Residential HVAC Replacement Refrigerants – A Compressor Manufacturer Perspective

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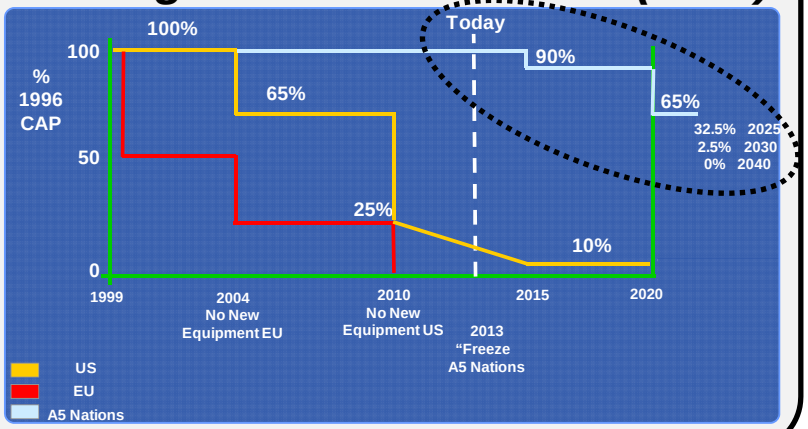
Building America Experts Meeting
FDD & Repair Of Residential HVAC Systems
9/10/13



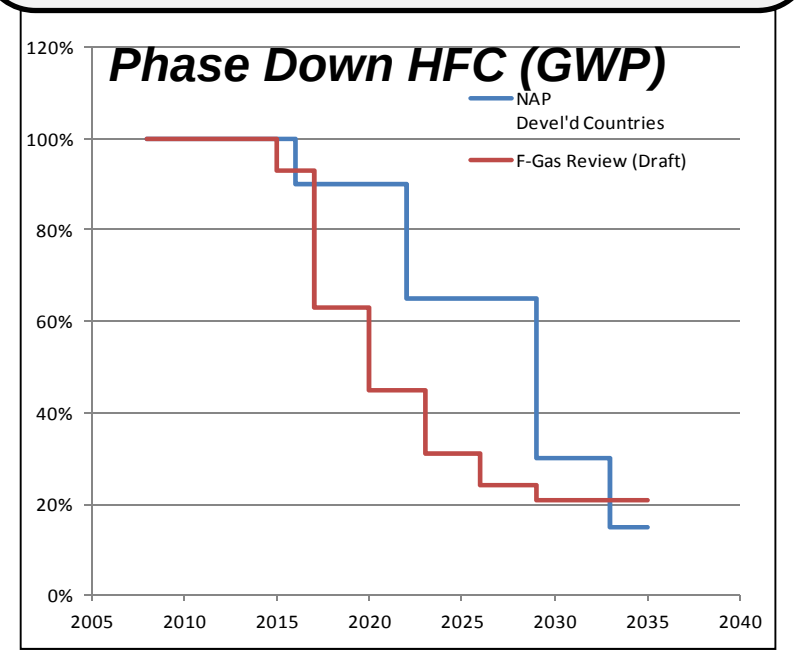


Global Refrigerant Regulatory Activities From R22 Phase Out To HFCs Phase Down

Phasing Out R22 In Service (ODP)



Phase Down HFC (GWP)



North America (GWP Phase Down)

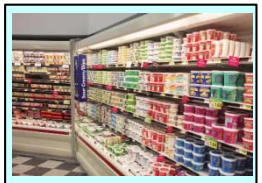
- Voluntary Initiatives To Reduce High GWP HFC Impact
- GWP-Based Phase-Down Effort (North America Proposal) Not Successful So Far

Europe (GWP Phase Down)

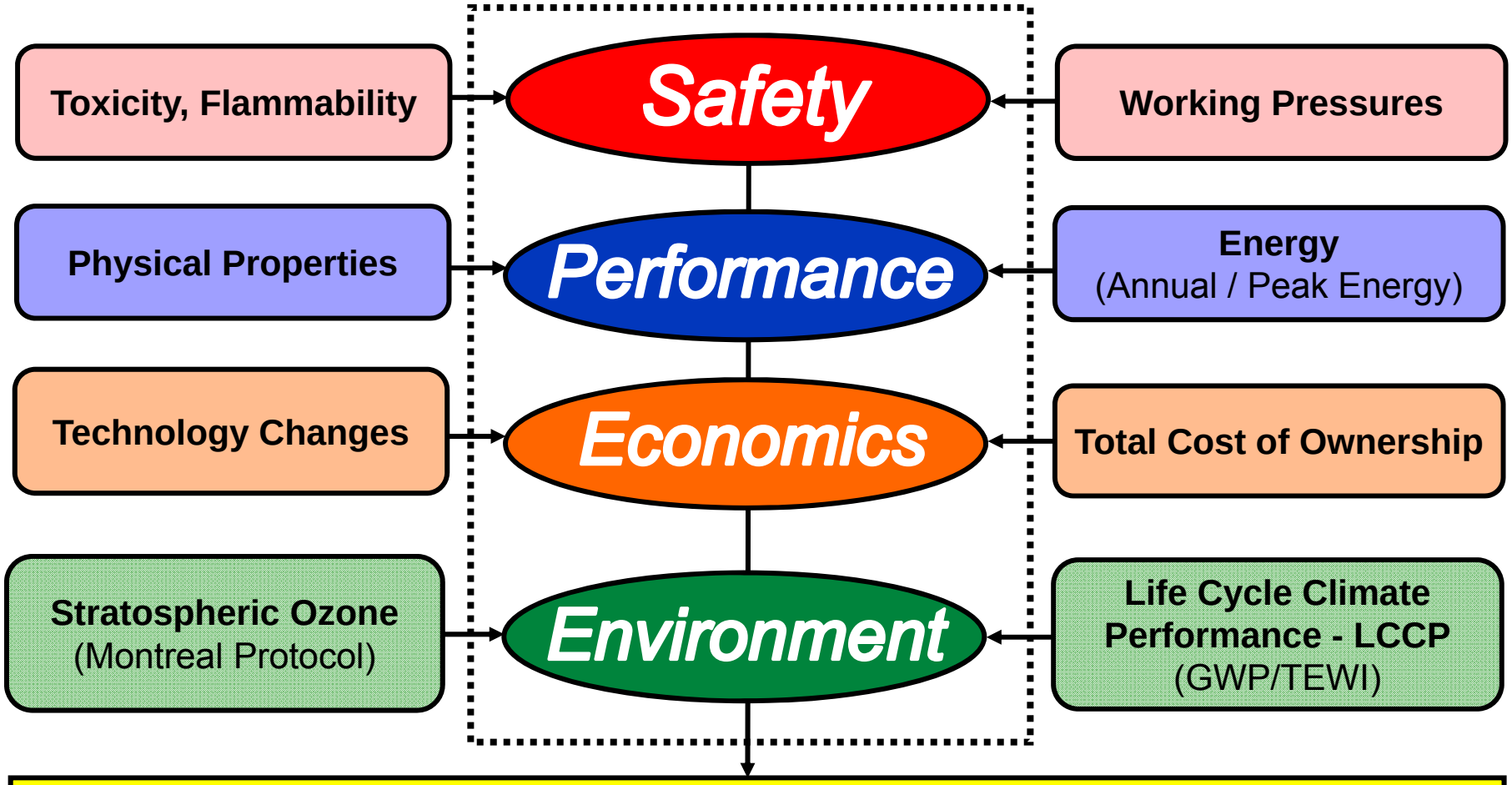
- F-Gas Regulation Under Revision
  - Propose Specific Application Bans On High GWP Fluids (i.e. R404A In Commercial Refrigeration)
  - GWP-Based Phase-Down Is Also Being Considered

The Refrigerant Applications Landscape

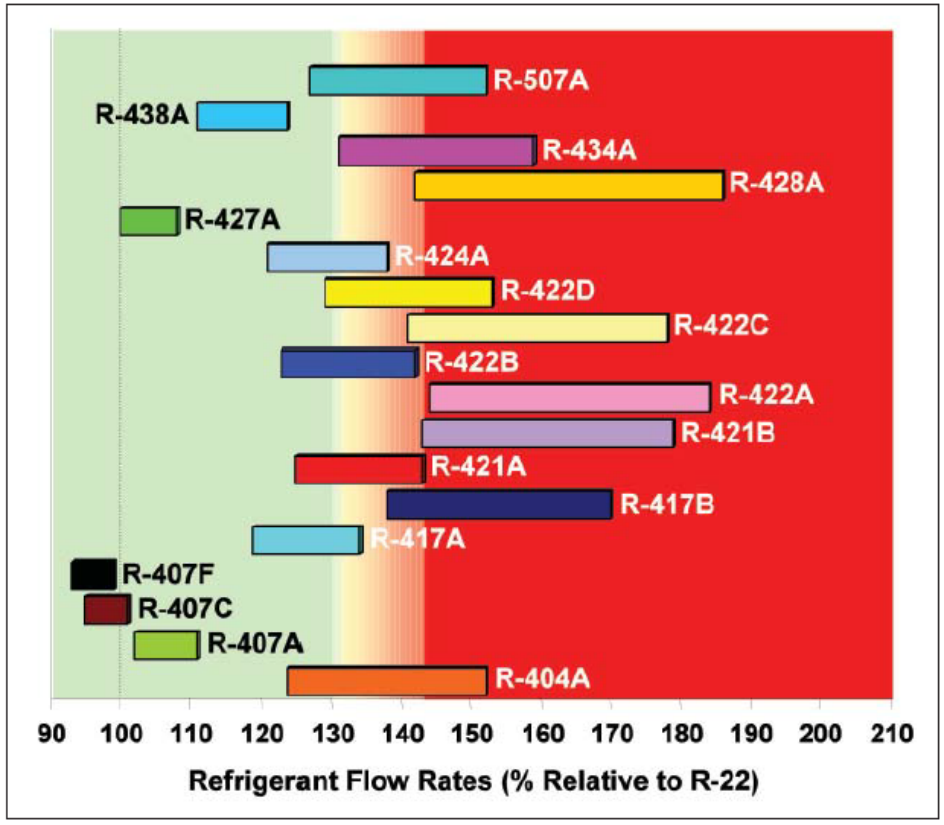
Markets & Geographic Diversity Leads To Refrigerants Proliferation

Markets	 **Industrial**	 **Transport**	 **Refrigeration** ***Food Retail***	 **Refrigeration** ***Foodservice***	 **A/C** ***Commercial***	 **A/C** ***Residential***
Common Refrigerants	**NH_3 R134a R404A/507 R22, R290**	**R134a R404A**	**R404A/507 R407A, R22 R134a CO_2**	**R404A/507 R407A, R22 R134a R290**	**R410A R407C R22 (R32 – Asia)**	**R410A R22 (R32 – Asia)**
Common Compressor Technologies	 **Screw Reciprocating**	 **Scroll Units**	 **Semi-Hermetic Scroll**	 **Hermetic Scroll Units**	 **Scroll Hermetic Semi-Hermetic**	 **Scroll Hermetic Rotary**

Holistic Approach To Refrigerant Selection
Avoid "Unintended Consequences"



Lots Of Variables To Consider In Evaluating R22 A/C Retrofit Candidates



"Refrigerants For R22 Retrofits" By Stephen Spletzer And Gus Rolotti Contracting Business, 2011 (Medium Temperature Application Example)

- **Pressures & Temps & Mass Flow**
  - Minimize Flow Control Change
  - Superheat Set Point Adjustment
- **Capacity**
  - Operating Comfort At Max Ambient
- **Reliability**
  - Oil Circulation & Management, Discharge Temp
- **Component Changes**
  - Compressors, Expansion Device, Filter Driers, Gaskets, O-Rings, Oil
- **GWP**
  - Retrofit With Higher GWP Candidates May Face Future GWP Phase Down

R22 A/C Retrofit Options

Emerson Position On R22 Retrofits:

- **Use Of HFC Refrigerants With 100% Mineral Oil Is Not Broadly Approved By Emerson on Copeland Brand Compressors**
  - Not UL Recognized
  - Oil Return/Lubrication Not Proven
  - Very Costly Approval Process – Too Many Candidates
  - OEM Has Final Say, Could Impact OEM Extended Warranties
- **R22 Retrofit Scenarios**
  - Scenario #1: Compressor Replacement & Refrigerant Retrofit (R407C/POE)
  - Scenario #2: Dry Charge Unit, Alternatives To Use Vs R22 (R407C/POE)
  - Scenario #3: Replace R-22 Unit W/ R-410A Unit & Use Existing ID Coil (R410A/POE)

- Recommend R-410A System Replacement
- If Must Retrofit, R-407C (With POE Oil) Is Approved. Follow AE Bulletin Guidelines
- Each Retrofit Refrigerant Has To Be Approved On A Case-By-Case Basis

Lower GWP Refrigerants Landscape

Options For New & Retrofit Applications

