



Options to HFC's & HCFC's

(Refrigerants & Foam Expansion Agent)

10th July'2015

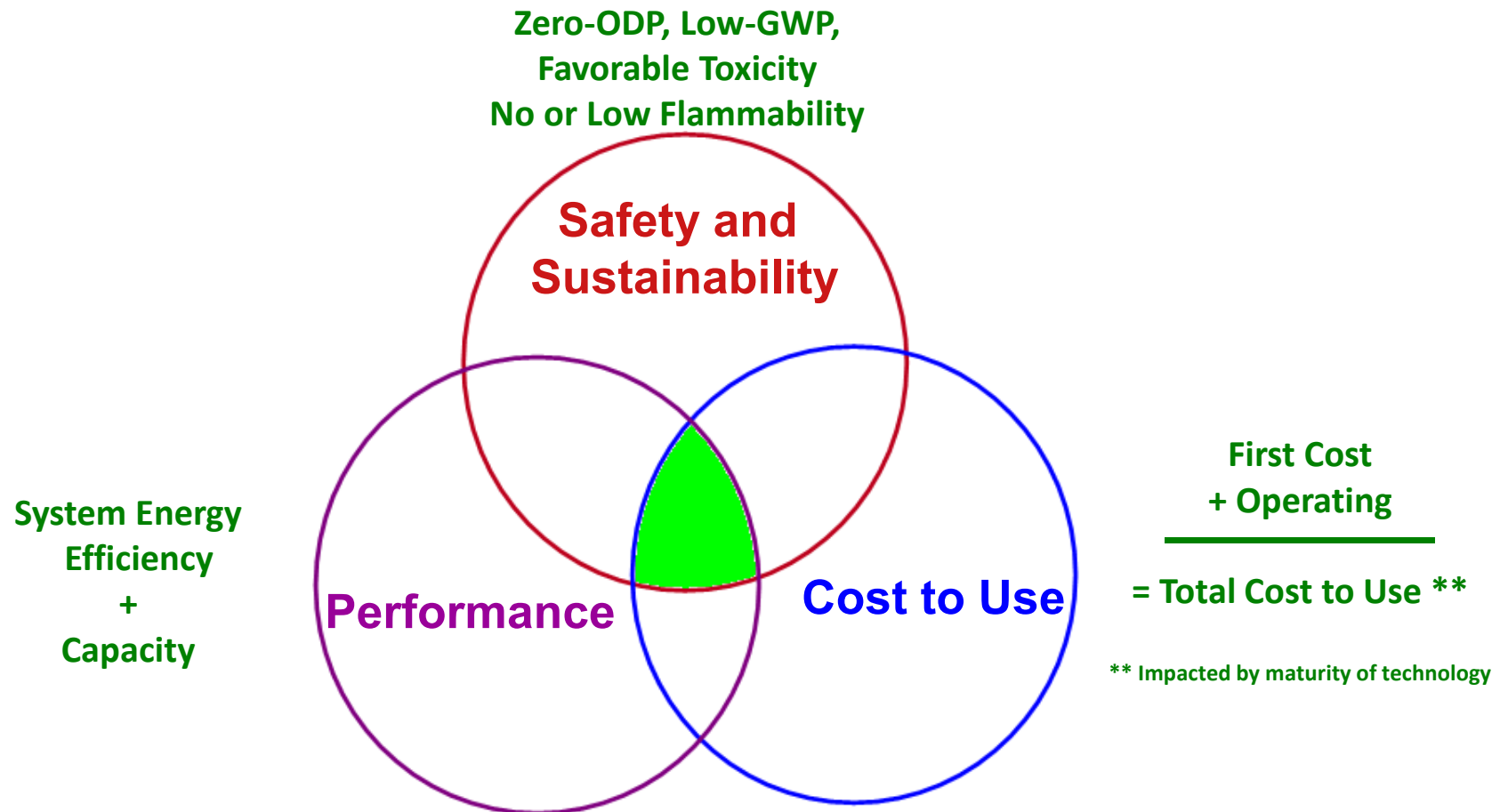
Bhushan Dhonde & Narendra Thakkar

Chemours – Mumbai

Formerly – E. I. DuPont India Pvt. Ltd.

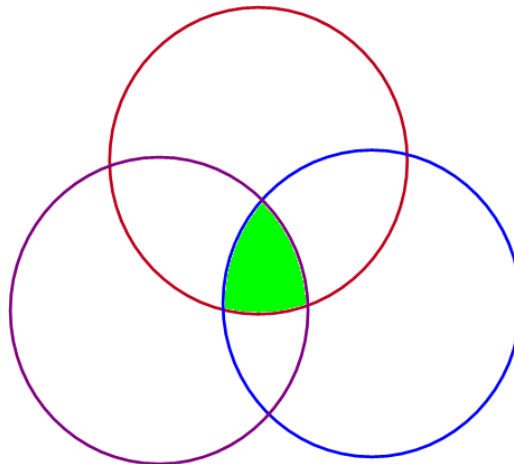
Refrigerant Selection

Best Balance of Properties for each Application



Chemours™ Opteon® Refrigerants

- ❑ The *Optimal* balance of properties
- ❑ GWP reduction over current HFCs
- ❑ Efficient performance
- ❑ Family of products for all applications



Chemours Zero-ODP, Low-GWP Refrigerants for Stationary AC & R

		Leading Lower GWP Candidates – HFO Based			
		Nonflammable		Mildly Flammable	
<u>Current</u>	<u>GWP</u>	<u>Name</u>	<u>GWP</u>	<u>Name</u>	<u>GWP</u>
HFC-134a	1430	XP10	630	YF	1
		DR-14	389		
HFC-404A	3902	XP40	1397	DR-7	246
		XP44	2140		
HFC-410A	2088			DR-5A	460
HCFC-22	1810	DR-91	940	DR-3	150
HCFC-123	77	DR-2	2		

Many Promising HFO Options

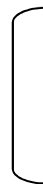
Chemours™ Opteon® Refrigerants Commercial Timing for Stationary AC & R

HFO Production

**Opteon™ yf
(HFO-1234yf)**

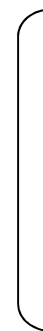


DR-2



Market Development/Demand for Stationary

**Opteon™ yf
&
HFO Blends
(e.g. DR-5,
DR-7)**



2012 2013 2014 2015 —————> 2020

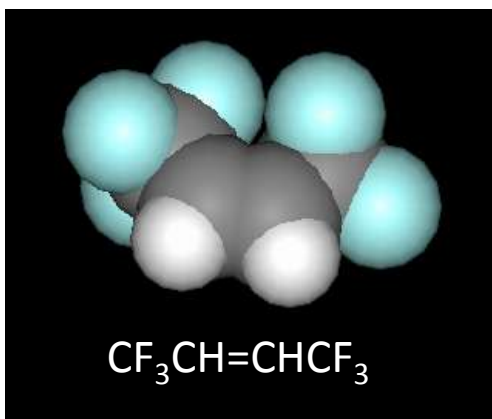
DuPont Confidential



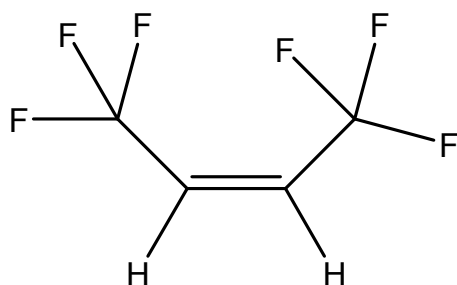
Chemours™

**Update on Formacel® 1100, a Zero ODP,
Low GWP, High Boiling Point Foam
Expansion Agent**

Formacel® 1100: A Next Generation Foam Expansion Agent

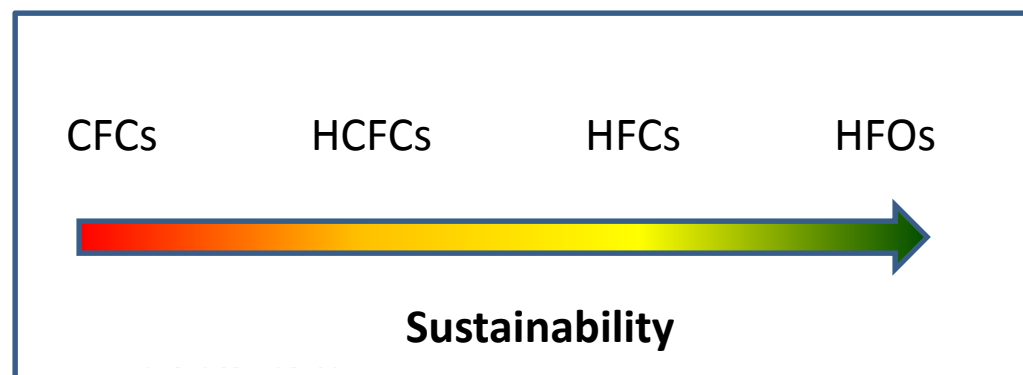


- Ozone Depletion Potential (ODP) = 0 (no chlorine)
- Global Warming Potential (GWP) 100 yr ITM = 2 (AR 5)
- Atmospheric lifetime = 22 days (NOAA)
- Nonflammable (ASTM E 681 at 60 °C & 100 °C)
- Boiling Point = 33 °C
- Vapor Thermal Conductivity $k = 10.7 \text{ mW/mK @ } 25 \text{ °C}$



HFO-1336mzz-Z

a: DuPont Acceptable Exposure Limits (8-12 hr TWA)



Formacel® 1100: Improve Energy Standard

Environment Friendly = **“ZERO”** Ozone Depletion Potential (ODP) :
& Low GWP (no chlorine)



Energy Efficient



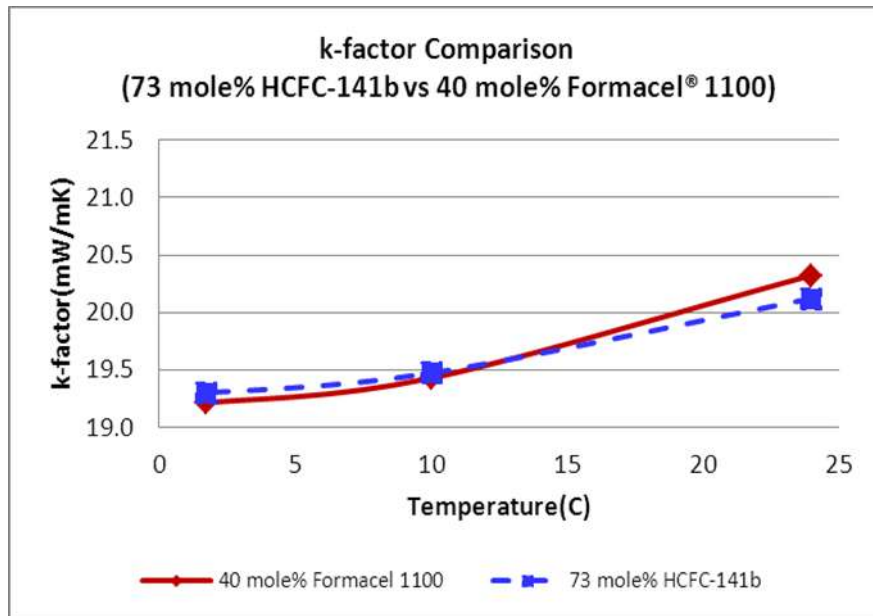
SAFE TO HANDLE = **Non-flammable**

High Boiling Point = **33 °C**



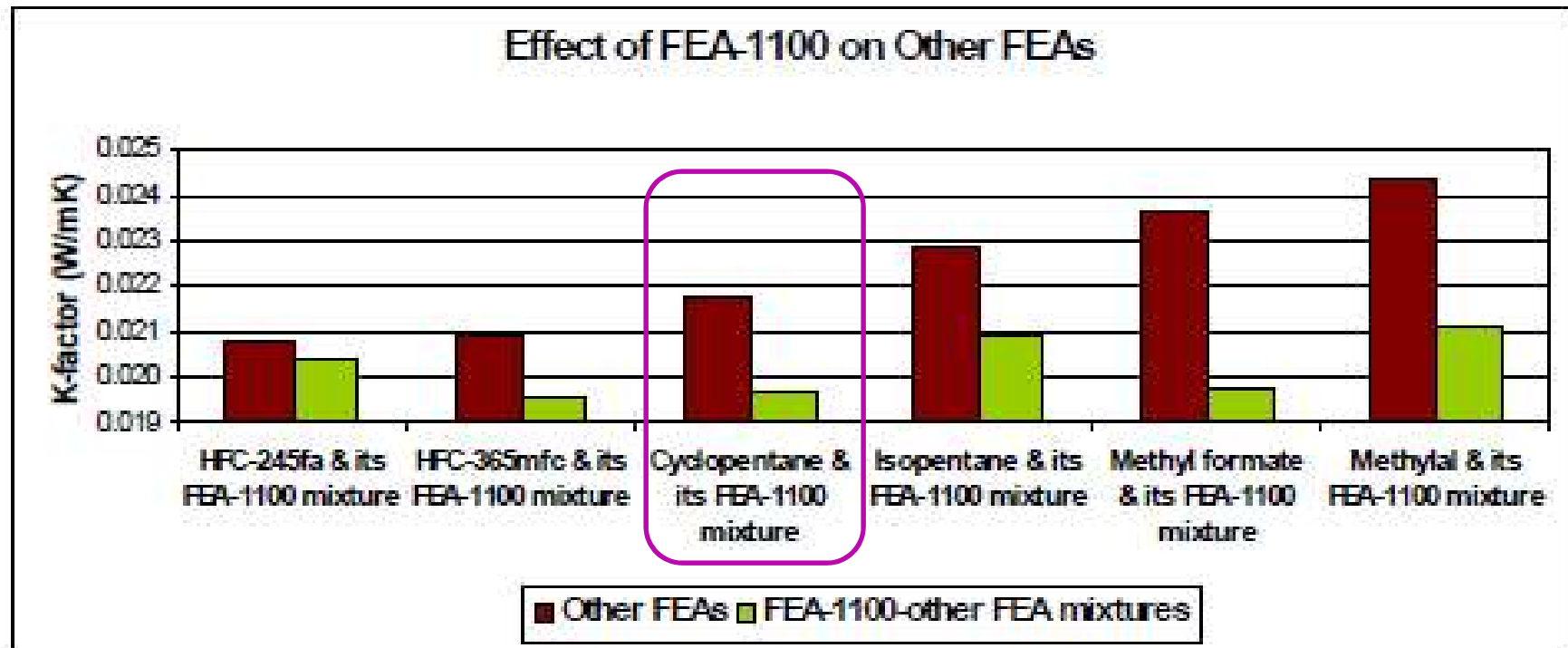
Comparison of Formacel® 1100 at 40 mole% vs HCFC-141b at 73 mole%

- Reduced Formacel® 1100 usage by 23 wt%
- Equivalent k-factor performance at all temperatures



Initial Foam Properties	73 mole % HCFC-141b	40 mole % Formacel® 1100
Density (kg/m ³)	28.8	28.5
k-factor (mW/mK) at 24 °C	20.1	20.3
k-factor (mW/mK) at 10 °C	19.5	19.4
k-factor (mW/mK) at 1.7 °C	19.3	19.2
Relative k-factors		
k-factor at 24 °C	Control	1.0%
k-factor at 10 °C	Control	-0.2%
k-factor at 1.7 °C	Control	-0.4%
Relative FEA Changes		
FEA (weight)	Control	-23%

Blend with other Blowing agents



Summery: HFO: Formacel® 1100

- ❖ Zero ODP and Low GWP blowing agent
- ❖ Non Flammable & High Boiling Point (Easy to Handle &Store)
- ❖ Minimum Vapour loss during process
- ❖ No additional Investment needed (Drop in solution)
- ❖ Lowers “K” Value to make Appliance More Energy efficient.
- ❖ Enables better STAR rating as per BEE norms.
- ❖ Compatible with ABS, HIPS, Steel and Aluminum etc.
- ❖ Technically Proven as tested by many global system house

Thanks



Chemours™