



ATMO
sphere

Market Trends & Opportunities

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Challenges & Opportunities

Global Market Dynamics

- Smaller Retail Formats

- Deep Urban Markets
- Convenience
- Speed of Delivery

- Millennials

- e-commerce
- Clicks vs. Bricks

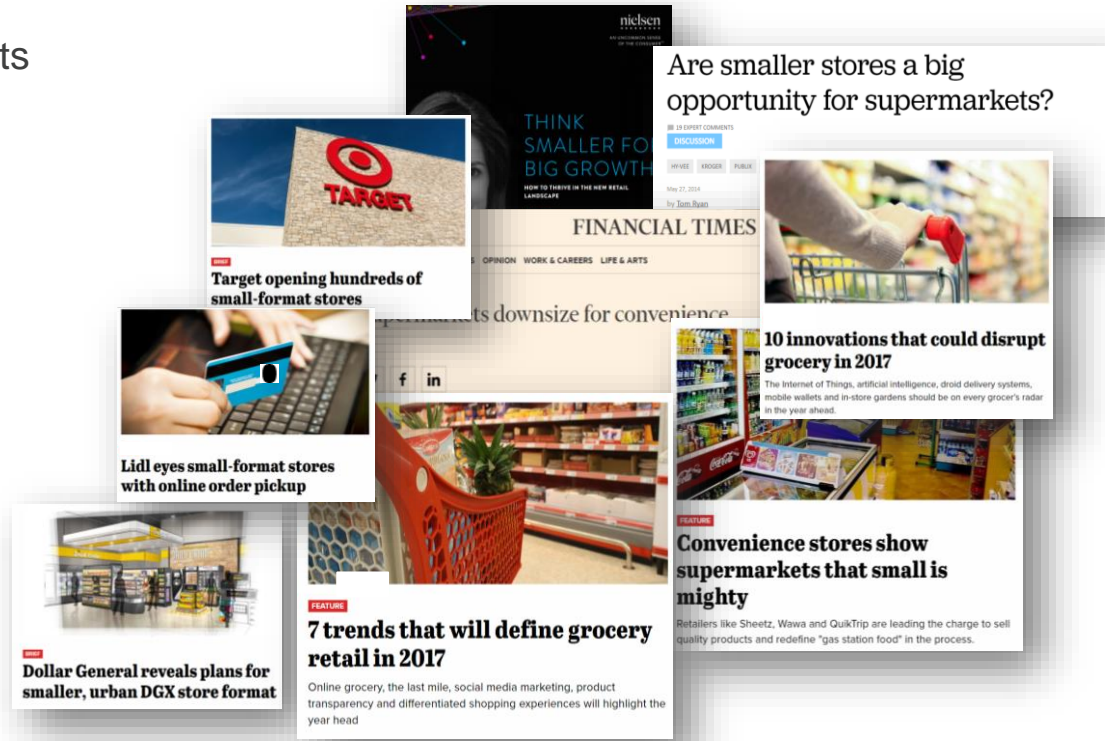
- Fresh

- Buy Local
- Natural and Organic

- Sustainability

- Regulations

- Incentives



Confidence not Perception
will drive NR Adoption

Path Towards Greater Adoption of Natural Refrigerants



CO₂ Energy Optimization Study

What is The Helix Innovation Center?

It is a building which will foster an environment for academia and industry collaboration. The Helix is dedicated to advancing research and education in heating, ventilation, air conditioning, and refrigeration technologies.

The Modules

The center will feature interactive real-world environments, or modules, designed to spur innovation and help advance the technology used in homes, commercial buildings, supermarkets, restaurants and data centers.



Residential
Connected
Home



Light
Commercial
Building



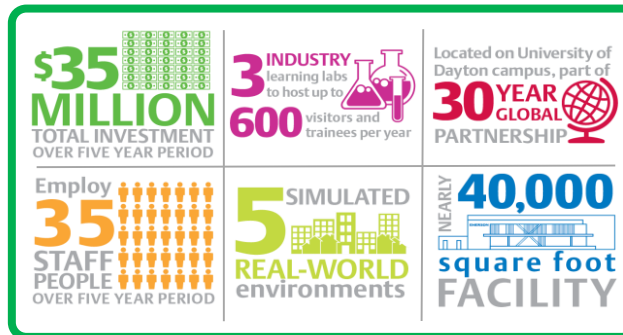
Data Centre
Thermal
Management



Food
Service
Operation



Supermarket
Refrigeration



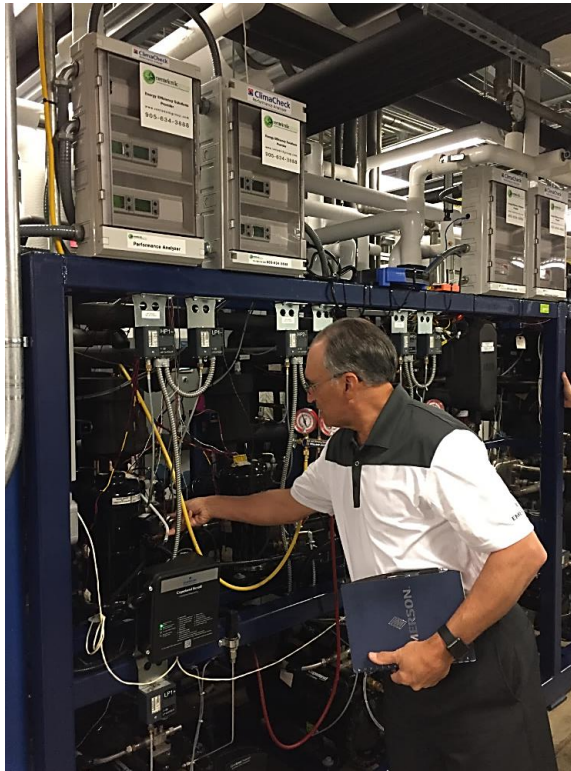
CO₂ Supermarket Refrigeration



Features

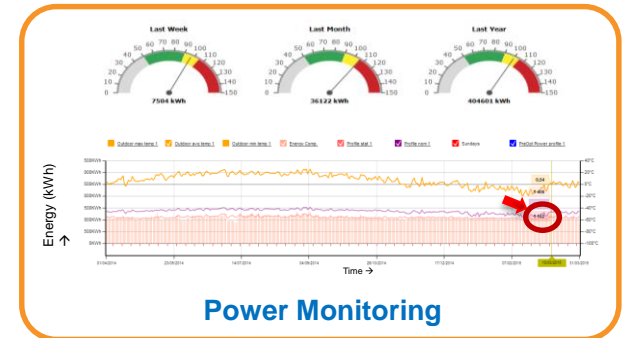
- CO₂ Transcritical Booster
- 2,500 sq. ft. Supermarket
- Humidity and Temperature control
- Condenser located in environment chamber
- Environmentally controlled chamber
 - Temperature: -25 to 125 °F
 - Humidity: 20 to 90%
- Full System Integration, Refrigeration & HVAC

CO₂ Supermarket Refrigeration



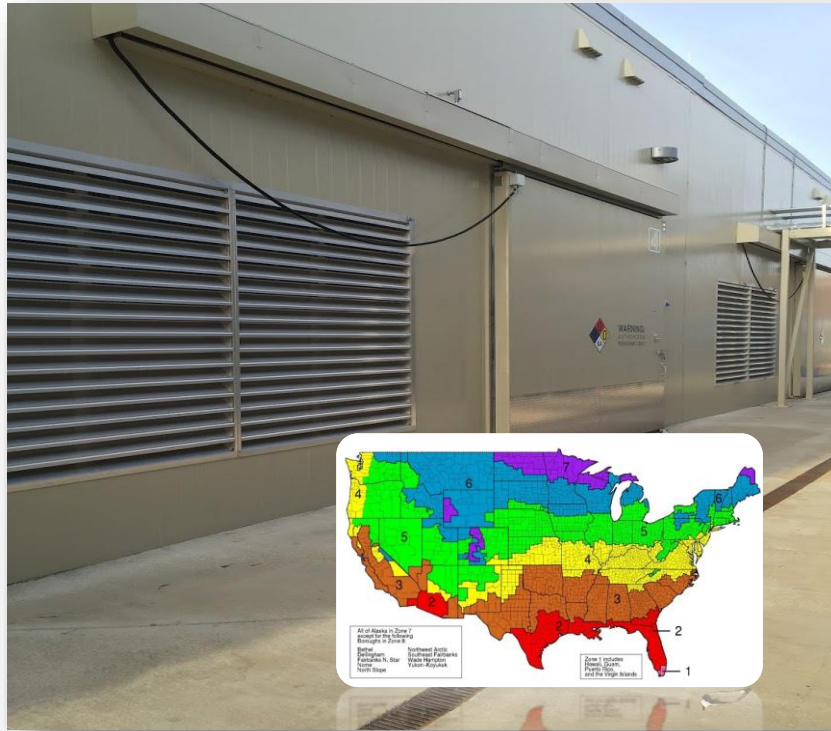
Features

- CO₂ Transcritical Booster
- Parallel Compression
- Dry Gas Cooler
- Adiabatic Gas Cooler
- Mechanical Sub cooling
- Heat Reclaim, Water,
- HVAC, & Snow Melt
- Interrelated A/C
- Gas Ejector



Environmental Chamber

Temperature Range (-25F to +125F Range)



Testing to ASHRAE Climate Zones

Zone Number	Zone Name
1A and 1B	Very Hot - Humid (1A) Dry 1B
2A and 2B	Hot-Humid (2A) Dry (2B)
3A and 3B	Warm - Humid (3A) Dry (3B)
3C	Warm - Marine (3C)
4A and 4B	Mixed - Humid (4A) Dry (4B)
4C	Mixed - Marine (4C)
5A, 5B, and 5C	Cold -Humid (5A) Dry (5B) Marine (5C)
6A and 6B	Cold - Humid (6A) Dry (6B)
7	Very Cold
8	Subarctic

Refrigeration Equipment for Environmental Chambers

175 Ton R134a Chiller



Two 50 Ton CO₂ Cascade Units



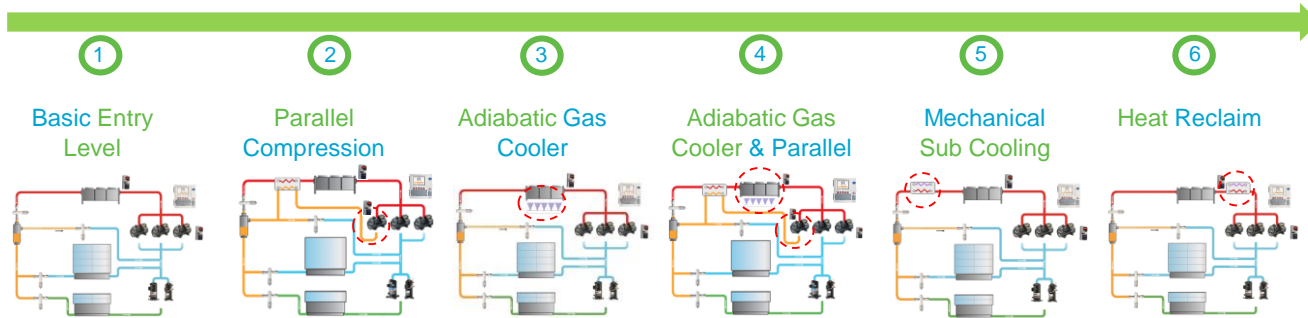
CO₂ Transcritical Booster System



CO₂ Energy Optimization Project

Phase 1

Testing Period
June 2017 through September 2017



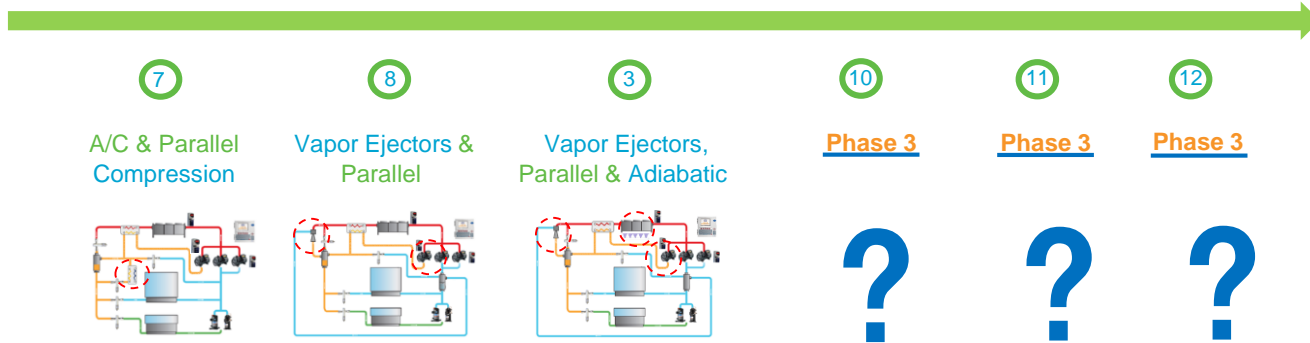
Scope of Project: To Understand the Net Benefit of Each Strategy With Repeatable Conditions

Weather Normalize Energy Data will be Collected from -20°F to 115°F Ambient Temperatures with Varying Humidity levels

CO₂ Energy Optimization Project

Phase 2

Testing Period
October 2017 to December 2017



1. Provide Industry with Comparable Data from a Controlled Store Environment
2. Demonstrate Energy Impact of Ambient and the Benefits of High Ambient Strategies
3. Provide Guidance to End Users and Utilities

Weather Normalize Energy Data will be Collected from -20°F to 115°F Ambient Temperatures
with Varying Humidity levels

Path Towards **Greater Adoption** of Natural Refrigerants



Thank you very much!

