



UNEP/FECO/CRAA Roundtable

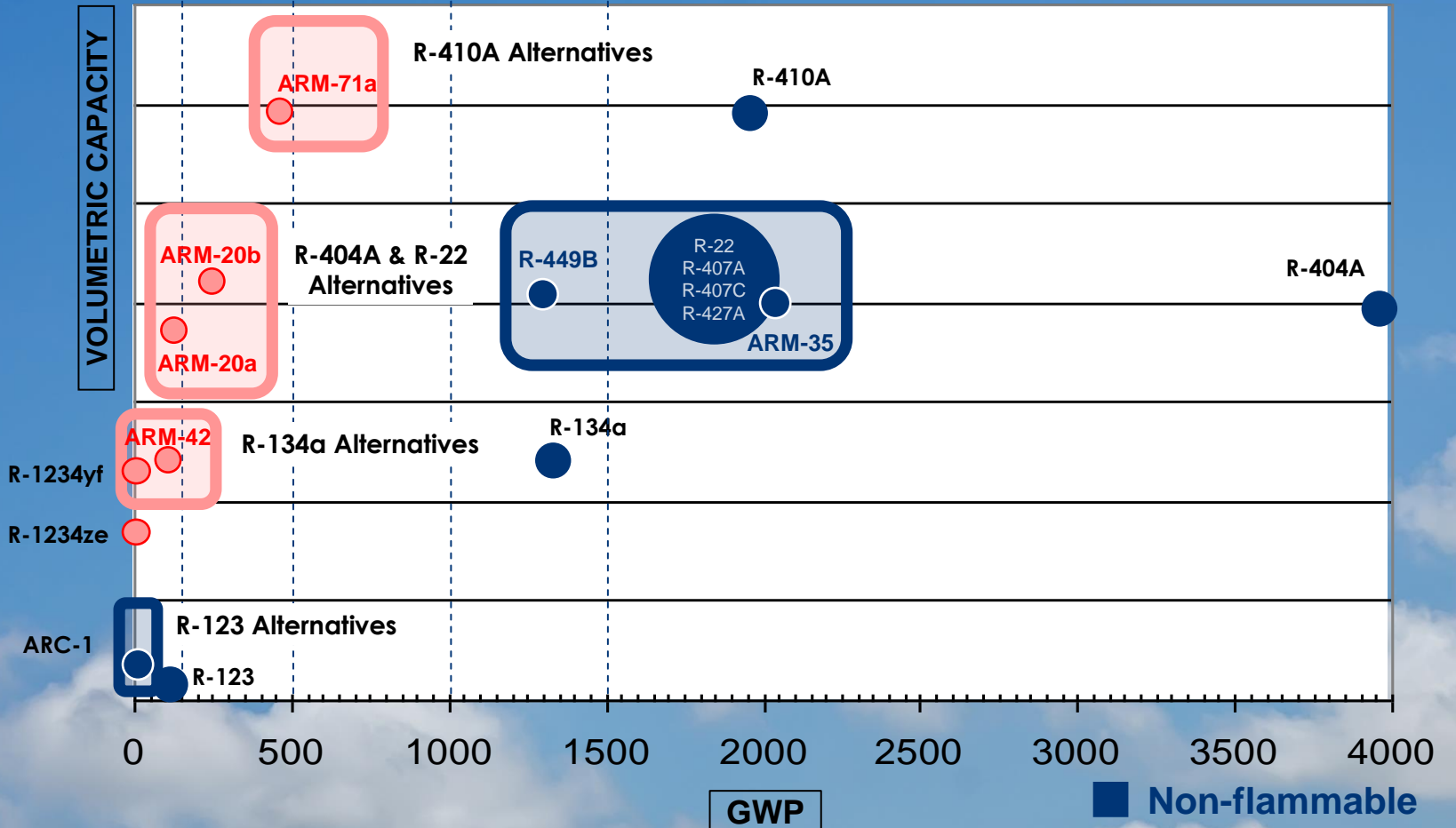
Update on Arkema's Current Portfolio and Next Generation of Materials

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Tomorrow's Low-GWP Refrigerants



GWP on 100-yr time horizon (IPCC AR5)

■ Non-flammable
■ Mildly flammable

Refrigerant Solutions for Tomorrow

<p>Current Refrigerant</p>	 <p>R-123 GWP = 79</p>	 <p>R-134a GWP = 1300</p>	 <p>R-410A GWP = 1924</p>	 <p>R-404A GWP = 3943</p>	 <p>R-22 GWP = 1760</p>
<p>Non-flammable</p>	<p>ARC-1 (GWP < 15)</p>			<p>ARM-35 (GWP < 2100) R-449B (GWP = 1296)</p>	<p>R-449B (GWP = 1296)</p>
<p>Mildly flammable</p>		<p>R-1234yf (GWP = 1) ARM-42 (GWP < 150)</p>	<p>ARM-71a (GWP < 500)</p>	<p>ARM-20a (GWP < 150) ARM-20b (GWP ~ 250)</p>	

GWP on 100-yr time horizon (IPCC AR5)

* R-449B pending ASHRAE public review

R-22 Replacements

Applications

Air conditioning & Heat Pumps



Mid-Temp Refrigeration



Low-Temp Refrigeration



R-22

For the Future

ARM-20

ARM-20a

GWP < 150

- Mildly Flammable
- R-22/R-404A Replacement for new systems

ARM-20b

GWP < 250

- Mildly Flammable
- R-22/R-404A Replacement for new systems

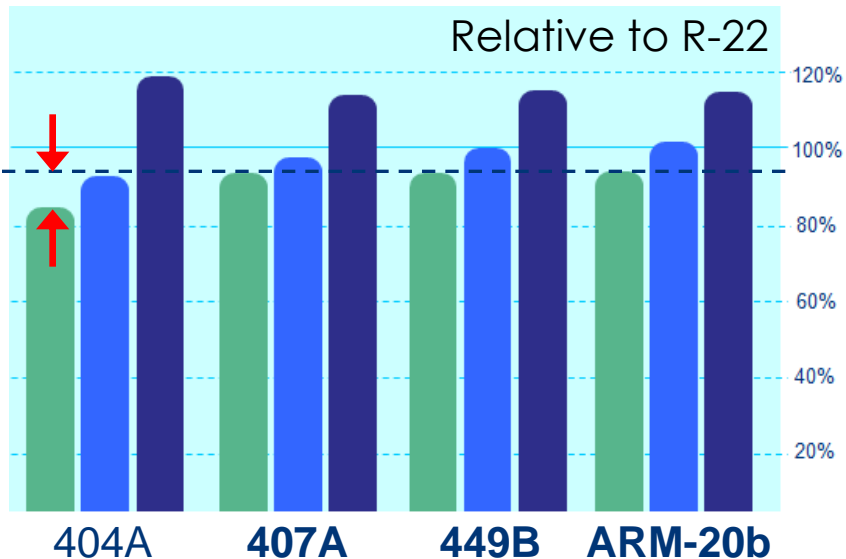
R-22 Replacements

Performance Comparison to Other Options

Refrigeration

ARM-20b

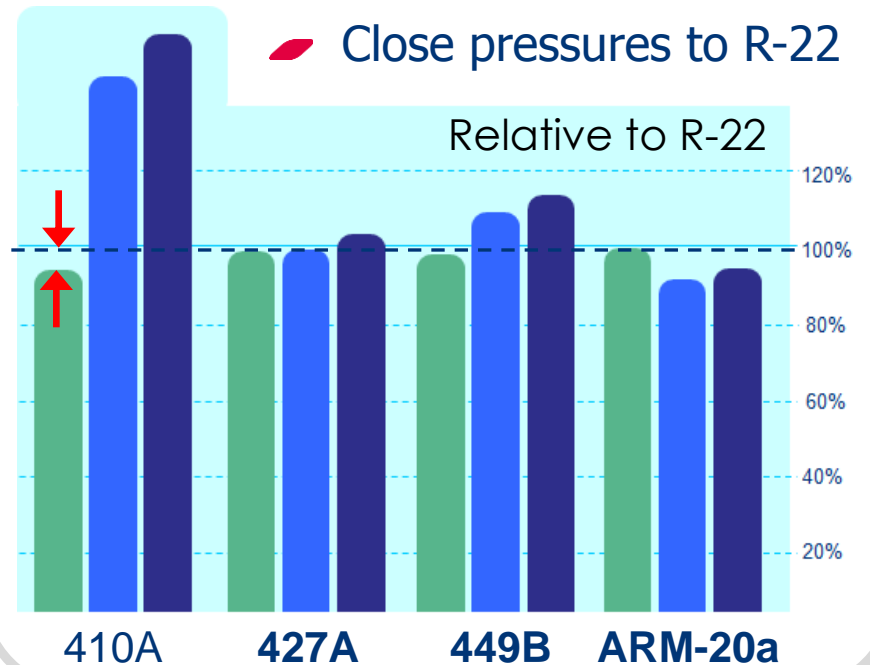
- Higher efficiency than R-404A
- Higher capacity than R-404A
- Closer pressures to R-22



Air Conditioning

ARM-20a

- High efficiency
- Close performance to R-22
- Close pressures to R-22



COP



CAP



P-cond

Summary

- **Evaluating a number of new materials in global testing programs- AREP/EGYPRA**
- **Broadening portfolio to allow for a number of defined solutions in each market sector**
- **Fluids designed to have similar pressure and equal or better performance to minimize equipment changes**
- **Developing solutions in line with market needs and timing**
- **Active in the development of codes and standards to facilitate the safe use of mildly flammable materials**