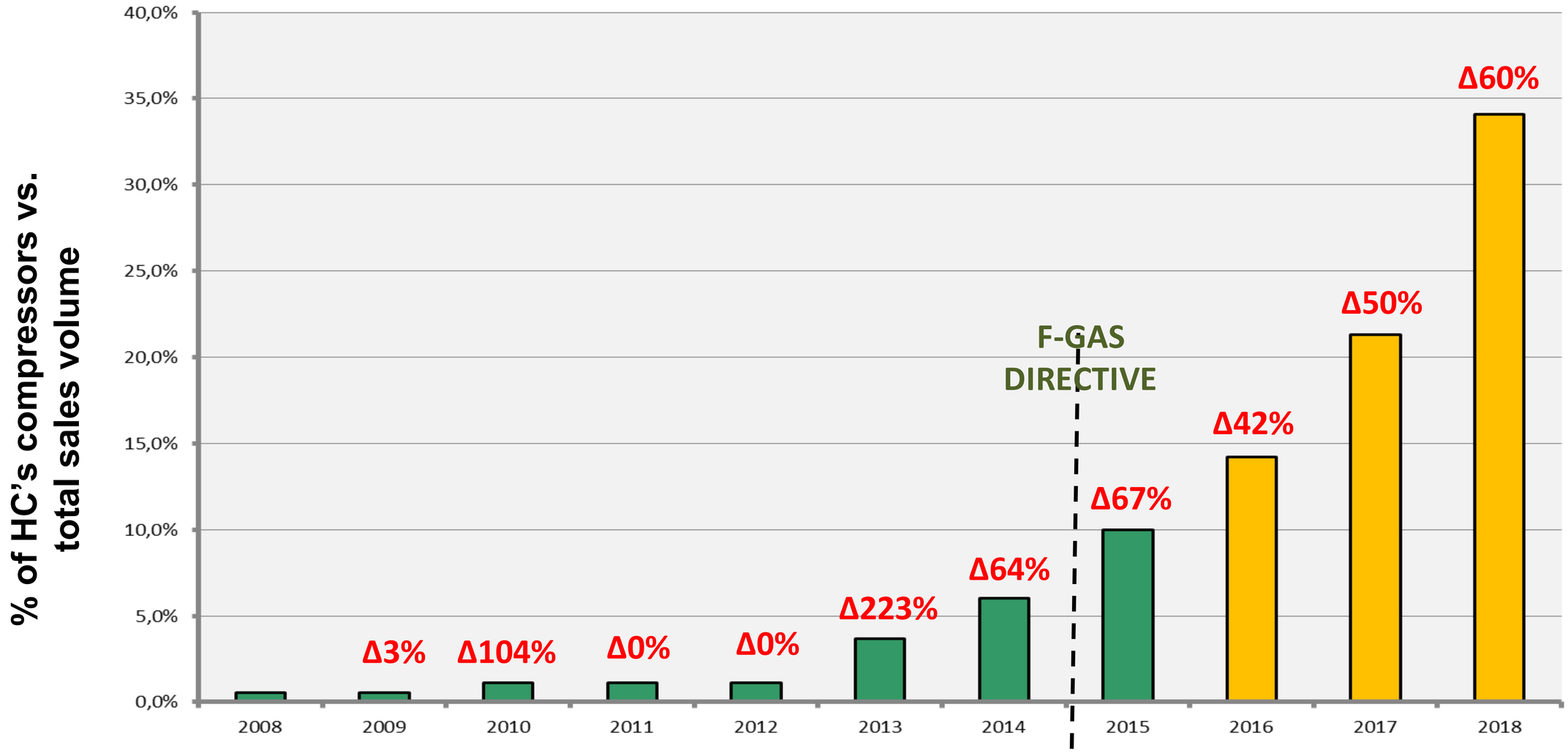
HC's Market Evolution

Market Demand



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Case of Study

Conclusions

R290 advantages vs other alternative gas refrigerants for light commercial Refrigeration in Europe:

- R290 one of the best environment friendly alternatives (excellent GWP).
- R290 already EPA SNAP approved: Global refrigerant solution.
- R290 applied in the most efficient appliances produced in Europe from last years with very positive results with million units running.
- R290 systems do not requires significant changes vs current HFC's and vs other ecological alternatives (CO_2) (Reasonable working pressures).
- R290 allows the use of lower displacement compressors vs R134a and some HF0's to get equivalent cooling capacity.
- Weak point of R290 is the limitation of 150 g charge per circuit (which cover most of light commercial appliances charge). Restriction under discussion to extend the maximum charge but estimated to middle term.

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Thank you very much!