



Business Case for  
Natural Refrigerants

07/05/2018 – Sydney

# A BLUEPRINT TO SUCCESSFUL DEPLOYMENT OF ALTERNATIVE REFRIGERANTS

*Brett Hedge*

May 2018





# WHY INSTALL AN ALTERNATIVE SYTEM?

- Reduced environmental/energy impact
- Climate change driving regulations
- Phase-out of synthetic refrigerants
- Sustainability alignment



# CREATING A FOUNDATION FOR LONG-TERM SUCCESS

- Expertise in commercial refrigeration
- End user and installer design engagement
- Critical support services for retailers
- Design practices
- Successful implementations

*“Sleep Well” Process for Refrigeration*

# CO2 IN COMMERCIAL REFRIGERATION

Our CO2 Success



Ensures reliability, performance and quick time to market for customers

## CO<sub>2</sub> Subcritical Systems

- **Local manufacturing & design capability**
- **Market leading product in ANZ region** (Install base > 125 Installations)
- **Proven** LT solution with optimal Total Cost of Ownership

## CO<sub>2</sub> Transcritical Boosters

- **Advanced in-house testing** ensured flawless market introduction
- **Component and supplier qualification**



# LABORATORY SYSTEM CRITICAL SUCCESS

Testing and Product Development

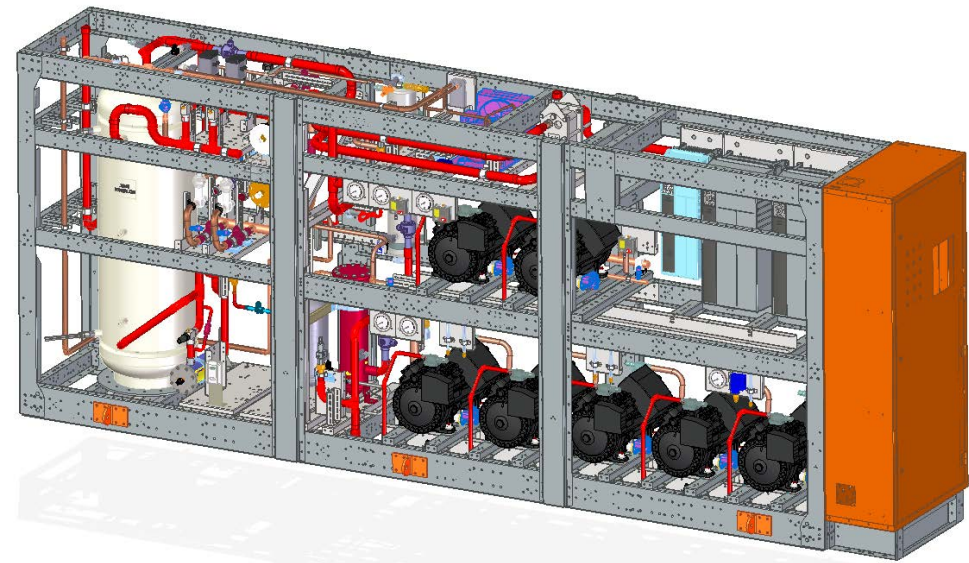


## Fully functional Laboratory TCO<sub>2</sub> Systems in North America & Europe

- **Product qualification / benchmarking**
  - Multiple Compressor and Control System Configurations
  - Exposure to all available components
- **Design / Performance Modelling & Verification**
  - Adiabatic Gas Cooler
  - Parallel Compression
  - Ejector Technology
  - Defrost optimisation
  - Heat Recovery
- **'Hands On' Training platform**
  - Heatcraft WWR Staff & Customers

**Providing critical knowledge for real world application supporting our “Sleep Well” philosophy**

- Defined sequence of operation
- Control system optimisation
- Customer specification verification



# GLOBAL TRANSCRITICAL APPLICATION SUCCESS

Our Platform

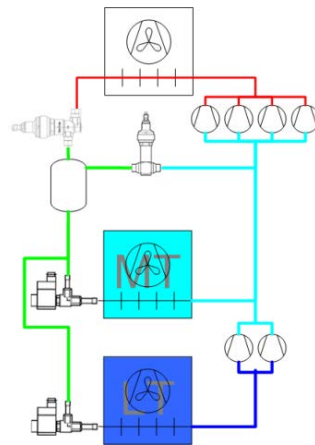


## Growth with key customers in key markets

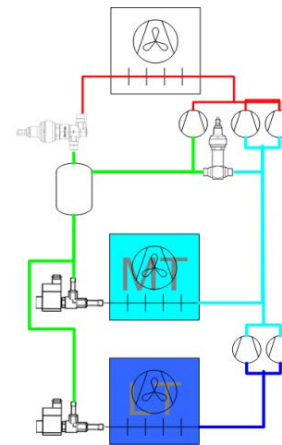
### Global Success

- End user partnerships key to delivery of new technology
- Partnering in 3 Geographical Regions
- Europe, North America, Australia 60+ installations
- Warm Climate & HVAC Ready

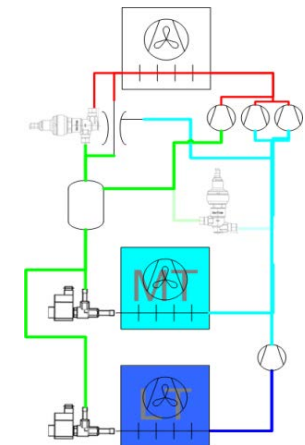
Flash Gas Bypass  
(Basic Conf)



Parallel Compression  
(Warm Climate Solution)  
(Increased efficiency respect to basic configuration)



Ejector / Parallel Compression  
(Warm Climate Solution enhanced)  
(Increased efficiency respect to parallel compression)



# AUSTRALIAN / NZ SUCCESS

CO2 System Evolution – Transcritical in Australia



## Transitioning to Natural Solutions

- +125 Sub-Critical Installations, cost parity with HFC applications
- Proven case to End Users for lower Total Cost of Ownership
- Investment in Box Hill TAFE, VIC CO<sub>2</sub> Training POD & HC Training Facility, Milperra NSW

## Transcritical Pilot System – Woolworths, NSW

- Training @ 'Heatcraft Centre of Excellence' – Stone Mountain, Atlanta
- Global platform >>> Local Specification
- Manufactured at Heatcraft Milperra, Australia
- Long term partnership considering TCO
- Detail design via global stakeholder collaboration
- Installed April, 2018 / Commissioning June, 2018

Supermarket System w/ Parallel Compression & Adiabatic Cooling 2x Systems = 2xLT+3xMT+2xPC  
LT Duty: 36kW / MT Duty: 200kW



# CREATING THE CASE FOR CO<sub>2</sub> TECHNOLOGIES

Partnering for Success

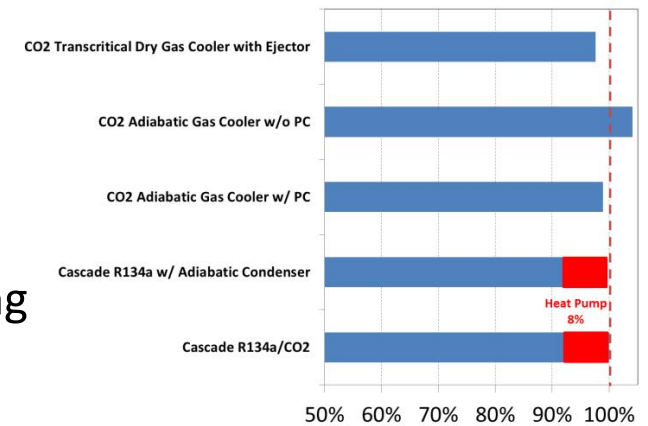


## If at first you don't succeed...

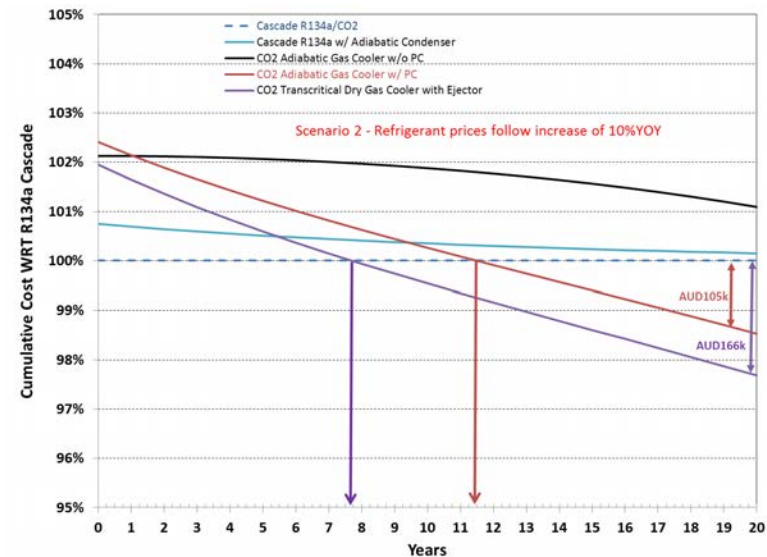
For every opportunity presented we have planted a seed

- We have modelled, quoted, met, discussed, revisited and re-quoted
- Even those that are convinced still require some convincing
- Momentum is building and so is the case for CO<sub>2</sub> Technologies

Sydney, AUS



	R134a/CO2 Cascade	R134a/CO2 Cascade Ad. Cond.	CO <sub>2</sub> Transcritical Adiabatic	CO <sub>2</sub> Transcritical Adiabatic + Parallel Compressor
Loads			LT: 46.8 kW MT: 337.4kW	
System cost	Traditional + Heat Pump		Heatcraft CO2 Transcritical Global Platform design + AUD40k for Suppl, Heat Pump	
Installation cost	Same Cost			
Refrigerant and cost	R134a Scenario 1: Indexed at 3% CPI Scenario 2: Indexed at 10% CPI Scenario 3: \$20/ton equiv. surcharge – direct only		CO <sub>2</sub> (Indexed at 3% CPI/year)	
Refrigerant leak	10%/yr (flat over time)			
Refrigerant charge	1361 kg R134a 73 kg CO <sub>2</sub>		590 kg CO <sub>2</sub>	
Maintenance cost	Same Cost			
Energy cost	\$0.14/kWh (variable based on 3% CPI/year)			
Heat recovery	0kW at 20C/100kW at 10C(max) – linear fit in between.			
Energy calculation	Pack Calculation Pro – Energy Simulation Software			
Lifetime	20 years			





# KEY LEARNINGS – NORTH AMERICAN PILOT

NH<sub>3</sub>/CO<sub>2</sub> Pilot Application

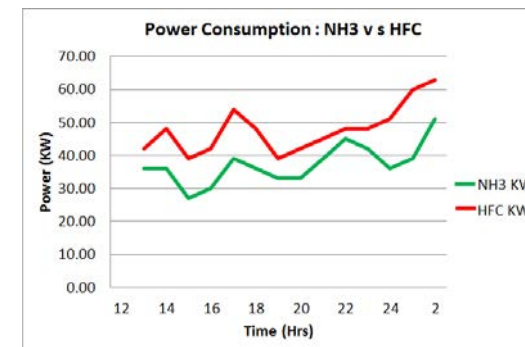


## The need for a variety of solutions... our experience with Piggly Wiggly



- **Key to success**
  - Innovative opportunity provided through customer partnership
- **NH<sub>3</sub> / CO<sub>2</sub> Cascade System**
  - Low charge ammonia
  - Best in class energy outcomes
- **Direct performance comparison**
  - Standby R407 System operated to provide true baseline

- ❑ Store grand opening held on 9th September 2015
- ❑ EPA Awarded **GreenChill Platinum Certification**
  - ❑ NH<sub>3</sub>/CO<sub>2</sub> cascade system – HFC free
- ❑ Only ten stores achieved this prestigious certification in last 5 years
  - ❑ Platinum stores reduce emissions by 95%
  - ❑ Piggly Wiggly achieved reduction by 99%



# CHALLENGES WITH CO<sub>2</sub> SYSTEMS IN AU/NZ

The need for training / information for technicians / customers and end users



## Investment in training “a must”

- Contractor application training **is critical**
- Training contractors on selling the benefits of technology to end users **is just as critical**
- CO<sub>2</sub> application training must become a basic competency for Trade Certificate and post graduate option for continued learning
- Investment in supplier led academy oriented study is required in lieu of Institution options for Qualified technicians is critical for technology leadership



*Image: Box Hill TAFE, VIC - Sub-Critical CO<sub>2</sub> Training POD*

# TRAINING SUPPORT FOR NETWORK



## Effective and flexible

- Critical for **contractor and entire service network**; offer to these and others
- **Hands-on training modules**
- **Drives hassle-free start-up & operation**
- Provided by **subject experts**
- **Globally consistent content with local flavor**

**CO2 Transcritical Booster System eCOBoost**  
December 7<sup>th</sup> and 8<sup>th</sup> 2016  
January 11<sup>th</sup>, 2017

**AGENDA**

April 5th	
CO2 INTRODUCTION (8:00 - 8:30)	SHITONG ZHA
CO2 SAFETY (8:30 - 9:00)	STEVE PFISTER
DESIGN OVERVIEW (9:00 - 9:30)	I. CHAPARRO
BREAK (10:00 - 10:15)	
SUBSYSTEM AND COMPONENTS (10:15 - 12:00)	A. ZIMMERMAN
LUNCH (12:00 - 12:30)	
CASES SET UP (12:30 - 1:30)	D. SIZEVORE
CASES CONTROLLER (1:30 - 2:00)	D. COLE
PIPING INSTALLATION (2:00 - 3:00)	D. SIZEVORE
BREAK (3:00 - 3:15)	
TESTING & EVACUATION (3:15 - 4:00)	D. SIZEVORE / S. AUSTRI

**INSTRUCTORS**

- SHITONG ZHA**  
Principal Engineer  
22 years of experience  
joined Heatcraft in 2014
- STEVE PFISTER**  
Principal Engineer  
20 years of experience  
joined Heatcraft in 2014
- RENARDO CHAPARRO**  
Technical Sales Engineer  
10 years of experience  
joined Heatcraft in 2016
- AUGUSTO ZIMMERMAN**  
Principal Engineer  
18 years of experience  
joined Heatcraft in 2014
- DANIEL SONNENBERG**  
Technical Support Engineer  
10 years of experience  
joined Heatcraft in 2016
- DOUG COLE**  
Service Engineer  
22 years of experience  
joined Heatcraft in 2007
- ROBERT AUSTRI**  
Service Engineer  
18 years of experience  
joined Heatcraft in 2009

KYSOR/WARREN

**HEATCRAFT**  
Worldwide Refrigeration

**INSTALLATION AND OPERATING MANUAL**  
**CO2 TRANSCRITICAL BOOSTER**  
**REFRIGERATION SYSTEM**

This manual provides information for system warranty, inspection, installation, start-up, operation, service and maintenance of Heatcraft CO2 Transcritical Booster Refrigeration Systems along with some general system specifications. See additional specifications required and provided by Heatcraft and the customer. Additional specifications may include:

- Schedule / Legend of Equipment Load and Electrical requirements
- Sequence of operations
- Specifications of Components
- Specific Piping Diagram
- Site specific installation drawings

This document is intended to provide guidance where customers do not have an existing process. Customer specifications and local codes take precedence over drawings contained in this document. Installation and service that do not comply with this manual may lead to poor performance or reliability, and will void the equipment warranty. Changes to the additional specifications (shown) that are not approved by Heatcraft will void the warranty of the system. Contact your Heatcraft representative to verify the most current version of this manual.

Revised: May 5, 2016 Page 1 of 55

**TESTIMONIALS**

**JOHNNY KIGHT**  
Sales Manager  
Sacramento Refrigeration, Inc.

“ Thank you! It was not only an informative training but also exciting to learn more about Kysor/Warren and the future anticipated plans for the company. It is great to have the level of support that Kysor Warren offers to its dealers as well as our All Star RSM and Customer Service and Technical Support. ”

**HEATCRAFT**  
Worldwide Refrigeration

**Sequence of Operations**

S00-CO2TCBSTR Revised: 11/1/2016

**CO2 Transcritical Booster System**

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		Oil Separator Dump Valve	
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# TRAINING SUPPORT FOR NETWORK



CLASSROOM



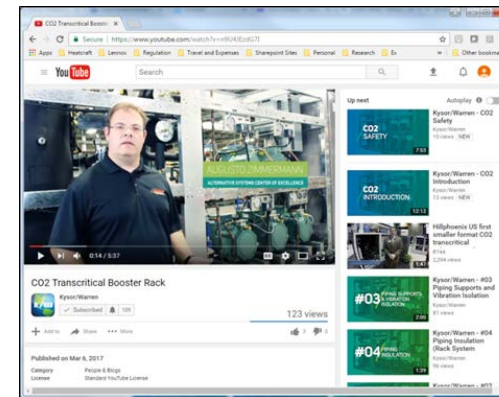
HANDS-ON



VIDEO



WEBINAR



## More than 150 professionals trained on Alternative Systems in North America

Main findings and feedback:

- 80-90% of skills are transferable
- Contractors receptive of new systems

**\*\*\*Launching in Australia July 2018 – Registrations Open\*\*\***

# GLOBAL DESIGN PRACTICES

## CO2 Transcritical Platform

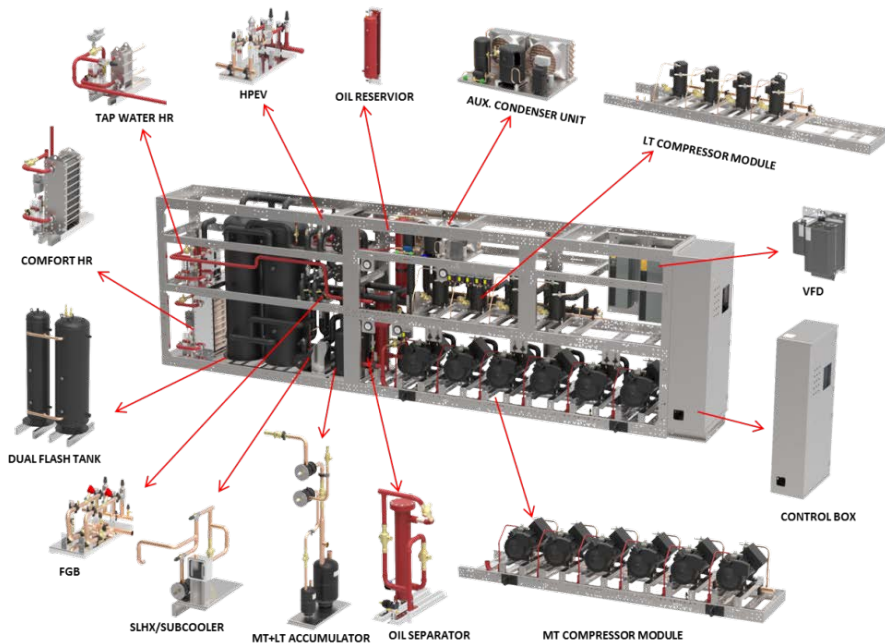


Common layout and design practices across the Globe

- Design for serviceability
- Modular and Scalable
- Repeatable
- Variable-climate considered
- Leverage latest technology advancements
- CE and UL compliant with local specification compliance



Australia/New Zealand



North America



Europe

## SUCCESSFUL IMPLEMENTATIONS



### Using the “Sleep Well” process, over 300 smooth CO<sub>2</sub> start-ups & operations in Australia/New Zealand, North America & Europe

- Global design platform for enhanced reliability for customers
- Effective training for contractors & customers
- On-site support and direct accessibility to experts
- Customer and service contractor testimonials



CUSTOMER  
testimonials





# IN CONCLUSION

## Keys to successful transition to CO2 Technologies

- ☑ End user, installer design engagement
- ☑ Critical support services for retailers
- ☑ Proven design / manufacturing practices
- ☑ Record of successful implementations
- ☑ Contractor application training installation



# ATMO sphere



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# THANK YOU

*Sleep Well Process for Refrigeration*