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?

Simple

Few Parts
Easy To Install
Easy To Operate
Easy To Maintain
Simple = Reliable

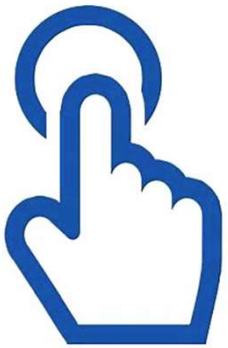
End Users/Operators – What Do They Want?

Simple

Sustainable

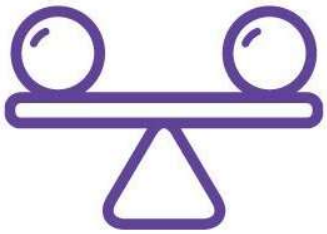
Environment Friendly
Regulatory Compliance
Efficient
Low First Cost
Low Operating Cost
Low Total Cost Of Ownership

End Users/Operators – What Do They Want?



Simple

Sustainable



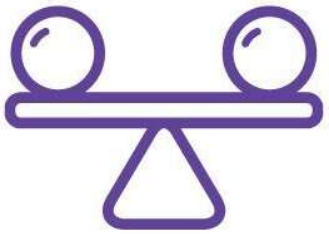
Stable

Max Uptime
Reliable Operation
Predictable Operation
Works As Designed

End Users/Operators – What Do They Want?

Simple

Sustainable



Stable

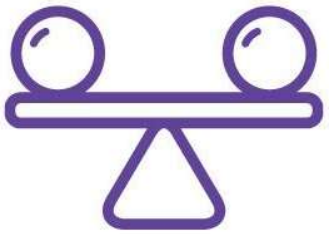
Serviceable

Easy To Maintain
Easy To Train Technician
Remote From Customer
Parts Available
Refrigerant Available

End Users/Operators – What Do They Want?

Simple

Sustainable



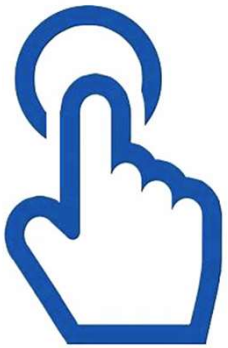
Stable

Serviceable

Safe

Customer Safety
Technician Safety

End Users/Operators – What Do They Want?



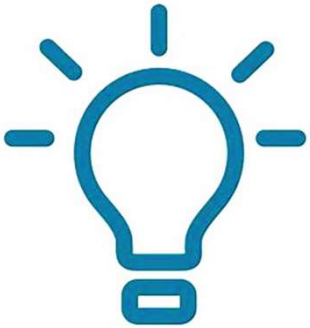
Simple

Sustainable

Easy To Operate
Easy To Maintain
Easy To Diagnose Failure
Self Correcting
"Like a Smart Phone"

Serviceable

Safe



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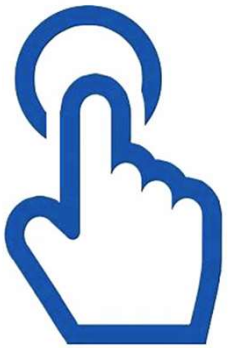
End Users/Operators – What Do They Want?



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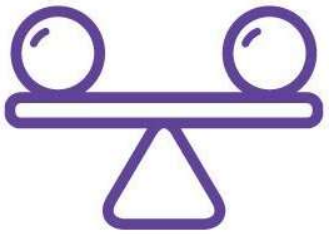

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Serviceable

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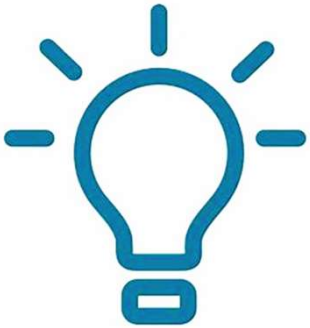

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U.S. Midwest Grocery Chains & R-448A

Coborn's Selects Solstice® N40 for New, Next-Gen Grocery Store

R-448A Refrigerant Offers Lasting, Cost-Effective Solution

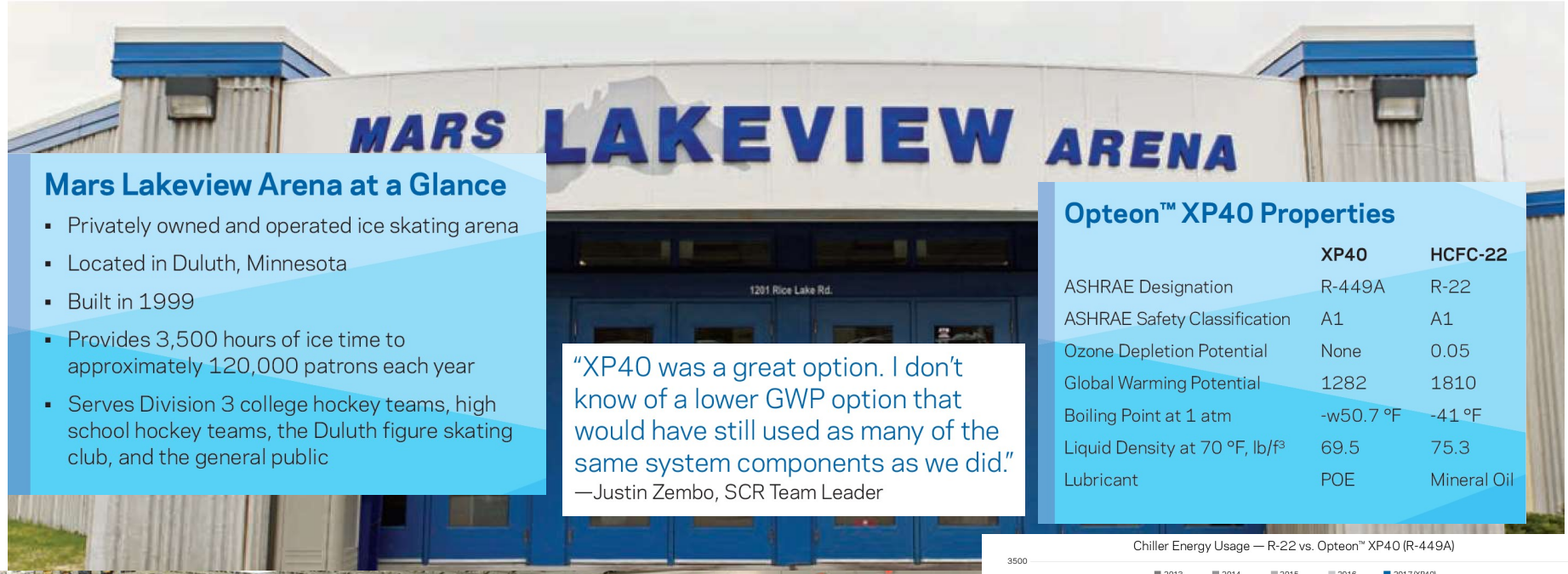
"The decision to go with a Solstice N40 refrigerant system was easy because it was significantly more cost effective than CO_2."

— Chris Braun, project manager for Coborn's

- Meet budget constraints
- Offer a lower GWP with regulatory staying power
- Deliver proven refrigeration performance
- Support easy installation
- Ensure easy serviceability and low maintenance

Mr. Roger Schlomann, 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…"

U.S. Ice Skating Arena & R-449A



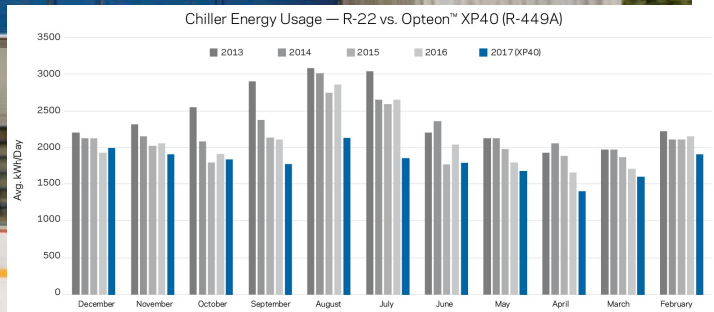
Mars Lakeview Arena at a Glance

- 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

	XP40	HCFC-22
ASHRAE Designation	R-449A	R-22
ASHRAE Safety Classification	A1	A1
Ozone Depletion Potential	None	0.05
Global Warming Potential	1282	1810
Boiling Point at 1 atm	-w50.7 °F	-41 °F
Liquid Density at 70 °F, lb/f³	69.5	75.3
Lubricant	POE	Mineral Oil



Park Cakes' Cold Storage in UK & R-454A

Opteon™ XL40 characteristics

ASHRAE Number	R-454A
GWP (AR4)	239
Boiling point	-48.3°C
Safety classification	A2L
Temperature glide	~ 5K

Table 1: Estimated performance comparison of Opteon™ XL40, R-407F and R-404A

	Opteon™ XL40	R-407F	R-404A
Mean Evaporator Temperature / °C	-29.8	-29.8	-29.8
Mean Condenser Temperature / °C	34.2	34.2	34.2
Evaporator Pressure / bar.g	0.994	0.769	1.048
Condenser Pressure / bar.g	14.75	14.69	14.80
Suction Temperature / °C	-1.0	-1.1	-3.0
Discharge Temperature w/o cooling / °C	105.4	119.8	88.8
Total Liquid Subcooling / K	2.4	2.4	2.4
Evaportaor Inlet Temperature / °C	-32.1	-32.0	-30.1
Evaporator Exit Temperature / °C	-17.5	-17.7	-19.6
Total Suction Superheat / K	26.6	26.6	26.6
Cooling Capacity / kW	20.7	18.4	19.4
C.O.P.	1.81	1.55	1.58

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"

Zanotti, Italy & R-455A

The Needs

In considering the replacement for R-404A, Zanotti established the following key criteria:

- Identify a low GWP refrigerant to replace R-404A in support of its corporate values focused on minimising environmental impact
- Find a solution compatible with current compressor technology
- Fully assess the flammability and safety risks associated with 'worst case' component failures or incorrect handling
- Ensure equivalent system capacity, energy efficiency and performance without the need for any fundamental design change
- Confirm the replacement refrigerant as a long-term, F-Gas-compliant solution, with the potential to extend into other temperature ranges and applications

The Benefits

The tests demonstrated equivalent performance between Solstice L40X and R-404A, with only minor, low cost adjustments.

Solstice L40X:

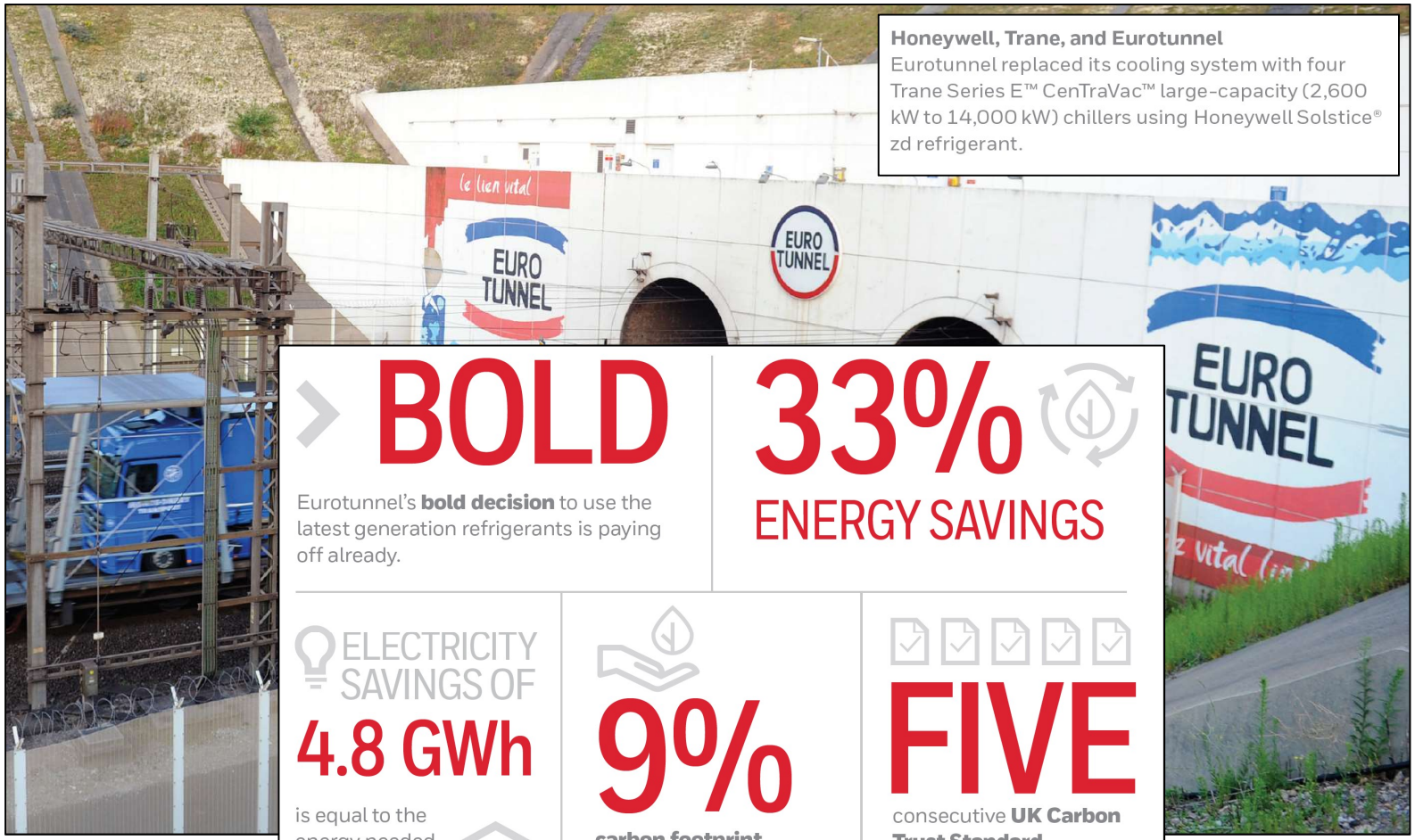
- Presents a very low flammability risk
- Is a long-term refrigerant solution for Zanotti's monoblock range
- Is compatible with current compressor technology
- Matches the cooling capacity and COP of R-404A with the same refrigerant charge
- Provides Zanotti with an F-Gas-compliant (GWP<150) solution and the potential for a significantly decreased Total Equivalent Warming Impact (TEWI) in line with the company's environmental values

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

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 Solstice® zd refrigerant.

BOLD

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

33%
ENERGY SAVINGS

ELECTRICITY SAVINGS OF
4.8 GWh
is equal to the energy needed to run **1,000** typical homes

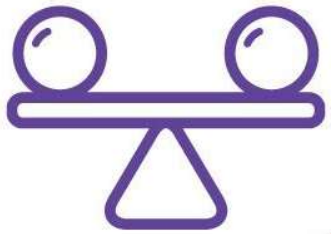
9%
carbon footprint decrease compared to earlier system

FIVE
consecutive **UK Carbon Trust Standard certifications** for sustainability efforts

Are We There Yet? ……Not Quite!

Simple

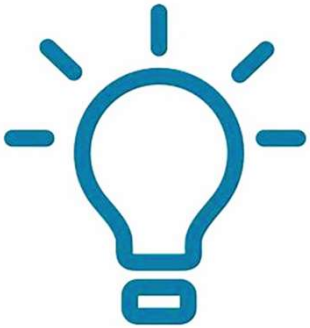
Sustainable ?



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!

Innovation is the art of establishing something different or new out in the real world that has a significant impact.

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?

Autodesk, How to innovate on-demand: A practical guide for making innovative choices on every engineering project

THANK YOU

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