Ingersoll Rand crowned climate leader

Posted on Wednesday, March 9, 2016 · Leave a Comment

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USA: Ingersoll Rand, with its brands Thermo King transport refrigeration and Trane air conditioners, was today recognised for its refrigerant phase-out efforts by the US EPA.

CLIMATE LEADERSHIP AWARDS

Ingersoll Rand was presented with an Organisational Leadership Award by EPA Administrator Gina McCarthy at the 2016 Climate Leadership Conference in Seattle today. Ingersoll Rand was one of 17 organisations from across America recognised at the event.

Singled out for praise was Ingersoll Rand's greenhouse gas emissions reduction goal of 35% by 2020 and its commitment to reduce the climate impact of the refrigerants used in its products by 50% by 2020. This includes its EcoWise portfolio of products combining low global warming potential refrigerants with high efficiency operation.

Through collaborations with external organisations, Ingersoll Rand also contributed to the 2003 Industry Genius book, the 2007 Adjustment to the Montreal Protocol accelerating the HCFC phase out, and the pending Amendment to the Montreal Protocol to phase down HFCs.

Ingersoll Rand also partnered with the refrigerant manufacturer Chemours to develop R452B a next-generation, low-GWP refrigerant that is design-compatible with R410A.

1938	World's first direct-drive, hermetic, multi-stage, centrifugal water chiller with first generation refrigerant R-113.
1981	The first three-stage, direct-drive centrifugal chiller with the most efficient refrigerant R-11.
1992	Stratospheric Ozone Protection Award for R-123 CenTraVac.
1993	EarthWise™ CenTraVac™, the world's most efficient lowest-emissions chiller.
1995	Wisconsin Society of Professional Engineers Award for New Products.
1998	Climate Protection Award.
2000	Energy Star® Gold Award.
2002	S-series oil-free EarthWise™ CenTraVac™.
2007	Best-of-the-Best Stratospheric Ozone Protection Award.
2012	First (and only) commercial chiller to earn Environmental Product Declaration.
2013	S-series oil-free, AdaptiSpeed EarthWise™ CenTraVac™.

TRANE

A Commitment to Technology and Environment…

that is proven by time

since 1938

Commitment of other companies

TRANE

Industry backs Obama plans to cut HFCs

Posted on Tuesday, September 16, 2014 - Leave a Comment

White House statement; " *These industry associations and companies are making significant commitments to phase out or phase down their use of HFCs and transition to climate-friendly alternatives, good for the environment and good for business ,"*

AHRI president and CEO Stephen Yurek stated; *"Close to $2bn has been spent by the industry since 2009 researching energy-efficient equipment and the utilization of low-GWP refrigerants," Yurek stated, "and over the next 10 years, the HVACR industry will invest an additional $5bn for R&D and capital expenditures to develop and commercialize low-GWP technologies."*

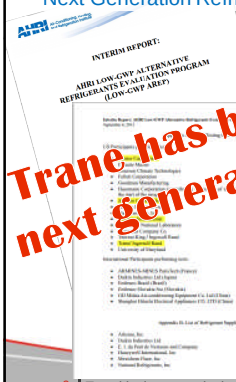
22 companies have committed to cutting HFC emissions by 2020

Carrier	**Carrier,** *announced that its commitment to pursue the commercialization of HFC-free refrigerants in road transportation refrigeration by 2020.*
Danfoss	**Danfoss,** *announced that its championing a stakeholder task force to accelerate adoption of standards and building codes for next generation, low-GWP refrigerants.*
Johnson Controls	**Johnson Controls,** *announced that it commits to using the lowest GWP option for each application that best fits the needs of its customers. It also committed to spend an additional $50 million over the next three years to develop new products and improve and expand its existing portfolio.*
DAIKIN	**Goodman Manufacturing Company,** *commitment to help slash greenhouse gas emissions by developing low-global warming potential (GWP) air conditioners and/or heat pumps. Daikin aims to reduce its greenhouse gas emissions in 2020 to one-quarter of its 2005 emissions.*

Our industry is investing…

TRANE

Next Generation Refrigerant Development

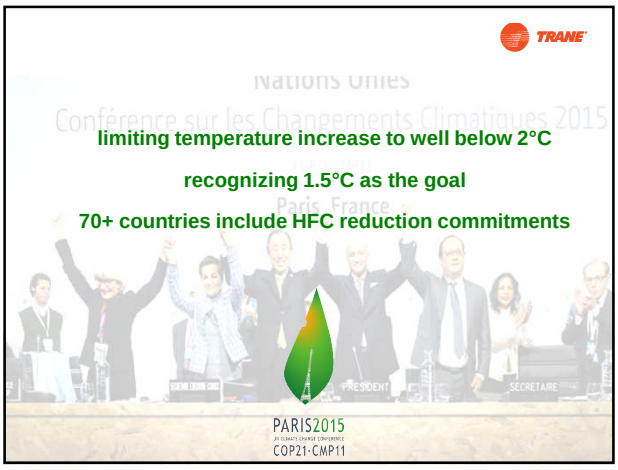


Trane has been leading in next generation chiller R&D

- *Spent US$2 billion since 2009*
- *Invest US$5 billion in the next 10 years*
- Phase I: 2011-2013
  - Tested 30+ Refrigerants
- Phase II: from 2014
  - Testing 20+ More Refrigerants
  - High Ambient Testing


TRANE
Next generation…
WHY?
7 | Transitioning towards the Next Gen Technology


2015
30 Nov – 11 Dec
PARIS2015


TRANE
limiting temperature increase to well below 2°C
recognizing 1.5°C as the goal
70+ countries include HFC reduction commitments
PARIS2015
COP21·CMP11

Montreal Protocol HFC Amendment Agreement

Kigali Amendment – Dubai Pathway on HFCs – Global Transitions Based on GWP

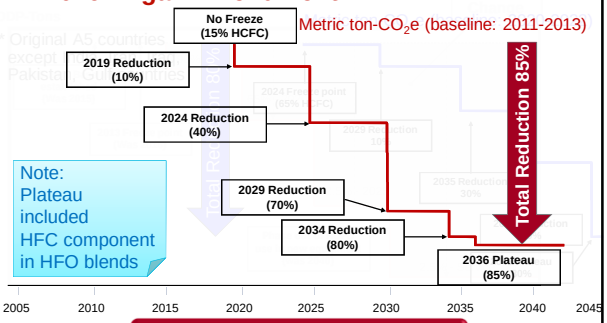
15 October 2016

Nations, Fighting Powerful Refrigerant That Warms Planet, Reach Landmark Deal

KIGALI, Rwanda — Negotiators from more than 170 countries on Saturday reached a legally binding accord to counter climate change by cutting the worldwide use of a powerful planet-warming chemical used in air-conditioners and refrigerators.

Modifies Existing MP Agreement to Globally Coordinate the Phase Down of HFCs

Article 2 Country (developed) Montreal Protocol HFC Cap & Reduction 2016 Kigali Amendment



85% Global Reduction by 2046

US places bans on R404A and R134a

Posted on Tuesday, September 27, 2016 · Leave a Comment

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USA: The US EPA is to ban a host of high GWP refrigerants including R404A, R134a, R407C and R410A in certain new products from as early as January 1, 2021.

The bans are part of wide ranging new rules finalised by the US Environmental Protection Agency yesterday, that will see bans on a number of existing refrigerants and a tightening of leak rate rules to reduce HFC emissions.

Commonly-used high GWP refrigerants R404A and R507A are among a number of refrigerants to be banned in new retail food refrigeration from as early as January 1, 2021, with both also being banned in new cold storage warehouses from January 1, 2023. Also included in the bans are many of the so-called retrofit blends including R407A and R407B.

R134a is one of a number of common refrigerants that will be banned from use in new centrifugal and positive displacement chillers as of January 1, 2024. Others include R407C and R410A, as well as a number of interim "drop-in" blends.

The new rules will also see R134a being banned in new domestic fridges and freezers from January 1, 2021.

Country Specific Plan

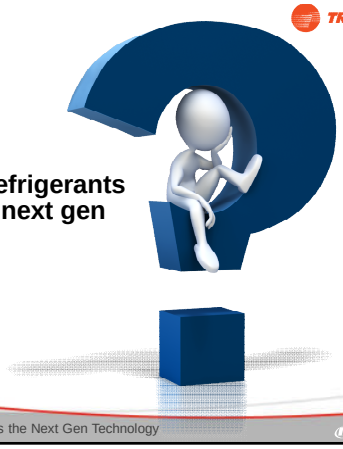
Designated products ※	Present refrigerant (GWP)	Target value (GWP)	Target year
Room air-conditioning	R410A(2090) R32(675)	750	2018
Commercial air-conditioning (for offices and stores)	R410A(2090)	750	2020
Condensing unit and refrigerating unit (for separate type showcases etc	R404A(3920) R410A(2090) R407C(1774) CO_2(1)	1500	2025
Cold storage warehouse （for more than 50000㎥）	R404A(3920) Ammonia (single digit)	100	2019
Mobile air-conditioner	R134a(1430)	150	2023
Urethane foam (for House building materials)	HFC-245fa(1030) HFC-365mfc(795)	100	2020
Dust blowers	HFC-134a(1430) HFC-152a(124) CO_2(1), DME(1)	10	2019

Country Specific Plan

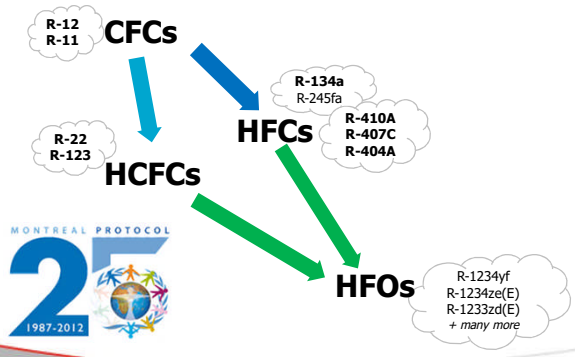
Year	HFC quota
2015	100 %
2020	63 %
:	
2030	21 %

2014 – European Parliament adopted the F-gas Regulation with overwhelming vote in favor
2015 – Established baseline, based on 2009-2012 EU market average
2020 – Remove 37% of bulk supply
2030 – Remove 79% of bulk supply

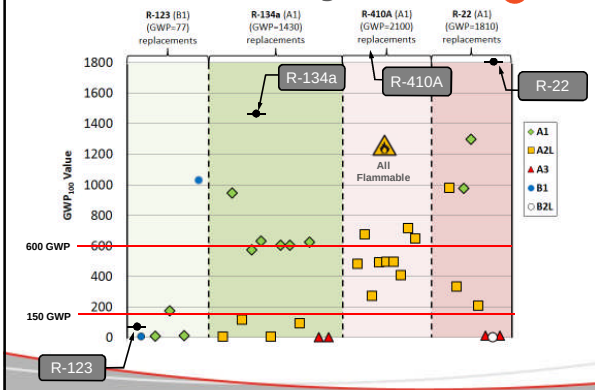
Alternative refrigerants available for next gen products



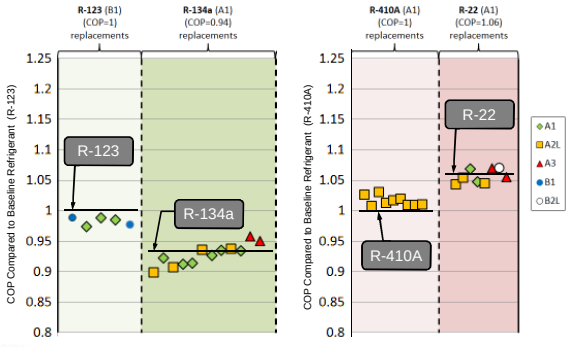
History of Refrigerant Transitions



Next Generation Refrigerants

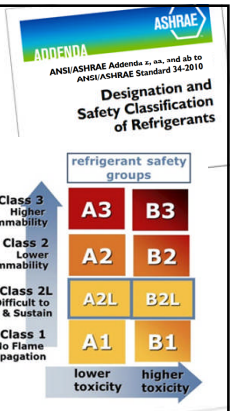


Next Generation Refrigerants

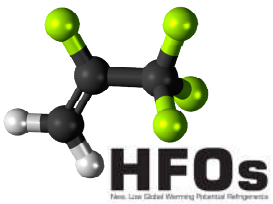


New Class of Flammability

- ASHRAE 2L Flammability Class
  - Created in 2010
  - "Difficult to Ignite & Sustain"
  - Key for Many New Refrigerants
- Current 2L Refrigerants:
  - R-1234yf
  - R-1234ze(E)
  - R-32
  - R-717 (Ammonia)
- 2L Definition Being Evaluated
  - Not all 2L fluids are created equally
  - Burning Velocities of R-32/R-717 higher than the proposed limit of <5 cm/s



Next Generation Refrigerants



- Unsaturated fluorinated fluid:
  - Performance characteristics similar to HFC/HCFC
  - Very short atmospheric life
  - GWP vs flammability
- Commercialized products:
  - R1234yf, GWP <1
    - Automotive "drop-in"
    - Atmospheric life = 14 days
    - Slightly flammable (A2L)
  - R1234ze(E), GWP <1
    - Not a drop-in replacement
    - Atmospheric life = 14 days
    - Slightly flammable (A2L)
  - R1233zd(E), GWP ~1
    - Foam blowing
    - Atmospheric life = 26 days
    - Non-flammable (A1)
  - R1336mzz(Z), GWP 8.9
    - Foam expansion
    - Atmospheric life = 24 days
    - Non-flammable (A1)

Application Considerations

Major Product Categories

- Scroll and reciprocating compressors
  - Smaller equipment, 100 tons and below

- Screw compressors
  - Medium size equipment, 100-450 tons
  - Used on medium and large commercial applications
- Centrifugal Compressors
  - Large equipment, 300+ tons
  - Used on large commercial/industrial properties

Application Considerations

Scroll and Recip Compressors

Current Offering

- **R-22**
  - GWP 1810
  - ODP 0.055
  - Non-flammable
- **R-410A**
  - GWP 2100
  - Non-flammable

Next Generation

R-452B (HFO blend)
- GWP 676
- R410A "drop-in"
- 2L, BV 3.0 cm/s, MIE 200 mj

R-32
- GWP 675
- New design
- 2L, BV 6.7 cm/s, MIE 29 mj

R-290
- GWP ~3
- New design
- Highly flammable

Comments:
- Cost sensitive segment
- No non-flammable alternative, safety concerns
- GWP level consensus

Application Considerations

Screw Compressors

Current Offering

- **R-22**
  - GWP 1810
  - ODP 0.055
  - Non-flammable
- **R-134a**
  - GWP 1430
  - Non-flammable

Next Generation

- **R-513A** (HFO blend)
  - GWP 573, non-flammable
  - Performance similar to R134a

R-1234ze (medium pressure HFO)
- GWP <1, 2L flammability
- Efficiency same as R134a
- Capacity loss 10~20%

R-1234yf (medium pressure HFO)
- GWP <1, 2L flammability
- Efficiency loss 4%
- Same capacity as R134a

Comments:
- Low GWP option with flammability concerns
- Higher GWP easy transition

Application Considerations

Centrifugal Compressors

Current Offering

- **R-123**
  - GWP 77
  - ODP 0.02
  - Non-flammable
- **R-134a**
  - GWP 1430
  - Non-flammable

Next Generation

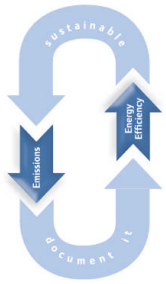
- **R-514A** (low pressure HFO blend)
  - GWP <2, non-flammable
  - Performance similar to R123
- **R-1233zd** (low pressure HFO)
  - GWP 1, non-flammable
  - 10% more efficient than R134a
- **R-1234ze**
  - GWP <1, 2L flammability
  - Efficiency same as R134a
  - Capacity loss 10~20%

Comments:
- Most efficient market segment
- Widespread options by 2020

Best Selection for Environment

Focusing on Emissions and Efficiency is fundamental to doing what's right both for business and the environment.

1. Low ODP
   (Ozone Depletion Potential)
2. Low GWP
   (Global Warming Potential)
3. High operating efficiency
4. Short atmospheric life
5. Low leakage rates



R-123 Remains the Best Option

ENVIRONMENTAL PRODUCT DECLARATION

TRANE CENTRIFUGAL CHILLERS

CENTRAVAC™ CHILLER PRODUCT PORTFOLIO

"EarthWise CenTraVac chiller:
A sustainable product with the papers to prove it."

TheFutureBuild.com

The results: decisively green. EarthWise™ CenTraVac™ centrifugal chiller from Trane is the first (and only) commercial chiller in the world to earn Environmental Product Declaration (EPD) registration, following the requirements of ISO 14025.

Documented green chiller

HK G-PASS scoring for Trane CTV (self-asse

Credit item	Max score	Trane CTV	Description
Energy Efficiency	40	**40**	Highest full load COP = 7.8[a]
Operating Noise	15	**15**	81 ~ 83[b] dBA
Eco-friendly Refrigerant	15	**15**	R123: GWP = 77[c]
Refrigerant Leakage Rate	10	**10**	Annual leakage 0.5%; leak detection by refrigerant monitor
Environmental Management System	5	**5**	ISO 14001
Paint Used	5	**5**	Latest lab test reports
Identification of Lubrication Oil	5	**5**	O&M manual
Recyclability	5	**5**	Re-cycling principle including electronic components
Total score:		**100**	

a) Full load COP rated at AHRI conditions
b) Sound Pressure Levels and Attenuation for CenTraVac Chillers: 60Hz and 50 Hz, refer to Trane literature CTV-PRB012D-EN
c) GWP(100-year) data from IPCC 2007

TRANE

Trane offers the right refrigerant for the right product at the right time

Consistent message over time

since 1938

TRANE

Closing Remarks

- Take a balanced approach
  Safety, Environmental Impact, Efficiency
- R-123, R-134a, R-410A, R-407C… are all giving way to the next generation refrigerants
  being commercialized over the years before 2020
- Focus on Equipment not Refrigerant
  Means lower emissions, higher efficiencies, lower cost

There are No Perfect Refrigerants