Panorama y Tendencia de la Industria de Aire Acondicionado y Refrigeración en Colombia

Giovanni Barletta

Presidente ACAIRE 2017-2018

Agenda:

1. Reflexiones de la actual situación climática en Colombia
2. Estadísticas del sector
3. Tendencias tecnológicas en sistemas de aire acondicionado y refrigeración.
4. Oportunidades de crecimiento.
5. Normalización, certificación y capacitación.
6. Compromisos del sector con COP 21-22

EL TIEMPO INICIAR SESIÓN SUSCRIBIRSE

Inundados: la embestida de la Ciénaga Grande y el Mar Caribe contra los pueblos del Magdalena

Julio /2017

19 de Julio 2017

EL UNIVERSAL

"Pequeña onda de tsunami" inundó a varias comunidades en la Costa Caribe

EFE | @ElUniversalCtg | BARRANQUILLA | 19 de Julio de 2017 06:15 pm |

EL ESPECTADOR Domingo 23 De Julio

Onda de tsunami en el mar Caribe ocasionó emergencia en Magdalena

Julio 22/ 23

EL HERALDO

Onda de tsunami arrasó casetas en las playas de Puerto Colombia

El mar se mete en Tasajera y sobrepasa la vía en km 19

"El mar retrocedió 100 metros y se devolvió con una ola gigante"

El Tiempo, Junio 15/17

debes saber

A finales de siglo se perderían 50.000 ha por cambio climático

Estudio del Ideam señala que en los últimos 30 años, **la temperatura del país ha aumentado 0,8 ºC** y en 100 años el incremento será de 2,4 ºC.

Estadística en Colombia del Efecto del Cambio Climático

(Informe Ideam-PNUD)

- Costa Pacifica pierde 50 cms de costa/año
- Incremento de Temp Promedio 0.8 C en últimos 30 años
- Estimado de +2.4 C en 2100
- 6 de 8 Departamentos Caribe y Pacifico con cambios negativos en las costas

Estimado de Perdida de Territorio en Ha

	2040	2070	2100
COSTA PACIFICA	7.579	15.631	26.117
COSTA ATLANTICA	5.049	12.827	23.070

Departamentos mas afectados Choco; Nariño & Valle

119 Municipios en Alto & y Muy Alto Riesgo

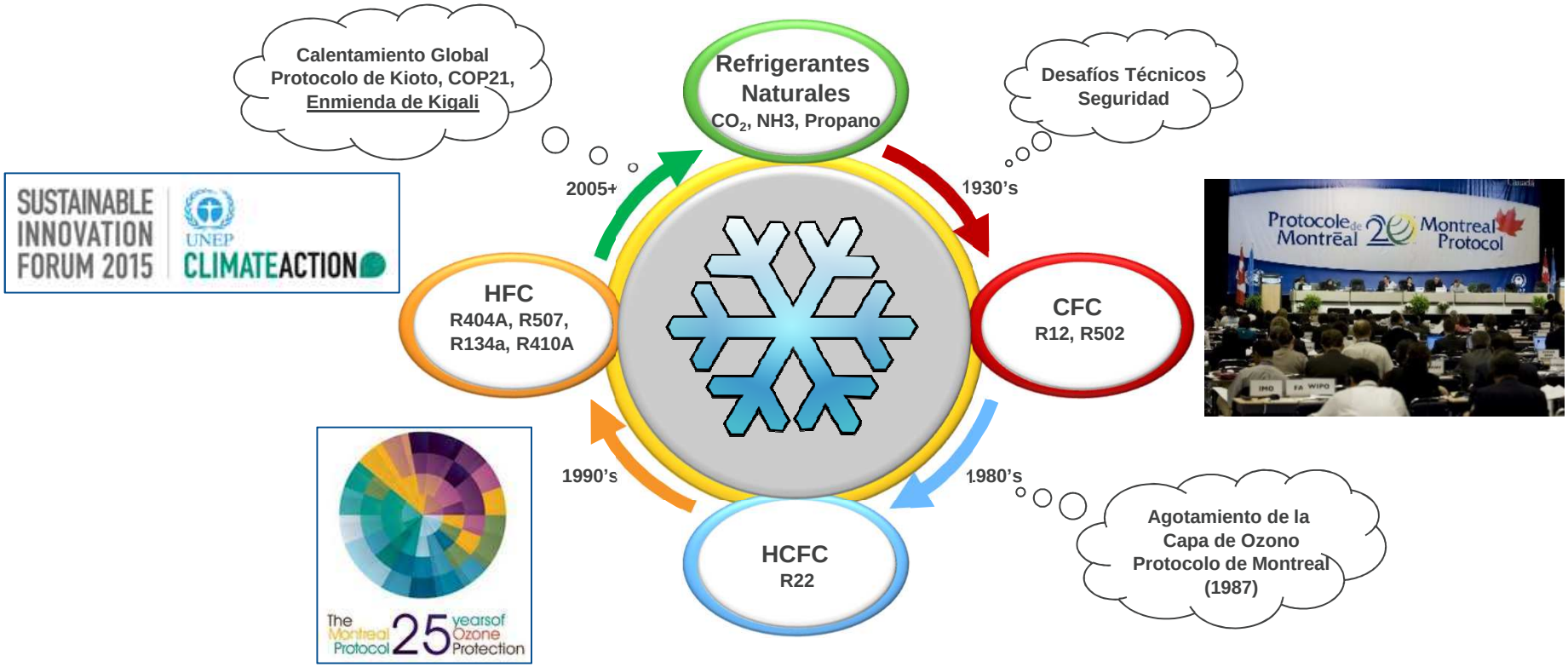
Riesgo de afectar mas de 50.000 ha por efecto del cambio climatico

Refrigerantes Alternativos con un Menor Impacto Ambiental, en Aplicaciones Para Aire Acondicionado y Refrigeración

Agenda

- Introducción – Enmienda en el Protocolo de Montreal
- Posibles Candidatos con Bajo Impacto Ambiental Para Refrigeración y Aire Acondicionado
- Evaluación del Impacto Climático Total
- Tendencias en la Arquitectura de los Sistemas
- ¿Qué es “The Helix”?
- Conclusiones

“Círculo Histórico Completo” Para los Refrigerantes



Regulaciones y Estándares de Eficiencia y de Refrigerantes, Normas de Aplicación, Códigos de Edificación…Cobran Suma Importancia

Tendencias Globales Claves en Refrigeración

Respuestas de la Industria a Tres Tendencias Globales Claves

- Sustentabilidad

- Refrigerantes con Menor GWP
- Detección Temprana de Fugas
- Menor Carga de Gas

- Eficiencia Energética

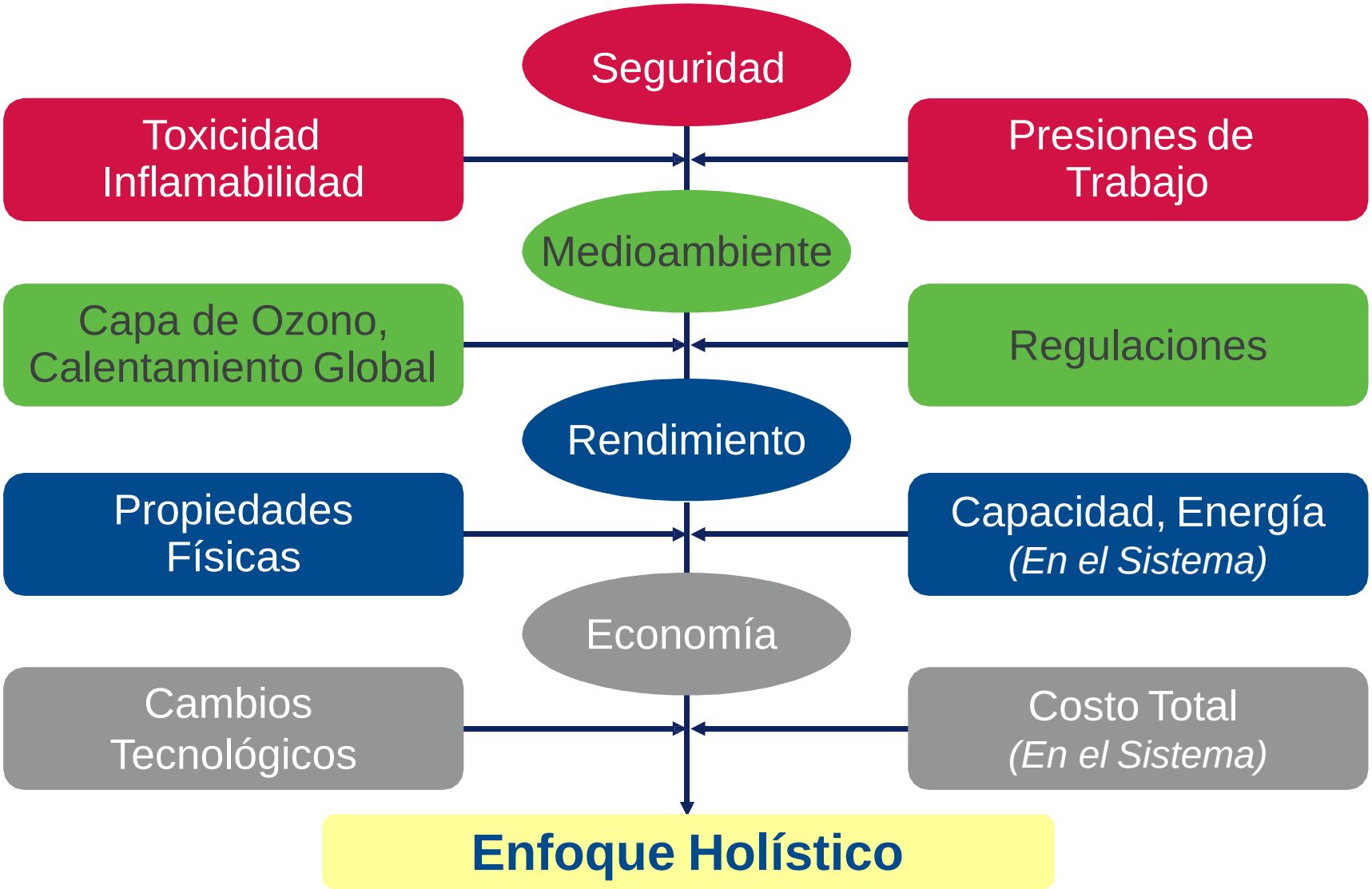
- Sistemas Más Eficientes
- Estrategias Modulación
- Controles Electrónicos

- Conectividad

- Diagnóstico, Comunicación
- Integración Electrónica
- Gerenciamiento Energético

¿Cuándo un Refrigerante es una Opción a Largo Plazo?

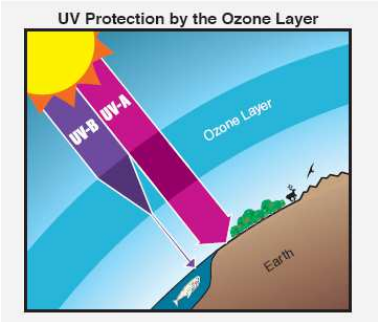
Cualquier Opción Implica un Compromiso



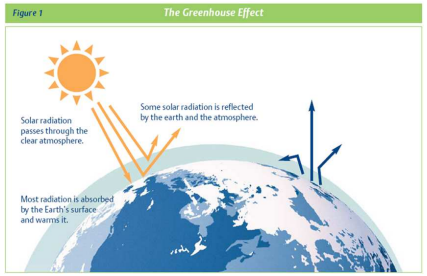
Vamos hacia los refrigerantes naturales?

Step 1 - Elimination of Ozone Depleting Refrigerants (CFC & HCFC)
Step 2 - Phase Down of Global Warming Refrigerants (HFC)
Step 3 - Ramp up of CO_2 Commercial Refrigeration Equipment

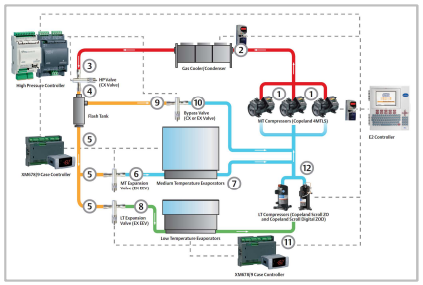
Step 1, Completed
Thinning of the Ozone Layer
Caused by CFC & HCFC
(Banned)



Step 2, Ongoing
Global Warming Damage
Caused by HFC
(Phased Down / Usage Bans)

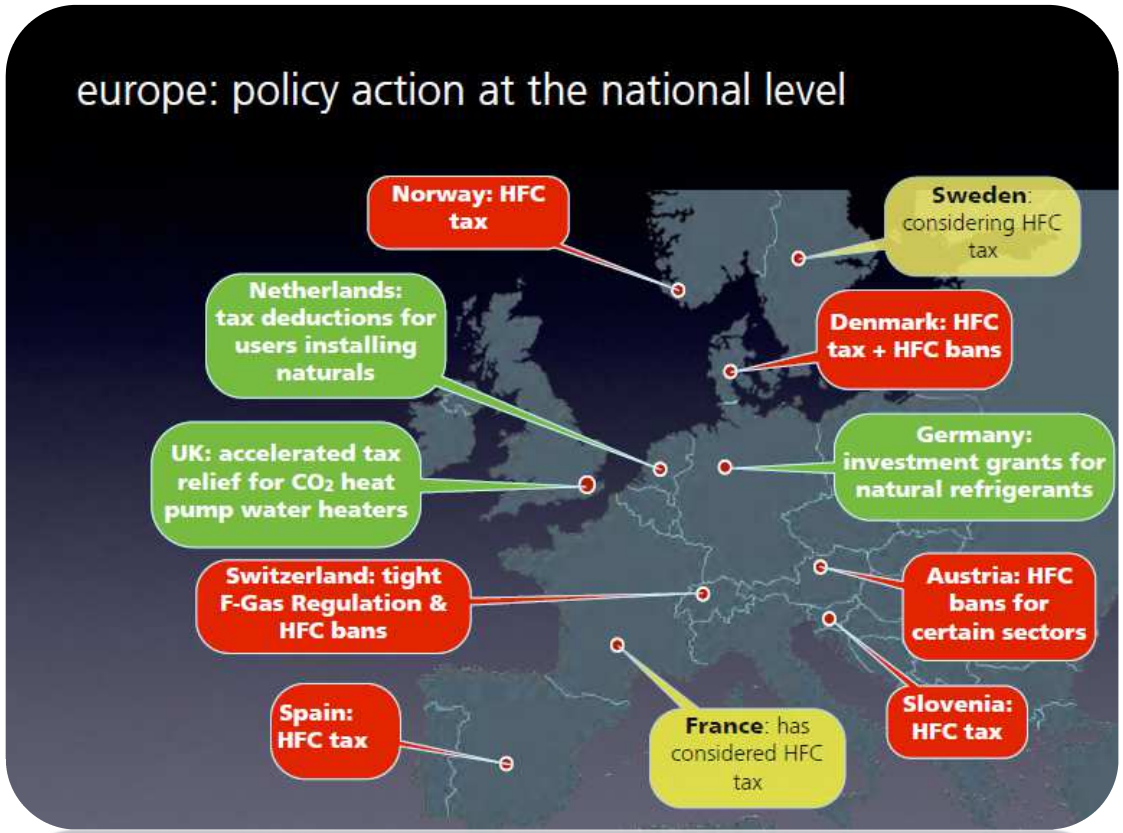


Step 3, Ongoing
Natural Refrigerants
CO_2, Propane, Ammonia
(Ramping Up)



CFC	= Chlorofluorocarbon
HCFC	= Hydro chlorofluorocarbons
HFC	= Hydrofluorocarbons

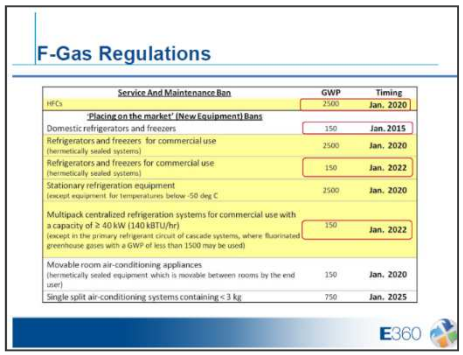
Aggressive European Measures to Reduce and Eliminate HFCs



F-Gas Regulations - Europe

Service And Maintenance Ban	GWP	Timing
HFCs	2500	Jan. 2020
'Placing on the market' (New Equipment) Bans		
Domestic refrigerators and freezers	150	Jan. 2015
Refrigerators and freezers for commercial use (hermetically sealed systems)	2500	Jan. 2020
Refrigerators and freezers for commercial use (hermetically sealed systems)	150	Jan. 2022
Stationary refrigeration equipment (except equipment for temperatures below -50 deg C	2500	Jan. 2020
Multipack centralized refrigeration systems for commercial use with a capacity of ≥ 40 kW (140 kBTU/hr) (except in the primary refrigerant circuit of cascade systems, where fluorinated greenhouse gases with a GWP of less than 1500 may be used)	150	Jan. 2022
Movable room air-conditioning appliances (hermetically sealed equipment which is movable between rooms by the end user)	150	Jan. 2020
Single split air-conditioning systems containing < 3 kg	750	Jan. 2025

Global Regulations
Confusing Time for End Users



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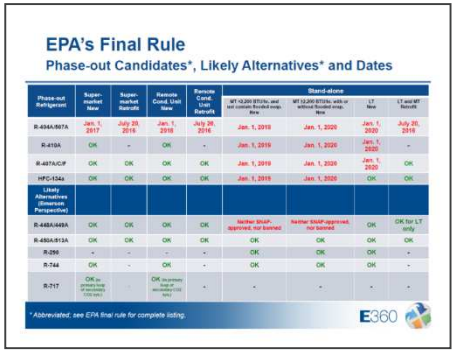
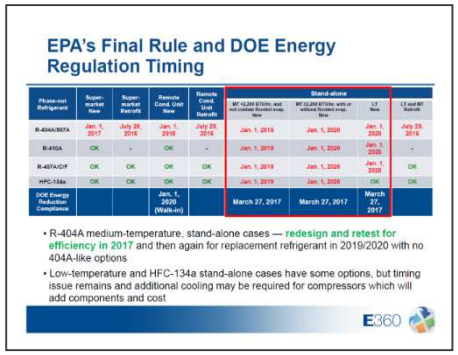


EPA's Final Rule

Phase-out Candidates*, Likely Alternatives* and Dates

Phase-out Refrigerant	Super-market New	Super-market Retrofit	Remote Cond. Unit New	Remote Cond. Unit Retrofit	Stand-alone: MT <2,200 BTU/hr, and not contains flooded evap. New	Stand-alone: MT ≥2,200 BTU/hr, with or without flooded evap. New	Stand-alone: LT New	Stand-alone: LT and MT Retrofit
R-404A/507A	Jan. 1, 2017	July 20, 2016	Jan. 1, 2018	July 20, 2016	Jan. 1, 2019	Jan. 1, 2020	Jan. 1, 2020	July 20, 2016
R-410A	OK	-	OK	-	Jan. 1, 2019	Jan. 1, 2020	Jan. 1, 2020	-
R-407A/C/F	OK	OK	OK	OK	Jan. 1, 2019	Jan. 1, 2020	Jan. 1, 2020	OK
HFC-134a	OK	OK	OK	OK	Jan. 1, 2019	Jan. 1, 2020	OK	OK
Likely Alternatives (Immune Perspective)								
R-448A/449A	OK	OK	OK	OK	Neither SNAP-approved, nor banned	Neither SNAP-approved, nor banned	OK	OK for LT only
R-450A/513A	OK	OK	OK	OK	OK	OK	OK	OK
R-290	-	-	-	-	OK	OK	OK	-
R-744	OK	-	OK	-	OK	OK	OK	-
R-717	OK (in primary loop of secondary-loop systems)	-	OK (in primary loop of secondary-loop systems)	-	-	-	-	-

* Abbreviated; see EPA final rule for complete listing.



EPA's Final Rule and DOE Energy Regulation Timing

Phase-out Refrigerant	Super-market New	Super-market Retrofit	Remote Cond. Unit New	Remote Cond. Unit Retrofit	Stand-alone: MT <2,200 BTU/hr, and not contains flooded evap. New	Stand-alone: MT ≥2,200 BTU/hr, with or without flooded evap. New	Stand-alone: LT New	Stand-alone: LT and MT Retrofit
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- R-404A medium-temperature, stand-alone cases — **redesign and retest for efficiency in 2017** and then again for replacement refrigerant in 2019/2020 with no 404A-like options
- Low-temperature and HFC-134a stand-alone cases have some options, but timing issue remains and additional cooling may be required for compressors which will add components and cost

CARB: Short-lived climate pollutant reduction strategy – proposal April 2016

Commercial application	GWP limit	Date
All refrigerant sales*	2,500	2020
Non-residential refrigeration	150	2020
AC (non-residential and residential)	750	2021

- Rule-making process begins in 2017 with possible final rule late 2018

*Exception for recycled or reclaimed refrigerant

Environmental Canada (EC) proposal November 26, 2016

Commercial application	GWP limit	Date
Refrigeration – centralized systems (MT/LT racks)	1,500	2020
Refrigeration – condensing units	2200	2020
Refrigeration – LT stand-alone	1,500	2020
Refrigeration – MT stand-alone	700	2020
Foams	150	2021
Mobile refrigeration	2,200	2025
AC – chillers	700	2025
Domestic refrigeration	150	2025

Other Refrigerant Regulation Activity

F-Gas (EU): effective May 20, 2014

Commercial application	GWP limit	Date
Self-contained refrigeration	2,500	2020
Stationary refrigeration	2,500	2020
Self-contained refrigeration	150	2022
Centralized refrigeration	150	2022
– Except top side of cascade	1,500	2022

CARB: Short-lived climate pollutant reduction strategy — proposal Nov 28, 2016 (Comments, Jan 17, 2017)

Commercial application	GWP limit	Date
All refrigerant sales	2,500	?
Non-residential refrigeration	150	?
AC (non-residential and residential)	750	?

Environmental Canada (EC)**: proposal November 26, 2016

Commercial application	GWP limit	Date
Refrigeration – centralized systems (MT/LT racks)	1,500	2020
Refrigeration – condensing units	2200	2020
Refrigeration – LT stand-alone	1,500	2020
Refrigeration – MT stand-alone	700	2020
Foams	150	2021
Mobile refrigeration	2,200	2025
AC – chillers	700	2025
Domestic refrigeration	150	2025

- Phase-down (NAP) option also proposed (2019 — 90%; 2024 — 65%; 2030 — 30%; 2036 — 15%; baseline 2011–2013)

** http://www.gazette.gc.ca/rp-pr/p1/2016/2016-11-26/html/reg1-eng.php
Comment period ends Feb 8, 2017

California Proposal for Regulating HFCs

- Governor's 2015 order to reduce all GHGs (over 1990 levels)

  40% in 2030

  80% in 2050

- Draft strategy released September 2015
  - All sectors targeted for emission reductions

    1/1/2021 - New commercial refrigeration equipment, **<150 GWP**

    1/1/2022 - New HVAC equipment (comm. and resi), **<750 GWP**
  - If international and national actions inadequate, CA will follow Europe, Australia and Japan in taking additional measures like above
- Final proposal in "Spring 2016"

States/Provinces (in US/Canada) and nations in EU could pass more stringent regulations – we have to be aware

U.S. Environmental Protection Agency (EPA)

Proposed Status Changes:

Refrigeration & Air Conditioning

End-Use (New Equipment)	Proposed Change of Status Date*
• Centrifugal chillers	January 1, 2024**
• Positive displacement chillers	January 1, 2024**
• Cold storage warehouses	January 1, 2023
• Refrigerated food processing and dispensing***	January 1, 2021
• Household refrigerators and freezers	January 1, 2021

**Refer to proposed rule for specific substitutes and dates. Would change status for various HFCs and HFC refrigerant blends with GWPs ranging from about 900 to 4,000*

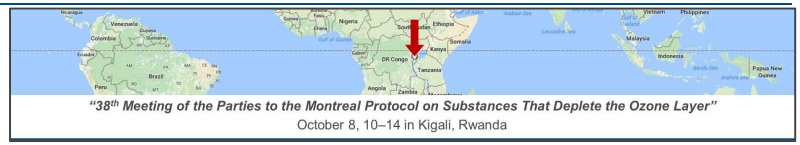
***Narrowed use limits apply as of January 1, 2024 for military marine vessels and for human-rated spacecraft and related support equipment*

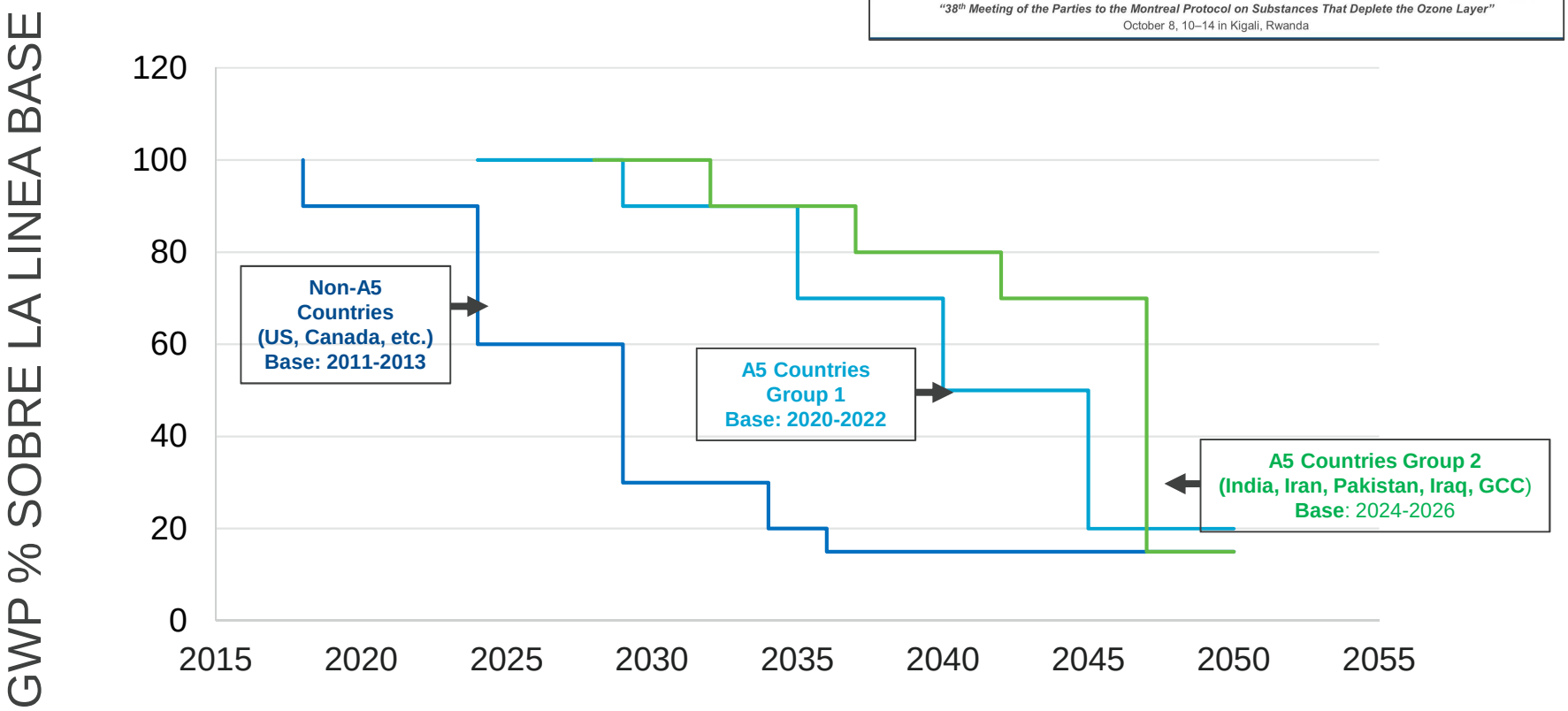
****Separate end-use category within retail food refrigeration end-use*

- *Slide from Tom Land, U.S.EPA, ATMOsphere America, June 17, 2016*

Kigali Amendment to the Montreal Protocol

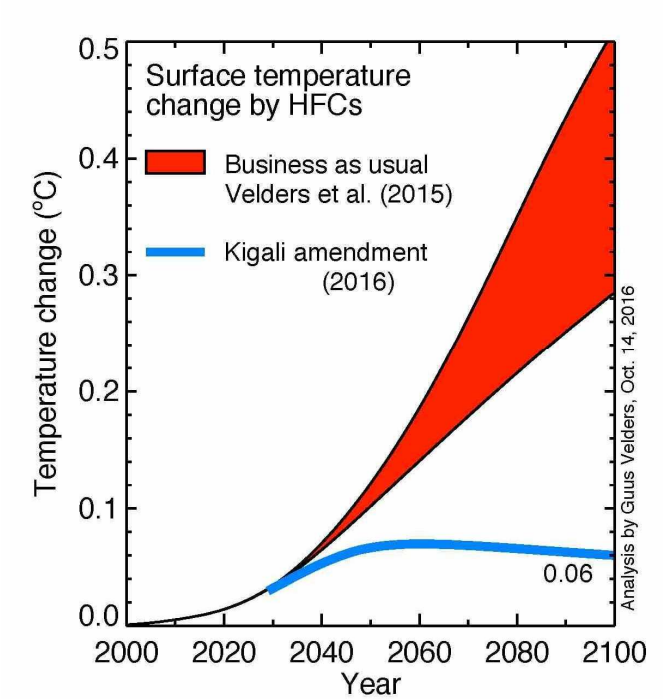
October 15, 2016





Countries Adopt Kigali Amendment to Phase Down HFCs

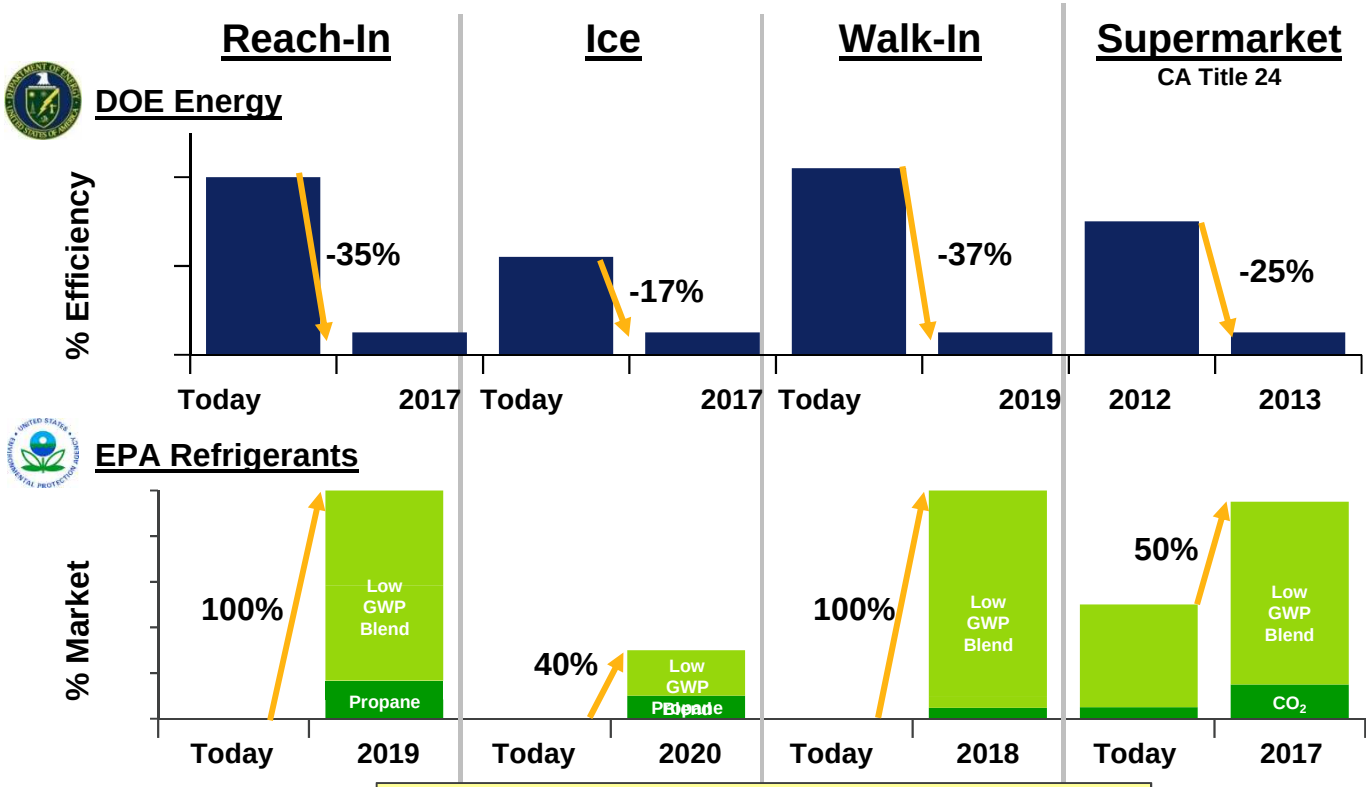
Oct.14, 2016



Full article below

https://www.nrdc.org/experts/david-doniger/countries-adopt-kigali-amendment-phase-down-hfcs

Where We Are: Regulations & Refrigerants



Redesigns Are Widespread.
Results Require System-wide Optimization.

EPA's Final Rule and DOE Energy Regulation Timing

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EPA's Final Rule, July 20, 2015, and Proposed Rule April 18, 2016 Changed listing status of certain HFCs*

	Final Rule: July 20, 2015								Proposed Rule: April 18, 2016^			
					Stand-Alone							
Phase-out refrigerant	Super-market (New**)	Super-market (Retrofit***)	Remote condensing unit (New)	Remote condensing unit (Retrofit***)	MT < 2,200 BTU/hr. and not contain flooded evap. (New)	MT ≥ 2,200 BTU/hr. with or without flooded evap. (New)	LT (New)	LT and MT (Retrofit***)	Refrigerated food processing and dispensing equipment (New)	Cold storage warehouses (New)	Ice machines (New)	Very low-temp refrigeration (New)
R-404A/507A	Jan. 1, 2017	July 20, 2016	Jan. 1, 2018	July 20, 2016	Jan. 1, 2019	Jan. 1, 2020	Jan. 1, 2020	July 20, 2016	^Jan. 1, 2021	^Jan. 1, 2023	OK	OK
R-410A	OK	-	OK	-	Jan. 1, 2019	Jan. 1, 2020	Jan. 1, 2020	-	^Jan. 1, 2021	^Jan. 1, 2023	OK	OK
R-407A/C/F	OK	OK	OK	OK	Jan. 1, 2019	Jan. 1, 2020	Jan. 1, 2020	OK	^Jan. 1, 2021	R-407C/F OK R-407A: ^Jan. 1, 2023	OK	R-407C only
HFC-134a	OK	OK	OK	OK	Jan. 1, 2019	Jan. 1, 2020	OK	OK	OK	OK	OK	-
Likely alternatives (Emerson perspective)												
R-448A/449A	OK	OK	OK	OK	Neither SNAP-approved, nor banned	Neither SNAP-approved, nor banned	OK	OK for LT only	-	-	OK	-
R-450A/513A	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	-
R-290	-	-	-	-	OK	OK	OK	-	-	-	^Pending	^Pending
R-744	OK	-	OK	-	OK	OK	OK	-	OK	OK	-	OK
R-717	OK (in primary loop of secondary system)	-	OK (In primary loop of secondary system)	-	OK (in primary loop of secondary system)	OK (in primary loop of secondary system)	OK (in primary loop of secondary system)	OK (in primary loop of secondary system)	OK (in primary loop of secondary system)	OK	OK	-

** Includes ice machines connected to a supermarket rack refrigeration system.
*** EPA uses term "retrofit" to indicate the use of a refrigerant in an appliance that was designed for and originally operated using a different refrigerant. Term does not apply to upgrades to existing equipment where the refrigerant is not changed.

Likely Refrigerant Alternatives
Emerson's perspective

- A1 – Non-flammable
- A2L – Mildly flammable
- A3 – Flammable
- B2L – Toxic, mildly flam.

Volumetric capacity / pressure	Naturals	Mildly flammable (A2L) HFO and blends	Lowest GWP non-flammable (A1) HFC/HFO blends	Today's non-flammable (A1) HFCs
Elevated	R-744 (CO_2) 1			
Medium "R-404A like"	R-290 (Propane) 3 R-717 (Ammonia) 0	R-455A (HDR-110) 146 R-454C (DR3) 146	R-449A (XP40) 1,282 R-448A (N40) 1,273	R-407C 1,624 R-407A 1,923 R-507A 3,985 R-407F 1,674 R-404A 3,943
Low "R-134a like"		HFO-1234yf <1 HFO-1234ze <1	R-513A (XP10) 573 R-450A (N13) 547	R-134a 1,300
GWP	0–5	0–150	500–1,300	1,300–4,000

Industry Efforts Are Increasing Around Flammable Refrigerants

AHRI Announces $5.2M Refrigerant Study

AHRI, ASHRAE, US DOE partnership devotes $5.2 million to broaden knowledge

AHRI Flammable Refrigerants Research Subcommittee

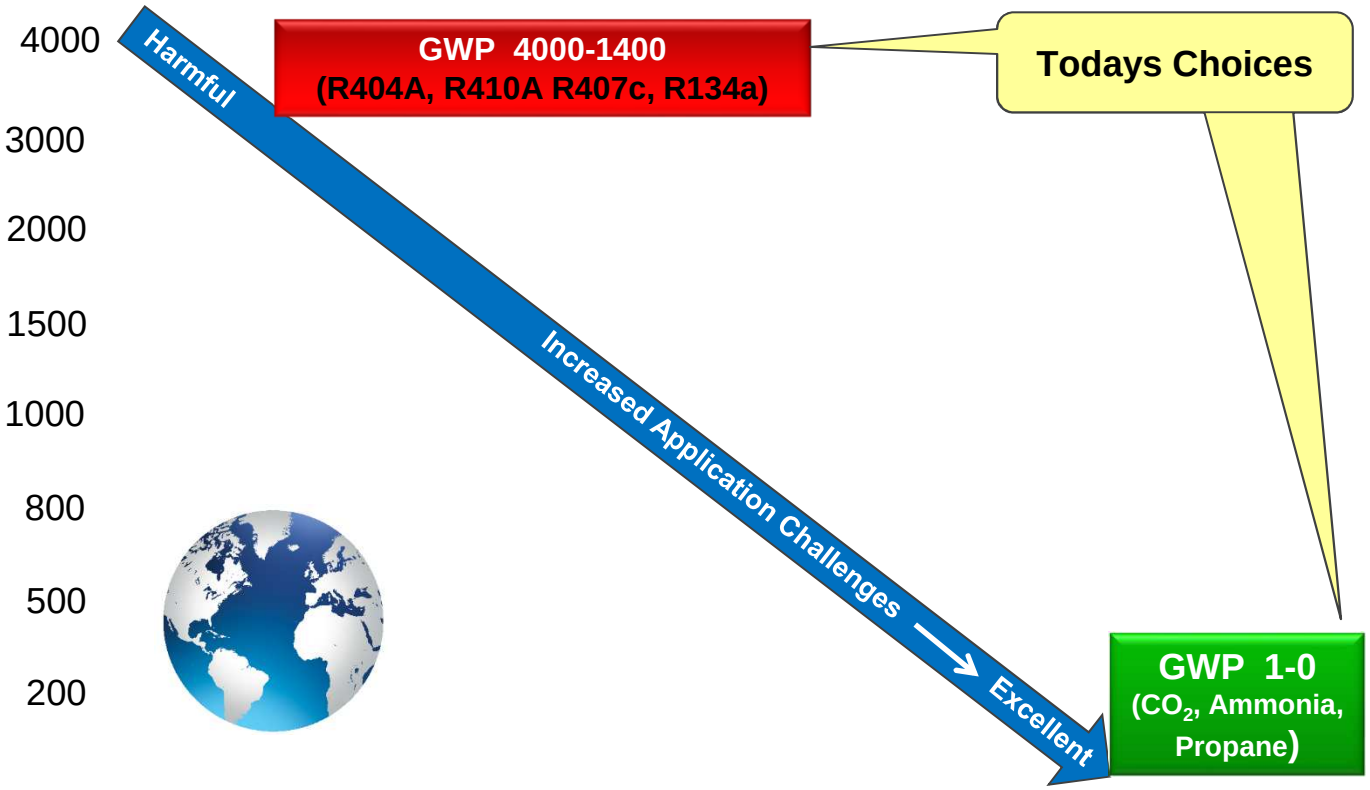
- Identify gaps in flammable refrigerant research
- Develop road map to complete critical research for safe use
- Focus on A2L & A3 refrigerants
- Pushing for closure on items by end of 2017

Next building code cycle is 2018–2021, so …

EPA Proposal to Amend Clean Air Act Section 608 Refrigerant Management Regulations (11/9/15)

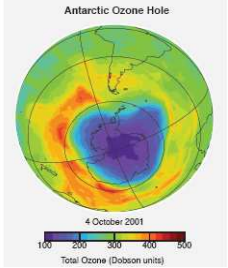
- Lowers repair leak rate threshold for 50+ lbs. refrigerant charge systems
  - From 35% to 20% for industrial process refrigeration (IPR) and comm. ref. equipment
  - From 15% to 10% for comfort cooling equipment
- Requires regular leak inspections or continuous monitoring devices for ref/AC systems:
  - Annual inspections for systems normally containing 50+ lbs. of refrigerant
  - Quarterly inspections for commercial refrigeration and IPR systems normally containing 500+ lbs. of refrigerant
- Prohibits operation of systems with 50+ lbs. of refrigerant that have leaked 75% or more of full charge
  for two consecutive years
- Requires techs to keep a record of refrigerant recovered during system disposal from systems with a charge size from 5–50 pounds
- Extends the requirements of the refrigerant management program to cover substitute refrigerants, such as HFCs

Complicated Refrigerant Choices



Refrigerant Change Being Driven by Regulations and Voluntary Actions

Regulations



Montreal Protocol Targets Ozone Depletion (R-22) Signed in 1987

United Nations Framework Convention on Climate Change

North American Proposal Targets CO_2 Emissions (High Global Warming)

SNAP

California Environmental Protection Agency Air Resources Board

Danish Ministry of the Environment Environmental Protection Agency

HFC Ban & Tax

Environment Canada

Australian Government Department of Sustainability, Environment, Water, Population and Communities

Carbon Tax

European Commission

F-Gas Regulation

Organizations

CCAC CLIMATE AND CLEAN AIR COALITION TO REDUCE SHORT-LIVED CLIMATE POLLUTANTS

The Consumer Goods FORUM

ipcc INTERGOVERNMENTAL PANEL ON climate change

U.S. ENVIRONMENTAL PROTECTION AGENCY GREENCHILL ADVANCED REFRIGERATION PARTNERSHIP

R744.com

ammonia 21 everything natural

shecco

ATMOsphere faster to market natural refrigerants

hydrocarbons 21 everything natural

Natural Refrigerants Gaining Traction in North American

H-E-B
Austin, TX
R290
Micro-Distributed

Sprouts
Dunwoody, GA
Transcritcal CO_2
Booster

Piggly Wiggly
Columbus, GA
Ammonia/CO_2 Hybrid

Walgreens
Evanston, IL
Net Zero Store,
Geothermal, CO_2

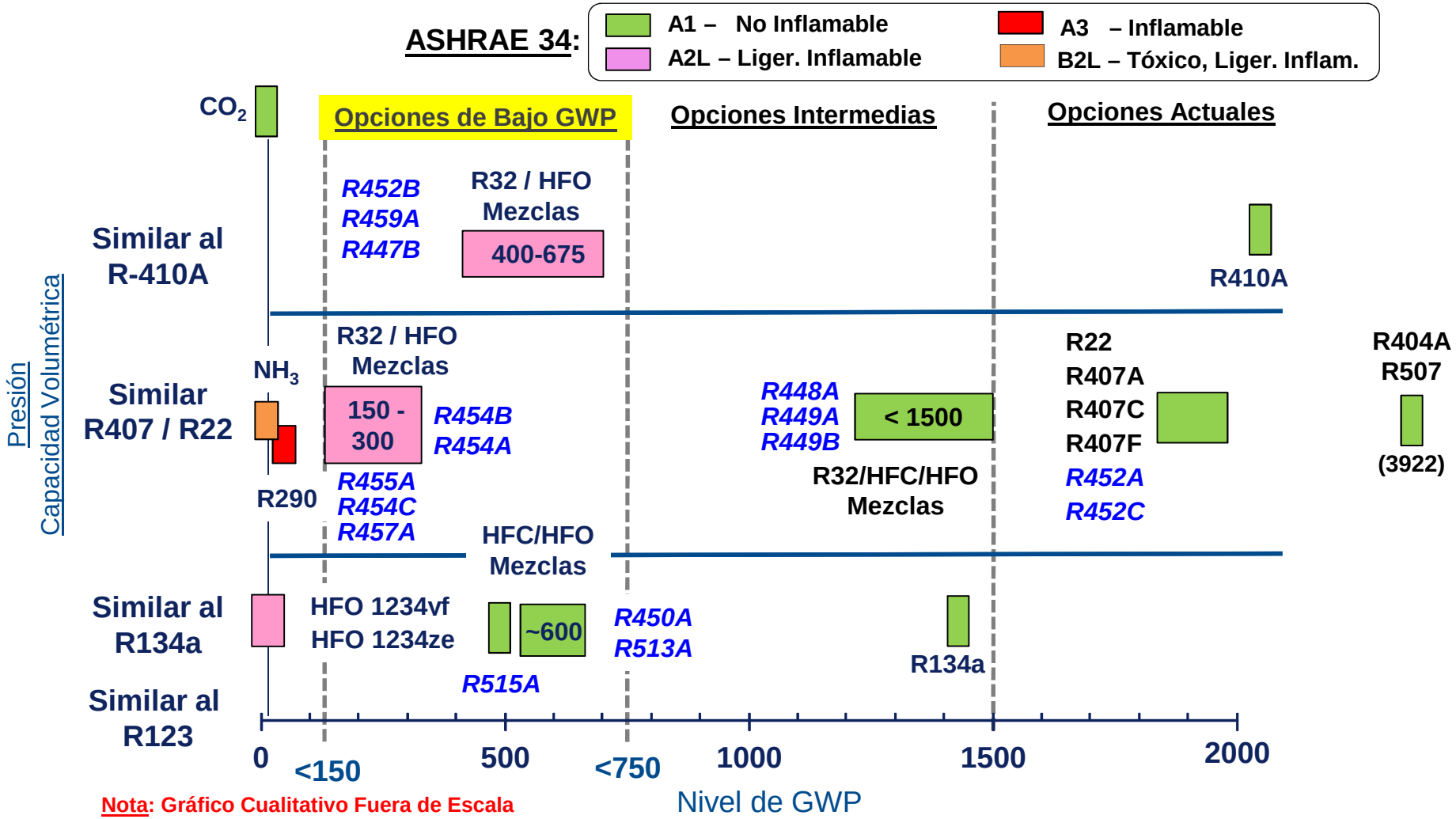
Aldi
Buffalo, NY
Transcritical CO2
Booster & Propane

IGA
Magog, QC
Transcritical CO2
Booster

Whole Foods
Santa Clara, CA
Propane Chiller/CO2
Secondary & Cascade

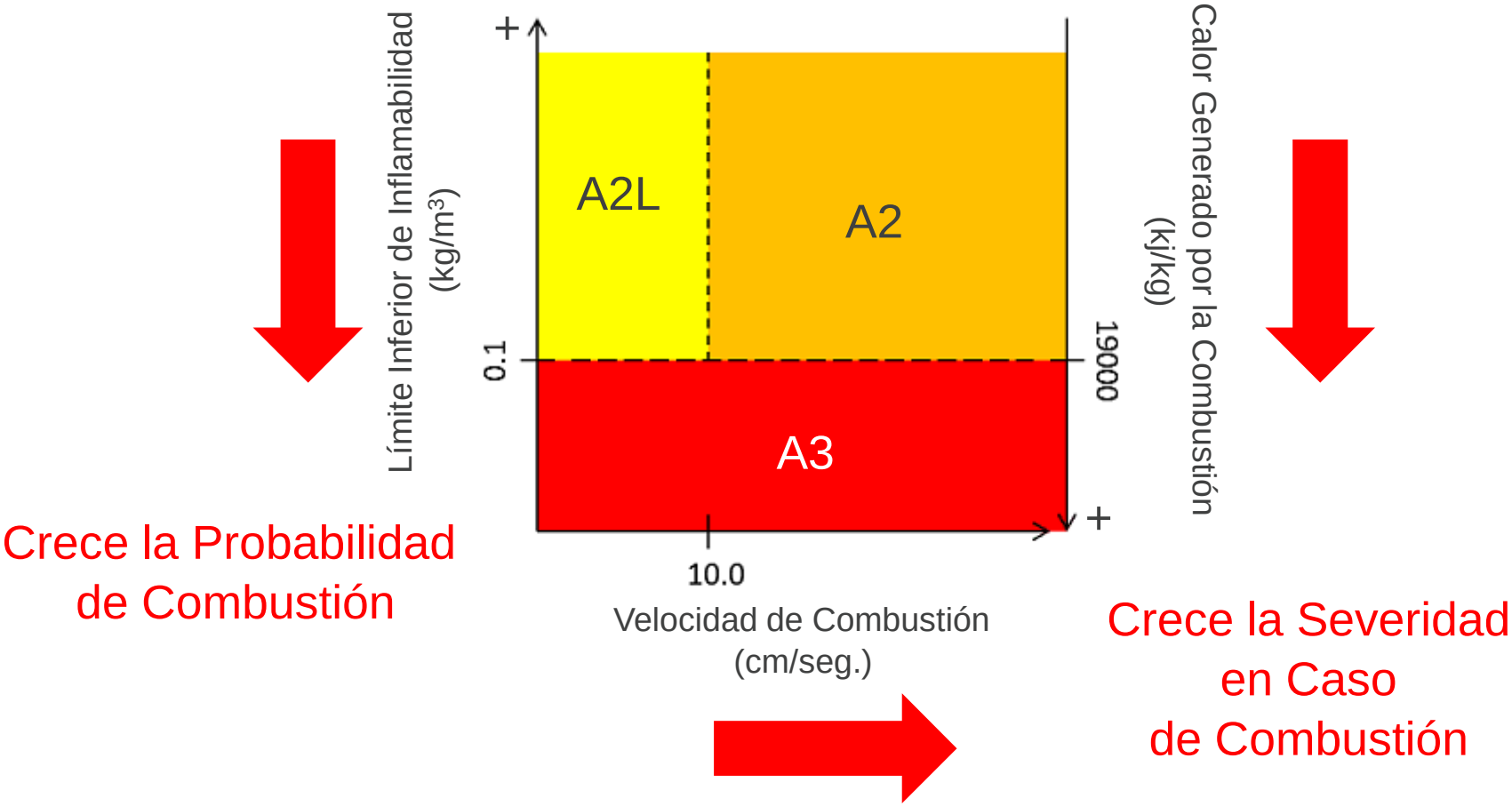
Metro
Montreal, QC
Ammonia / CO2
Secondary

Posibles Candidatos con Bajo Impacto Ambiental Para Refrigeración y Aire Acondicionado



Opciones con Bajo GWP Tienden a Ser Inflamables, Parcialmente Inflamables, u Operan a Altas Presiones

Nivel de Riesgo Para Refrigerantes Inflamables



Referencia: P. Johnson, ASHRAE 2012 Annual Meeting Seminar

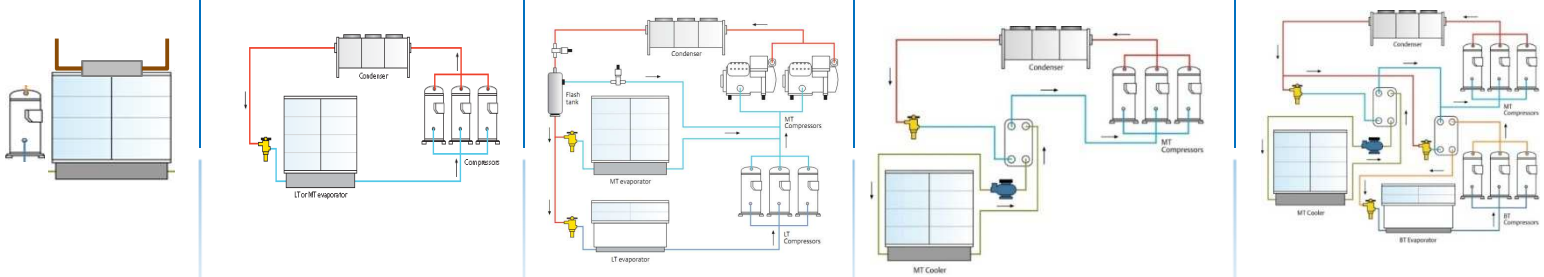
Posibles Candidatos en Aire Acondicionado
R32 vs. Mezclas R32/HFO - R410A Como Base

	R32	R32/HFO	
GWP / Carga de Gas (%)	675 / -20%	670 / -10%	Mezclas de: *R32 + HFC + HFO1234yf*
Diseño del Compresor	Temp. de Desc., Rango de Aplicación, Lubricación	Cerca de Ser un "Drop-In"	Calor generado durante la compresión del R32, aumento en la Temperatura de Descarga (~17°C+)
Eficiencia	~ +2%	~ + 5%	Resultado en ensayos preliminares, reemplazo directo, sin optimización
Inflamabilidad	A2L	A2L	R32/HFO tienen casi la mitad de velocidad de combustión del R32
Costo del Refrigerante		Por Determinar	Estimaciones muestran entre $15 - $20 más para un Split de 3Tn
Costo del Sistema			**R32: Temp. Desc., Prop. Intelectual** **R32/HFO: Costo del HFO**

Algunas Mezclas R32/HFO son Casi un Reemplazo Directo, que Requiere un Trabajo Mínimo de Optimización

System Architecture, Refrigerant Choice And Environmental Conditions Interact

Self-Contained	Small Pack / Condensing Unit	CO_2 Booster	Secondary	Cascade



Refrigerant Charge

System Integration

Service Infrastructure

System Life Cycle

Application Environment

Legislation & Policy

Climate

Evaluación del Impacto Climático Total

LCCP
(Life Cycle Climate Performance)

=

Impacto Directo

+

Impacto Indirecto

Enfoque Holístico:
- Seguridad
- Medio Ambiente
- Rendimiento
- Economía
- **Arquitectura**

- **Fugas de Gas**
- **Carga de Gas**
- **GWP del Gas**

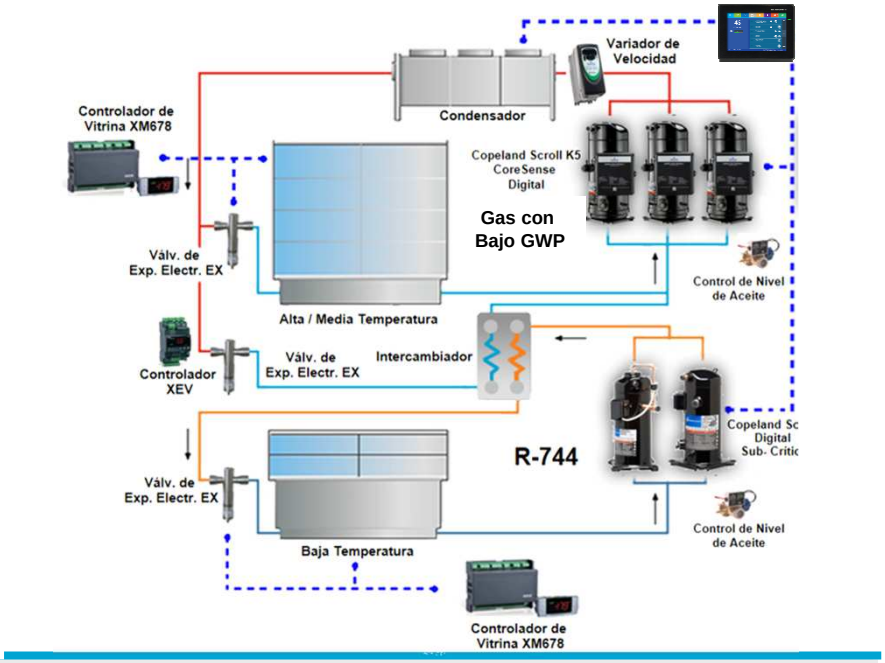
- **Energía Consumida**
- **Recurso Energético**

LCCP: Impacto Climático Total Durante el Ciclo de Vida del Equipamiento, Medido en Masa Equivalente de CO_2

Cualquiera Sea la Solución, Debe Contribuir a Disminuir el LCCP

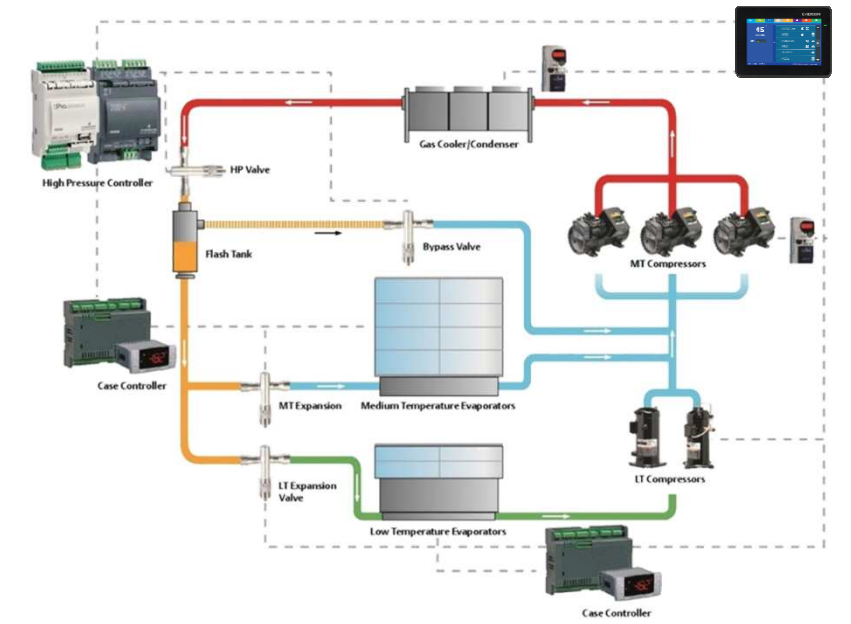
Tendencias en Arquitectura de Sistemas Para CO_2

Cascada (Sub-Crítico)



Presiones Bajas
Dos / Tres Fluidos
Dos / Tres "Loops"
Menor Complejidad
Menor Influencia de la Temperaturas Ambiente

"Booster" (Trans-Crítico)

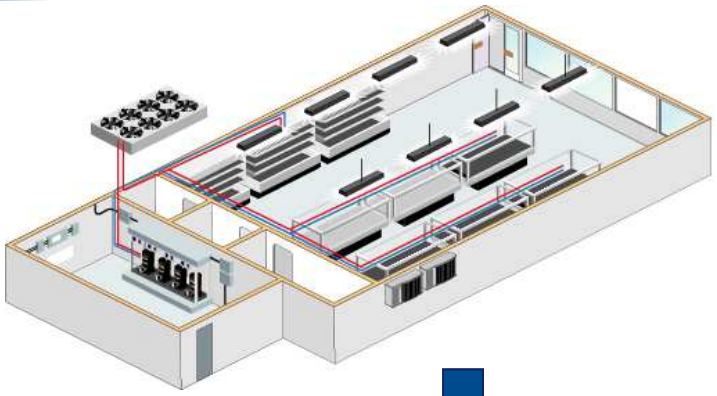


Presiones Más Altas
100% CO_2
Tres "Loops"
Mayor Complejidad
Mayor Influencia de la Temperaturas Ambiente

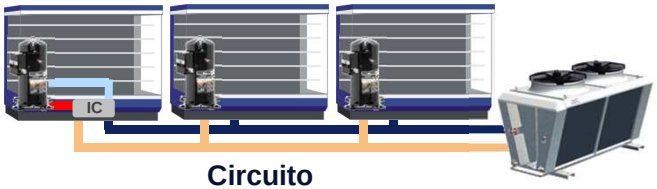
Eficiencia, Complejidad (Instalación, Operación, Mantenimiento), Costo Inicial

Tiendas con Formatos de Conveniencia o Descuento, Favorecen la Reduccion de Craga

Sistema Centralizado Convencional



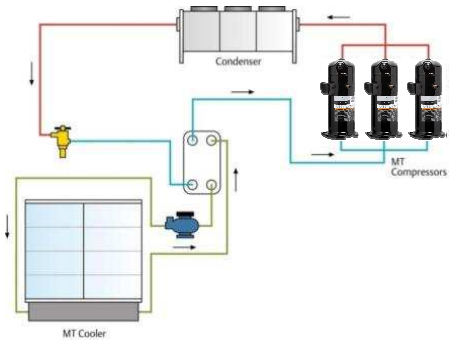
"Micro Distribuido"



Circuito
de Agua

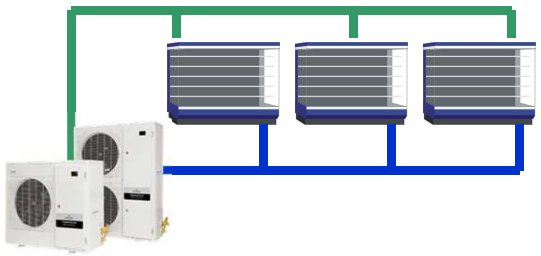
Refrigerantes: HC, HFO, HFC (Bajo GWP)
Aplicación: MT

Ciclo Secundario



Refrigerantes: HC, HFO, HFC (Bajo GWP)
Aplicación: MT (HC) & BT (CO_2)

Unidades Condensadoras



Refrigerantes: HFC (Bajo GWP)
Aplicación: MT / BT

Tipo de Refrigerante, Carga de Gas, Riesgo de Fugas, Eficiencia, Complejidad (Instalación, Mantenimiento), Costo Inicial

THEHELIX
INNOVATION CENTER

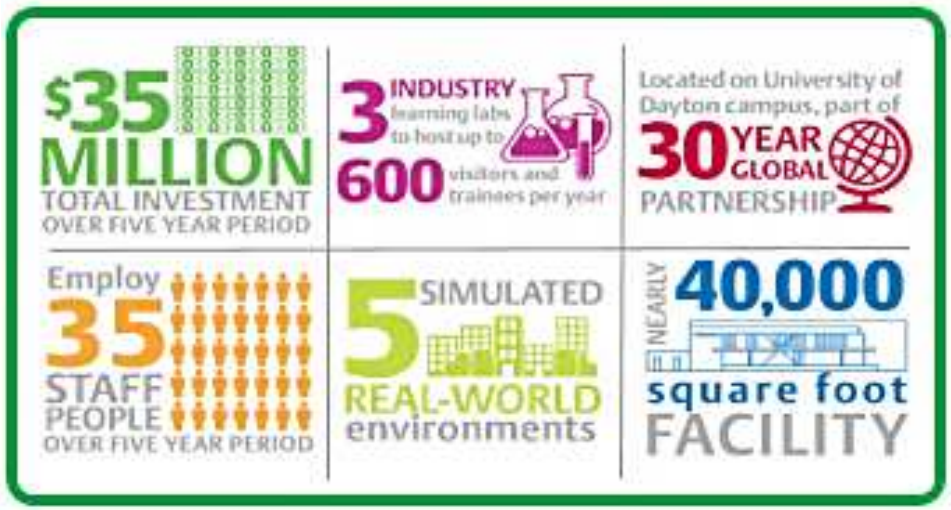
Dayton, Ohio, Estados Unidos

¿Qué es “The Helix”?

Es un centro de innovación que fomenta un ambiente académico y de colaboración para la industria. Se dedica a promover la investigación y la educación en tecnologías avanzadas para calefacción, ventilación, aire acondicionado y refrigeración

Los Módulos

El centro cuenta con ambientes interactivos reales, o módulos, diseñados para estimular la innovación y avances tecnológicos en los hogares, edificios comerciales, supermercados, restaurantes y centros de cómputo



AA Residencial | AA Comercial | Centro de Cómputos | Servicio de Comidas | Supermercado

Generación de Ideas, Colaboración, Innovación, Para Enfrentar los Desafíos Tecnológicos por Venir

Los Próximos Tres Años Definirán un Período Dinámico de Cambios en la Historia de Nuestra Industria

La Industria Intentará Hacer un Balance Entre Estas Cuatro Variables