HFO’S IN USE - FEEDBACK FROM END USERS

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Outline

End Users/Operators – What Do They Want?

Case Studies

U.S. Midwest Grocery Chains & R-448A
U.S. Ice Skating Arena & R-449A
Park Cakes’ Cold Storage in UK & R-454A
Zanotti, Italy & R-455A
European Data Center & R-1234ze
Euro Tunnel & R-1233zd

Are We There Yet?

What More Do We Need To Do?
End Users/Operators – What Do They Want?

Few Parts
Easy To Install
Easy To Operate
Easy To Maintain
Simple = Reliable
End Users/Operators – What Do They Want?

Simple

Sustainable

Environment Friendly
Regulatory Compliance
Efficient
Low First Cost
Low Operating Cost
Low Total Cost Of Ownership
End Users/Operators – What Do They Want?

**Simple**

**Sustainable**

**Stable**

Max Uptime
Reliable Operation
Predictable Operation
Works As Designed
End Users/Operators – What Do They Want?

Simple

Serviceable

Sustainable

Stable

Easy To Maintain
Easy To Train Technician
Remote From Customer
Parts Available
Refrigerant Available
End Users/Operators – What Do They Want?

- Safe
- Customer Safety
- Technician Safety
- Stable
- Simple
- Sustainable
- Serviceable
End Users/Operators – What Do They Want?

Simple

Sustainable

Serviceable

Safe

Smart

Easy To Operate
Easy To Maintain
Easy To Diagnose Failure
Self Correcting
“Like a Smart Phone”
End Users/Operators – What Do They Want?

- Simple
- Sustainable
- Stable
- Serviceable
- Safe
- Smart
U.S. Midwest Grocery Chains & R-448A

“The decision to go with a Solstice N40 refrigerant system was easy because it was significantly more cost effective than CO₂.”
— Chris Braun, project manager for Coborn’s

Mr. Roger Schloemann, Festival Foods: “…store service is regionalized and local…therefore any new technology has to be easily learned and serviceable, especially when it is hard to find good technicians…”

- Meet budget constraints
- Offer a lower GWP with regulatory staying power
- Deliver proven refrigeration performance
- Support easy installation
- Ensure easy serviceability and low maintenance
U.S. Ice Skating Arena & R-449A

Mars Lakeview Arena at a Glance
- Privately owned and operated ice skating arena
- Located in Duluth, Minnesota
- Built in 1999
- Provides 3,500 hours of ice time to approximately 120,000 patrons each year
- Serves Division 3 college hockey teams, high school hockey teams, the Duluth figure skating club, and the general public

“XP40 was a great option. I don’t know of a lower GWP option that would have still used as many of the same system components as we did.”
—Justin Zembo, SCR Team Leader

Opteon™ XP40 Properties

<table>
<thead>
<tr>
<th></th>
<th>XP40</th>
<th>HCFC-22</th>
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<tbody>
<tr>
<td>ASHRAE Designation</td>
<td>R-449A</td>
<td>R-22</td>
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<tr>
<td>ASHRAE Safety Classification</td>
<td>A1</td>
<td>A1</td>
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<tr>
<td>Ozone Depletion Potential</td>
<td>None</td>
<td>0.05</td>
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<tr>
<td>Global Warming Potential</td>
<td>1282</td>
<td>1810</td>
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<tr>
<td>Boiling Point at 1 atm</td>
<td>-50.7 °F</td>
<td>-41 °F</td>
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<tr>
<td>Liquid Density at 70 °F, lb/ft³</td>
<td>69.5</td>
<td>75.3</td>
</tr>
<tr>
<td>Lubricant</td>
<td>POE</td>
<td>Mineral Oil</td>
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System has performed as expected since Oct 2017....
Mr. George Walsh, Supply Chain Manager, “....The new building is far better value: delivering same storage capacity from a much smaller footprint....lower running costs and easier access....far more economical....have R454A gas at work, makes a significant contribution to environmental impact”
R-455A, <150 GWP “long-term refrigerant”, A2L,…met and exceeded expectations

“….close working partnership between chemical manufacturer, equipment maker, end use operator, installer and service technician is essential to meet and exceed expectations of customer when converting to low GWP refrigerants,…..”
European Data Center & R-1234ze

Honeywell, EUROCONTROL, and ENGIE Axima collaborated on a new cooling system for EUROCONTROL’s data center, which comprises four Engie Quantum® chillers using Honeywell Solstice® ze refrigerant.

No Room For Downtime
EUROCONTROL provides air-traffic management for up to 36,000 commercial flights per day throughout European airspace. Data center is at the core of EUROCONTROL’s activities and it is essential it is protected with proper cooling. The new system delivers the needed performance while reducing energy costs.

LONG-TERM
Designed to bring energy savings and prevent overheating over two decades.

12+0% REDUCTION
in annual energy consumption

€150,000 saved per year in energy costs

Solstice ze Benefits
- Regulatory compliance
- Energy savings
- Performance
- Reduced carbon footprint

FULL VIEW
The cooling system is integrated into the existing building management giving facility managers a complete view of their infrastructure.
Euro Tunnel & R-1233zd

Honeywell, Trane, and Eurotunnel

Eurotunnel replaced its cooling system with four Trane Series E™ CenTraVac™ large-capacity (2,600 kW to 14,000 kW) chillers using Honeywell Solistica™ zd refrigerant.

Eurotunnel’s bold decision to use the latest generation refrigerants is paying off already.

**BOLD**

**33%**

ENERGY SAVINGS

**ELECTRICITY SAVINGS OF 4.8 GWh**

is equal to the energy needed to run 1,000 typical homes

**9%**

carbon footprint decrease compared to earlier system

**FIVE**

consecutive UK Carbon Trust Standard certifications for sustainability efforts
Are We There Yet? ......Not Quite!

Simple  
Sustainable  
Stable
Serviceable  
Safe  
Smart
There Is Much More To Do.....

The Installed Base Is A HUGE Problem; Yet Most Of Us Spend Time On New!

Refrigerant Management Through End Of Life – Need Education, Sharing Of Best Practices And Strong, Implementable Regulations

A Holistic Approach To Design Yields Greater Benefits Than A Component View; Refrigerant Change Alone Isn’t Enough.....
We have a once in a lifetime opportunity.... need to innovate more, especially systems!

1. What could we LOOK at in a new way or from a new perspective?

2. What could we USE in a new way or for the first time?

3. What could we MOVE, changing its position in time or space?

4. What could we INTERCONNECT in a new way or for the first time?

5. What could we ALTER or change, in terms of design or performance?

6. What could we MAKE, that is truly unique?

7. What could we IMAGINE to produce a great experience?
THANK YOU

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