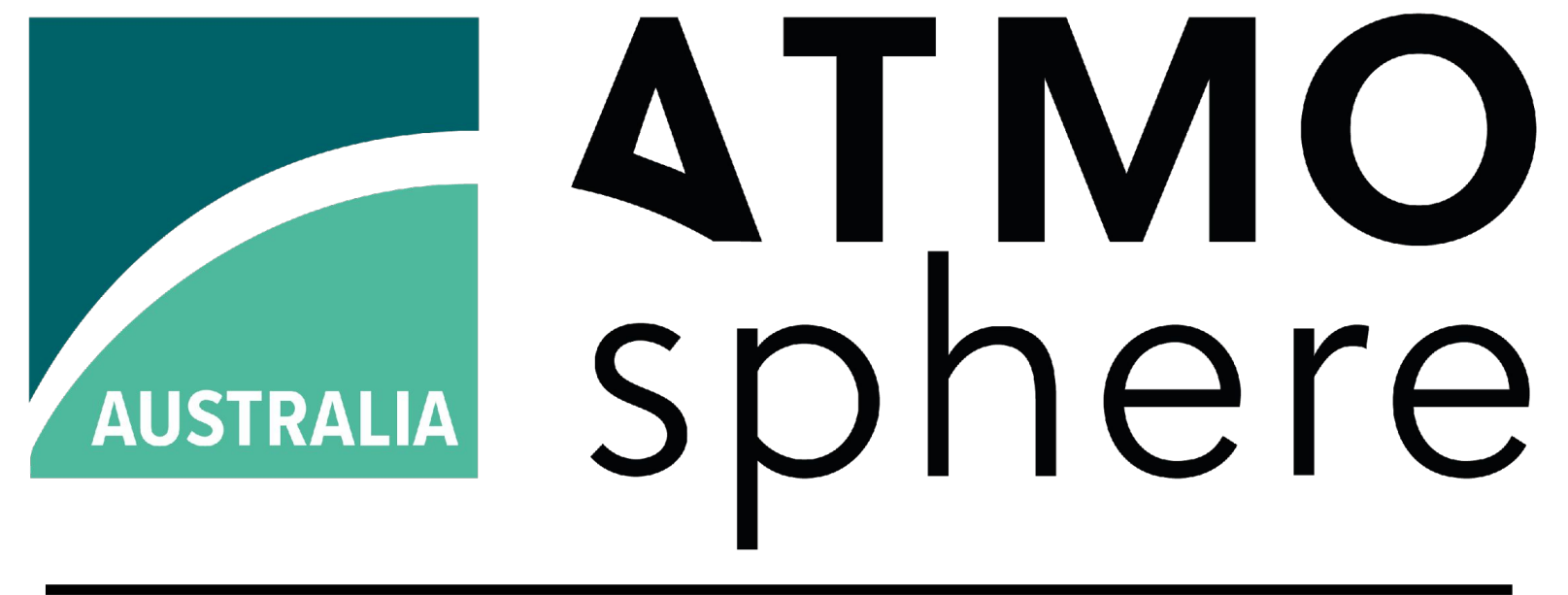




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Woolworths' investment in the Australian industry to deliver sustainable HFC-free refrigeration innovation

Dario Ferlin - Woolworths

Refrigerants policy (un)certainty and technology roadmap

- Australian industry experienced a decade of policy uncertainty surrounding synthetic greenhouse gas policy hence a decade without a framework to develop a technology roadmap
- 2016 COP21 agreement, ratification by Australian government and Adoption of an 85% HFC phase down strategy by 2036 have provided local industry with a framework
- Woolworths has both responded and pre-empted government policy. Firstly with the 2007-2015 sustainability strategy, then in 2010 as a signatory to the Cancun CGF agreement and again in 2017 with the 2020 sustainability strategy.
- Woolworths fleet now numbers +200 cascade CO₂/R134a systems and by mid May 2017 will have opened its first transcritical CO₂ store to trade.
- Acknowledgement that sustaining the innovation requires a strategy which includes investing in the upskilling of the local commercial refrigeration industry.

Transcritical CO₂ - the HFC-free end game

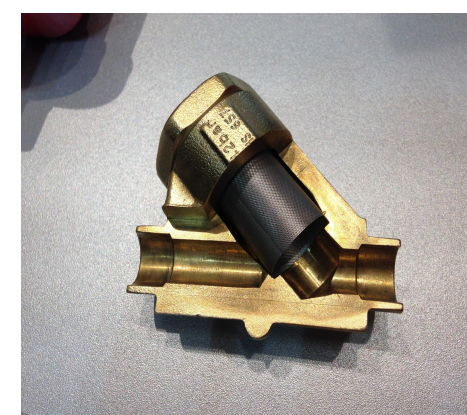
- Transcritical CO₂ systems are not new. The first commercial refrigeration systems were installed in Europe close to 20 years ago and by last count (courtesy of Schecco) there are now over 8,700
- The challenge with transcritical systems is implicit in the very name; when a system is running in transcritical mode it is no longer able to condense the compressor discharge gas into useful liquid.
- To obtain useful liquid, the discharge fluid from the gas-cooler must first be throttled via a “high pressure valve”. The throttling process creates useful liquid refrigerant and a proportion “unuseful” flash gas.
- Managing flash gas with efficiency in mind:
 - Adiabatic cooling
 - Parallel compressors
 - Ejectors

Lead up to piloting the first transcritical CO2 system

- Extensive research including installation inspections, manufacturing facility visits and trade exhibitions with the view to developing system and equipment design briefs.

CHILLVENTA

International Exhibition
Refrigeration | AC & Ventilation | Heat Pumps
Energy & Store
Development Conference
E+SC 2015
September 27-30, 2015 • San Diego, CA
Sheraton San Diego Hotel
FMI THE VOICE OF FOOD RETAIL



**Woolworths Transcritical CO2 Showcase
Design Brief**

1 Woolworths Specifications	
2 Design Pressures	
3 Showcase Construction	
4 Showcase control systems	
4.1 Modbus network	
4.2 Positive liquid closure	
5 Virtual Product Simulation Probe Temperature	
6 Light and night-blind override switch	
7 Product Engineering Data Sheets	
8 Showcase commissioning sheets	

**Woolworths Transcritical CO2
Plant Design Brief**

1 Woolworths Specifications	3
2 System Overview	3
3 Generic System Schematic & Design Pressures	3
4 Piping reticulation	4
5 Liquid Receiver	5
6 Compressor Selections	5
6.1 Low Temperature Compressors	6
6.2 High/Medium Temperature Compressors	6
6.3 Parallel Compression	7
6.4 Compressor selection verification	7
6.4.1 Operating conditions	7
6.4.2 P-H diagram points	8
7 Oil System	8
8 Gas Cooler Selection	9
8.1 Adiabatic cooling system	10
9 Heat reclaim for freezer room sub-floor heating	11
9.1 Heat reclaim heat exchanger	11
9.2 Pumps and ancillary equipment	12
10 Freezer room floor with hydronic sub-floor heating	13
11 Coolroom ratings	13
11.1 Distribution centre coolroom rating guidelines	13
12 Coolroom and Freezer Room Evaporators	15
13 Suction and liquid headers	15
14 Fixture evaporator pressure regulation	15
15 Emergency Cooling Unit	15
16 HVAC integration	16
16.1 HVAC Cooling Load - rack	16
16.2 HVAC Heating Load - rack	16
17 Mechanical Services	17
18 Switchboard, Control and Monitoring	18
18.1 Rack mounted switchboards and controls	18
Woolworths Transcritical CO2 Plant Design Brief - v.4	1

- Engagement with internal stakeholders for “buy in” to the 2020 corporate refrigerant objectives, actively partake in the T-CO2 pilot initiative, and foster a sense of participation and confidence in the proposed non conventional system with a view to obtaining business consensus.

Lead up to piloting the first transcritical CO2 system

- Engagement with local technology partners with a view to identifying suitable:
 - installation and maintenance contractors
 - showcase manufacturers with transcritical CO2 know how and manufacturing flexibility to deliver bespoke retailer solutions
 - transcritical CO2 rack designers with understanding of best practice design for warm climates and direct links/control on manufacturing
 - gas cooler manufacturers with robust local support
 - electronic controls providers with a strong presence in the local market, good support capacity, successful track record of transcritical CO2 delivery in warm climates

Lead up to piloting the first transcritical CO2 system

- Ongoing support from Woolworths Engineering and bridging the knowledge across all stakeholders
 - No single technology partner can see every piece of the big picture puzzle. Fostering a collaborative environment conducive to effective communication is paramount.
 - Ensure all stakeholders are granted the opportunity to understand the transcritical CO2 cycle and its implications on their equipment.
 - Creating opportunities for technology partners to meet, express concerns, provide feedback, make recommendations and optimise designs.
 - Coordinate training opportunities with hands-on workshops
 - Constantly challenge every stakeholder

Colebee transcritical CO2 technology partners

- Showcases



HUSSMANN®

- Coolroom evaporators



BUFFALO TRIDENT

- Compressor Racks



Bitzer

- Stepper EEV



CAREL

- HPEV and FGBV



Danfoss

- Controllers (showcases, rack, gas-cooler, HPEV & FGBV)



EMERSON™

- Gas cooler



ALFA LOM

- Installation contractor



RetailFM

Strategy, objective and roadmap become reality

Woolworths pilot transcritical CO2 store at Colebee (NSW)



Biggest challenges

1. Engineering a cost effective system for a design OAT of 45°C which is:
 - a. robust,
 - b. energy efficient
 - c. high level of serviceability

2. Imparting transcritical CO₂ skillset to the field teams - particularly around commissioning
 - a. sub-critical gas-cooler fan control: chasing large approach temp
 - b. transcritical gas-cooler fan control: chasing low approach temp
 - c. sub-critical HPEV control: chasing sub-cooling
 - d. transcritical HPEV control: chasing ideal gas-cooler pressure
 - e. parallel compressors or FGBV: when to use either

3. Sustaining the innovation beyond the store opening date. Encouraging learning/upskilling, triggering curiosity/imagination & creating momentum across the Australian industry!

Conclusions

- Transcritical CO₂ refrigeration is feasible for high ambient temperature environments
- Training of field teams must be part of the delivery strategy
- Engagement with internal business stakeholders to obtain endorsement for non-standard transcritical CO₂ systems is essential. The business must know why the engineers are proposing something so different if they are going to approve the change.
- CAPEX premium will be necessary for high ambient environments (additional systems are necessary to efficiently manage flash gas) until economies of scale are reached. Hence importance to seek business buy-in.

Antoine de Saint-Exupéry



“Your task is not to foresee the future, but to enable it.”



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Thank you very much!

