



JOINTWAY Study on HVACR

Alternative Refrigerant

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Montreal Protocol

Newly Aligned Appendix For HFCs

Category	Developed Countries	Developing Countries	World's hottest countries India / Pakistan/ Iran/ Saudi Arabia / Kuwait
Baseline	Average production and consumption 2011-2013	Average production and consumption 2020-2022	Average production and consumption 2024-2026
Schedule	Freezing HFC Use 2018 Starting Reduction 2019 Reducing to 15% By 2036	Freezing HFC Use 2024 Starting Reduction 2029 Reducing to 20% By 2045	Freezing HFC Use 2028 Starting Reduction 2032 Reducing to 15% By 2047

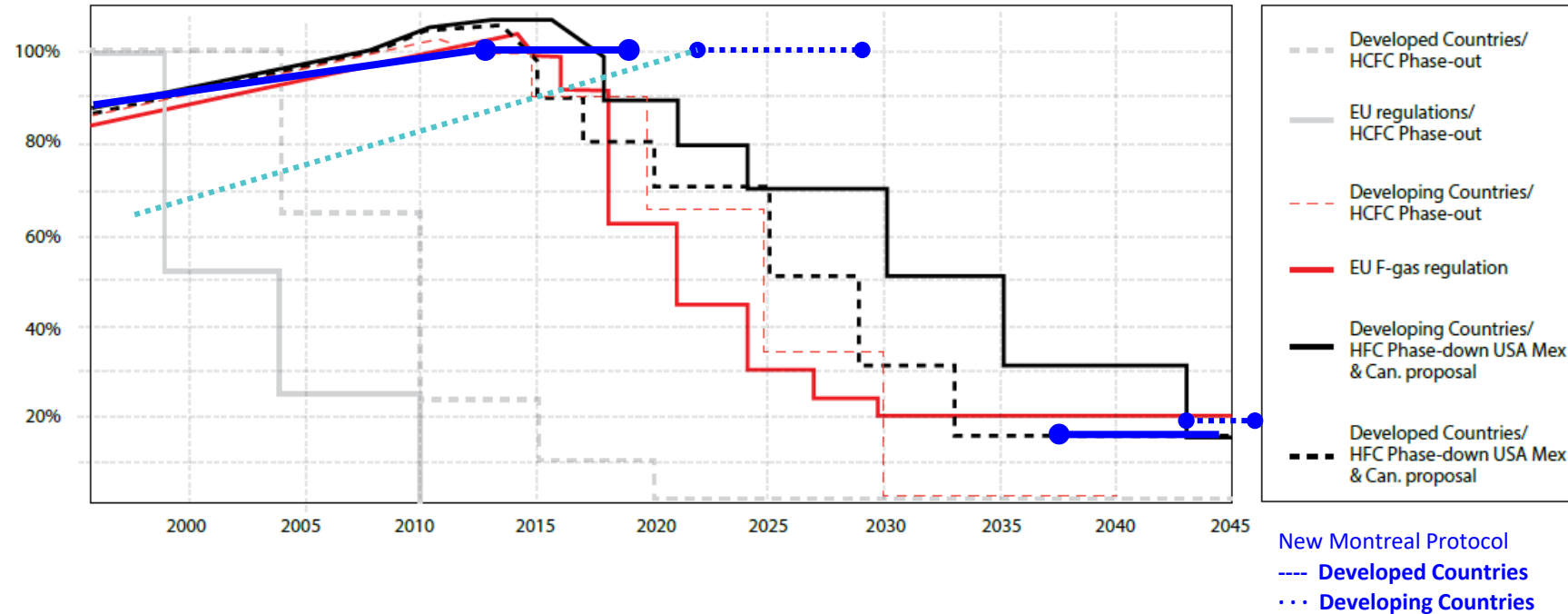
	Current HFCs R134a/R410A	R32 (HFC)	HFO HFO1234yf/ze	CO ₂	Hydrocarbons
GWP	1430/2088	675	4-6	1	<10
Compressor design and cost				Higher pressure	
Energy efficiency					
Safety	A1	A2L	A2L	A1	A3

The Appendix Does Not Mention About The GWP Information Like F-gas
Need To Understand More On This Point For R32

Potential Alternative Refrigerants By CRAA 2014 China

System Types	Compressor Types	Existing Refrigerants	Potential Alternatives
Small /Mid Size Cooling(HP) Chiller	Rotary/Scroll	R-22 /R410A	R410A (Near Term) R-32 (Medium/long Term)
Large Size Cooling(HP) Chiller	Screw/Centrifugal	R-22 /R-123 / R-134a	R-134a (Near Term) R-1234ze(E) (Medium/long Term) HFO Blend (Medium/long Term)
Heat-Pump Water Heater	Rotary/Scroll	R-22 / R-134a R410A / R407C	R-134a / R410A (Near Term) R-32 / CO ₂ (Medium/long Term)
PAC Unit	Rotary/Scroll/Screw	R-22 /R-142b R410A / R407C	R410A (Near Term) R-32 (Medium/long Term)
RAC	Rotary	R-22 / R410A	R410A (Near Term) R32,R290 (Medium/long Term)
VRF	Rotary/Scroll	R410A	R410A (Near Term) R-32 (Medium/long Term) HFO Blend (Medium/long Term)

Refrigerant Regulation Timeline And China Refrigerant Consumption And Possible Solutions

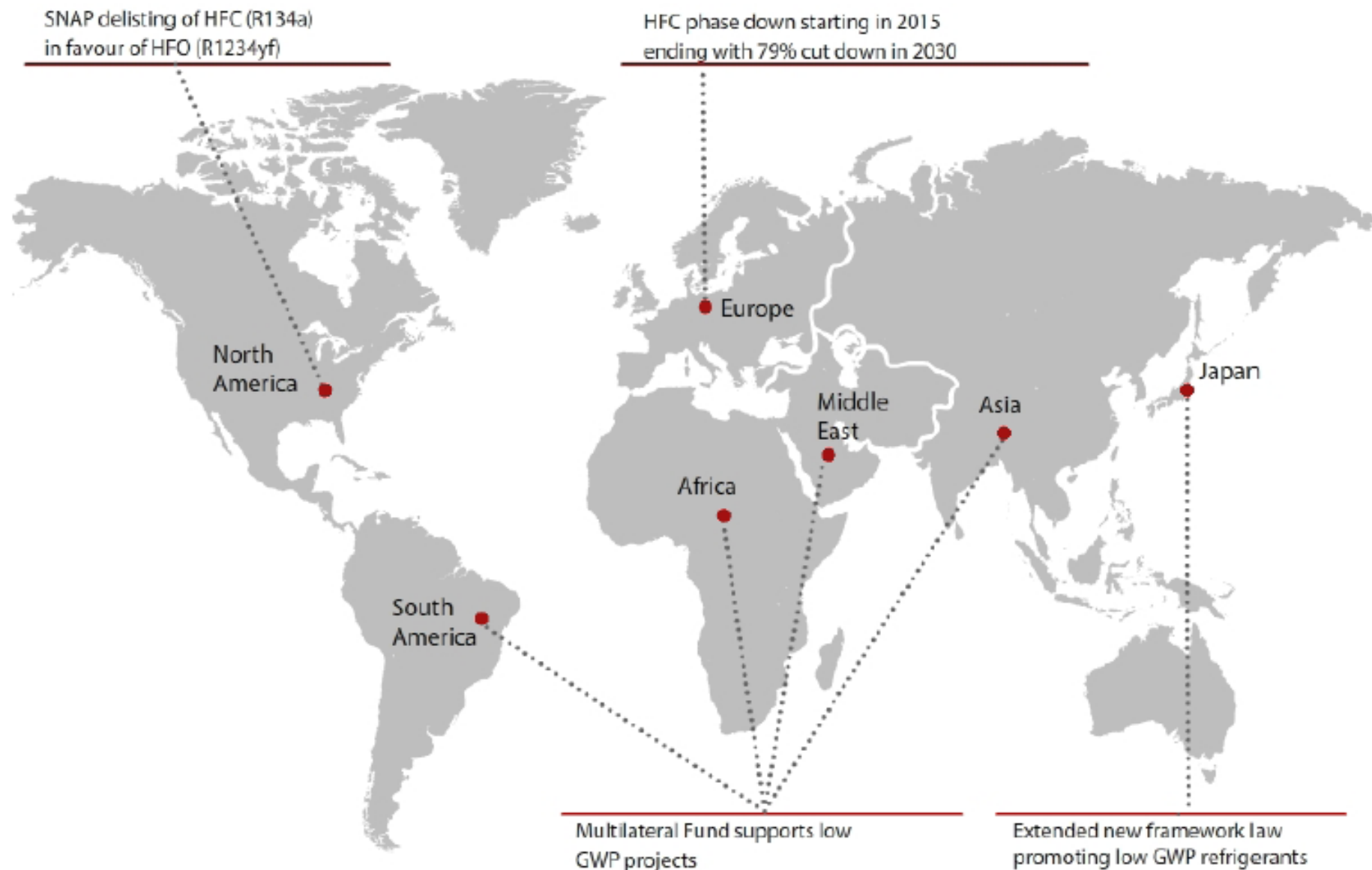


	Refrigerant Consumption	Compressor	Now	Possible Future	NPD Coverage
Residential AC	60%	Rotary	R22/R410A	R32/R290	NA
Light Commercial AC	~20%	Scroll/Rotary	R22/R410A	R410A/R32	Yes
Commercial AC	~10%	Screw/Centrifugal/Scroll	R134a Type/R22/R410A	HFO type/ R410A/R32	Yes
Refrigeration	~10%	Recip/Scroll		HFO Blends/R32	No Confirmed Candidate Yet, But in Follow-up

HFCs逐步削减修正案

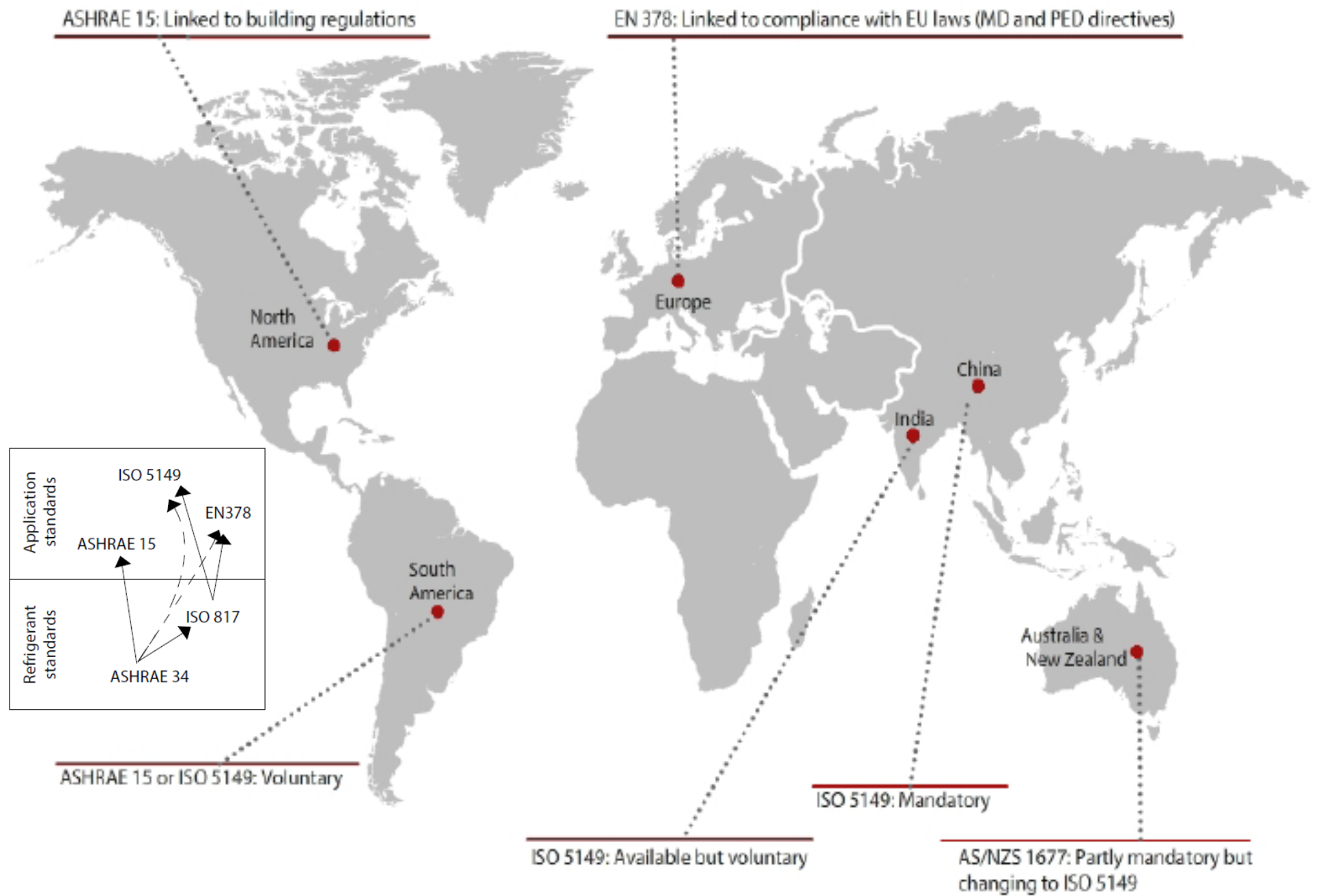
- 2016年10月15日，《蒙特利尔议定书》第28次缔约方会议于卢旺达首都基加利通过了关于削减HFCs的修正案：

国家类别	发达国家 (第二条款缔约方)	发展中国家 (第五条款缔约方)
基线	2011-2013平均值	2020-2022平均值
削减进度	2019年开始削减 2036年削减至15%	2024冻结年 2029开始削减 2045削减至20%
特殊情况	部分发达国家： 2020开始削减	部分发展中国家（印度、巴基斯坦、伊拉克等）： 2028开始冻结 2032开始削减



Worldwide:

- Ongoing discussions concerning a global phase down under the Montreal Protocol
- National tax schemes on HFC
- National incentives and subsidies



EPA Issued Notice Of Public Rulemaking On Delisting HFCs, August 6, 2014

Refrigerant	Supermarket*		Condensing Units* (field charged)	Standalone Self Contained Comm. Ref. Eqpt* (factory charged sealed systems)	Vending Machines	Foam	Auto AC
	Direct	Sec.					
R404A/507A	JAN 2016	JAN 2016	JAN 2016 Delay 6 years	JAN 2016 Delay 6 years	JAN 2016		
HFC-227 ea., R-407B, R-421B, R-422A, R-422C, R-422D, R-428A, R-434A	JAN 2016	JAN 2016					
R407A, R407F				JAN 2016 (New) Do not delist			
R134a				JAN 2016 (New) Do not delist	JAN 2016 (New)	JAN 2017 Delay 6 years	2021 Model (New)
Various Blends, GWP 600-9990**				JAN 2016 (New)			
Various Foam Refs**						JAN 2017 Delay 6 years	
Various Auto Blends**							2017 Model (New)

*Now and retrofit only; Service is allowed

**Check EPA Documents for details

Aerosol Application not shown in above table

Industrial, Ice Making heads, Warehouses and Transport Applications are not Included in This NOPR but comments have been requested.

**Do Not Delist Now In Industrial And Ice: No Alternates Without Glide
S.Mkt, Transport – No Comment**

**Emerson Submitted Written Comments, Along With 93 Others
Expect EPA Response And Final Rule Q1 CY2015**