Self-contained Display Cases with a Hydrocarbon Refrigerant Running on a Water Loop for Heat Rejection

Ian Garvey *F.inst.R M ASHRAE*
Technical Director
Carter Retail Equipment

AUSTRALIA ATMOsphere business case
natural refrigerants

16 May 2016 — Melbourne

The History

Manufacturing since
1945

1st CO2 display case built
2004

16000+ CO_2 Cases built

1st Hydrocarbon display case built
2009

20,000+ Hydrocarbon Systems built

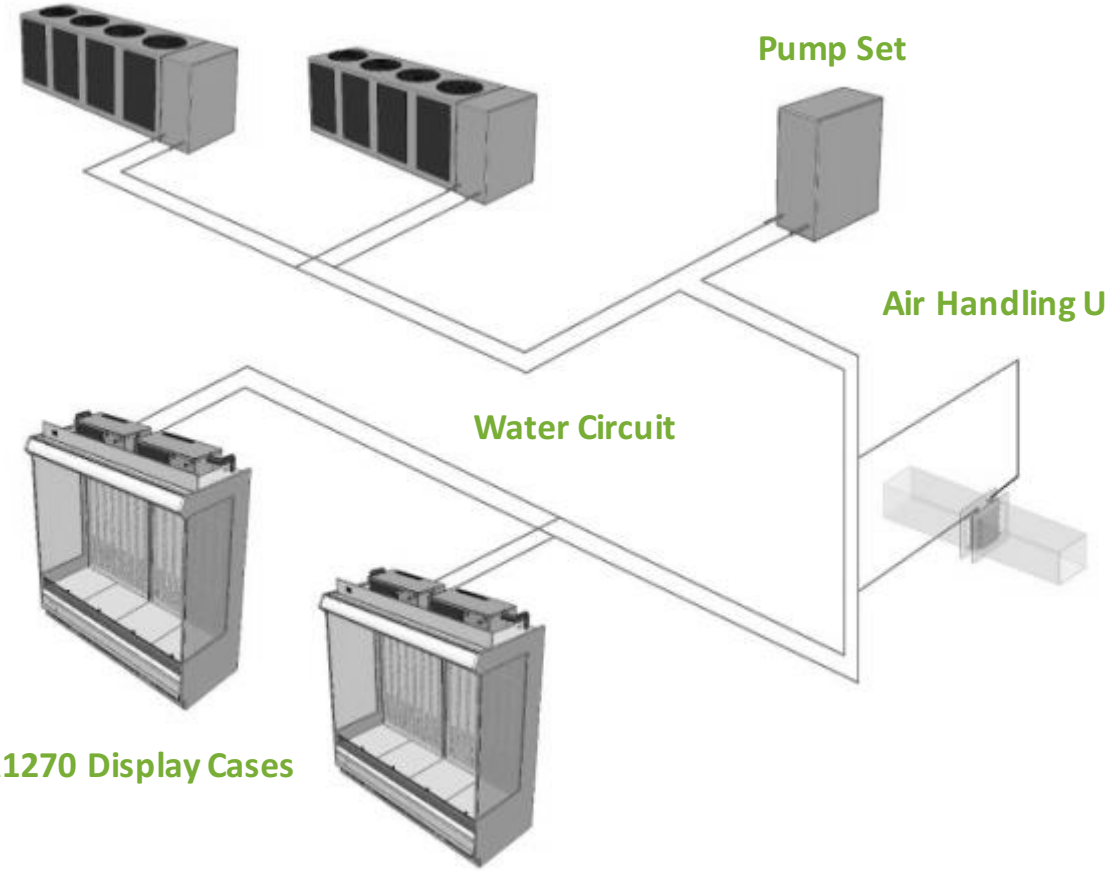
Natural refrigerants become the majority of case production
2013

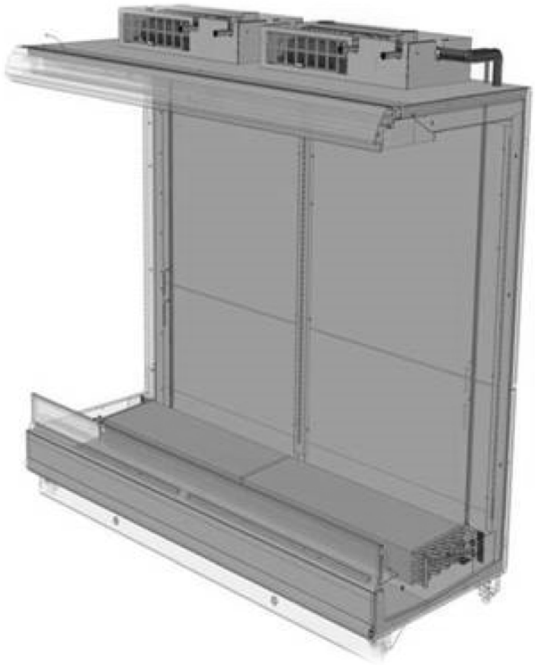
4,000 pa display cases

Partnered with Melbourne Refrigeration Services to support local market
2015

Full Turnkey Capability for the Australian Market for Hydrocarbon and Transcritical CO_2 Solutions

Simple Schematic of a Water Loop System





Capillary Control

Critical Charge

No service ports

Factory Sealed Systems

Spot the Difference

Any Format, Any location, Anywhere

Flexibility

Containment

Refrigerant Reduction

Retail Stores using Hydrocarbons

0% Refrigerant Leaks

90% Less Refrigerant than a DX system

60% Less Maintenance Events

8-18% Energy Saving

Simplicity

Low Maintenance

Energy Efficient

The Numbers

Warm Climate

Cool Climate

Tesco Lotus, Thailand

Benchmark Store HC Self-contained V's HFC DX. Three year case study

60% Reduction in Maintenance Events

Zero Maintenance Events to Refrigeration System

8% Reduction in Direct Energy Consumption

26 °C

Waitrose, United Kingdom

Estate 344 Stores -141 On HC's
1st HC Store 2009

41% Estate Self-contained Hydrocarbons

39% Reduction in Annual Leak Rates

15% Reduction in Maintenance Events Across the Entire Estate

11 °C

Standards Used

- **Charge < 150 g**
- Product standard
  - AS/NZS 60335-2-89
  - AS/NZS 60335-1

  - Note 104 states
  - Appliances with a charge of more than 150g are not covered by this standard , ISO 5149 may be applied

- **Charge > 150 g**
- System Standard
  - AS/NZS 1677
  - ISO 5149

(soon to be adopted by AS/NZ)

- 1677 6.2.2 states

Appliances For a Cat 1 occupancy

Max permissible charge of 1.5kgs of A3 refrigerant

Coles Liquorland – Coburg North

Cases

10m MT Open Multideck

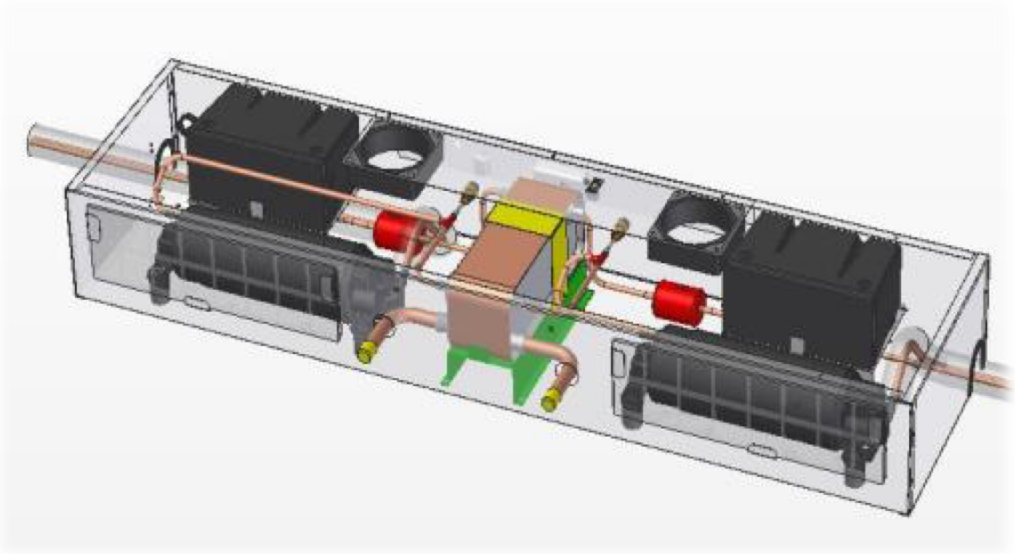
14kw Duty

3M0 designed

x3 Twin Horizontal Scroll CDU’s

Refrigerant R1270

CDU’s



Capacity

2.0hp twin = 6.2 kw @-7/50°C
1.5hp twin = 4.2 kw @-7/50°C

Refrigerant = R1270

Max System Charge = 450g

Dry Air Cooler

THR 23kw

x2 Pump Sets (Run & Standby)

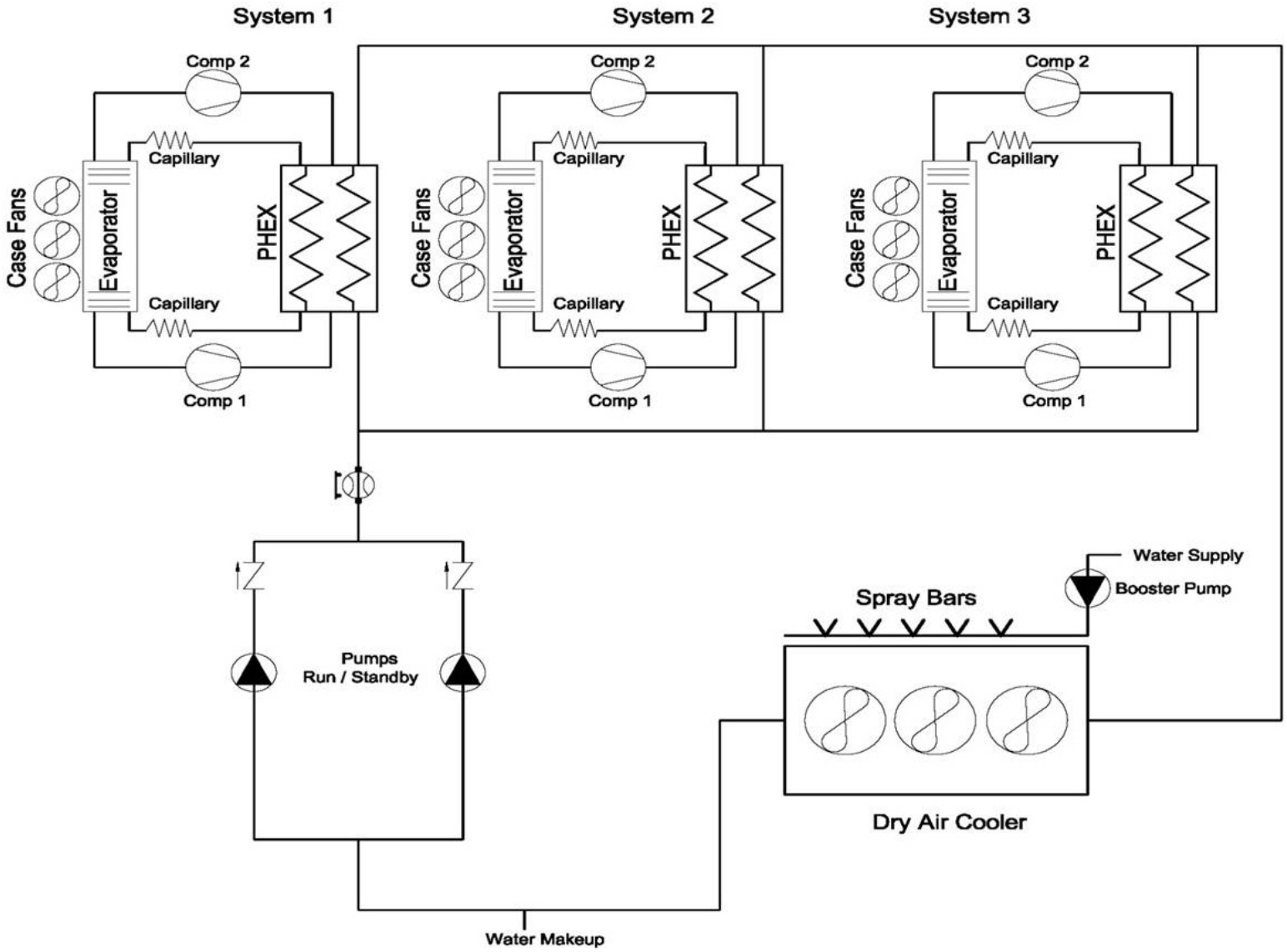
x3 Variable Speed Fans

Adiabatic Spray

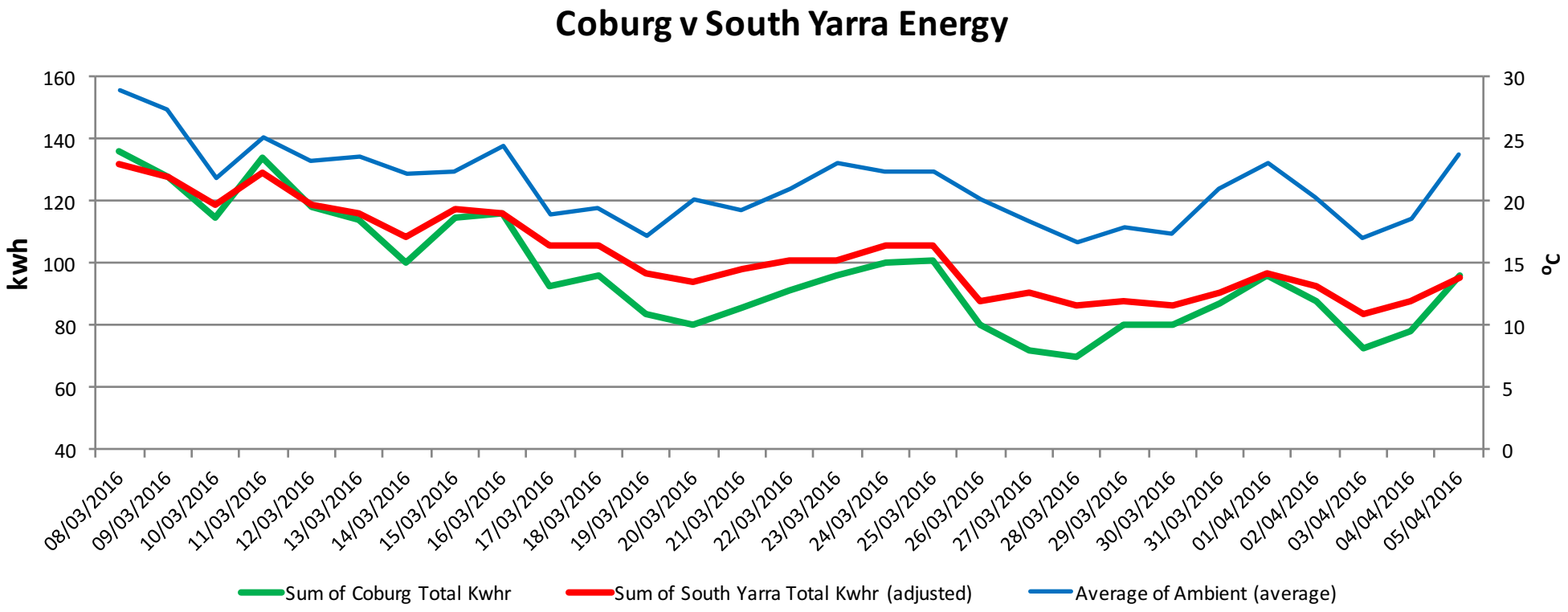
Fluid - Water with Inhibitor

Operation
VSD fans from 20°C - 35°C
Adiabatic spray above 36°C

Water Loop Schematic (Simplified)

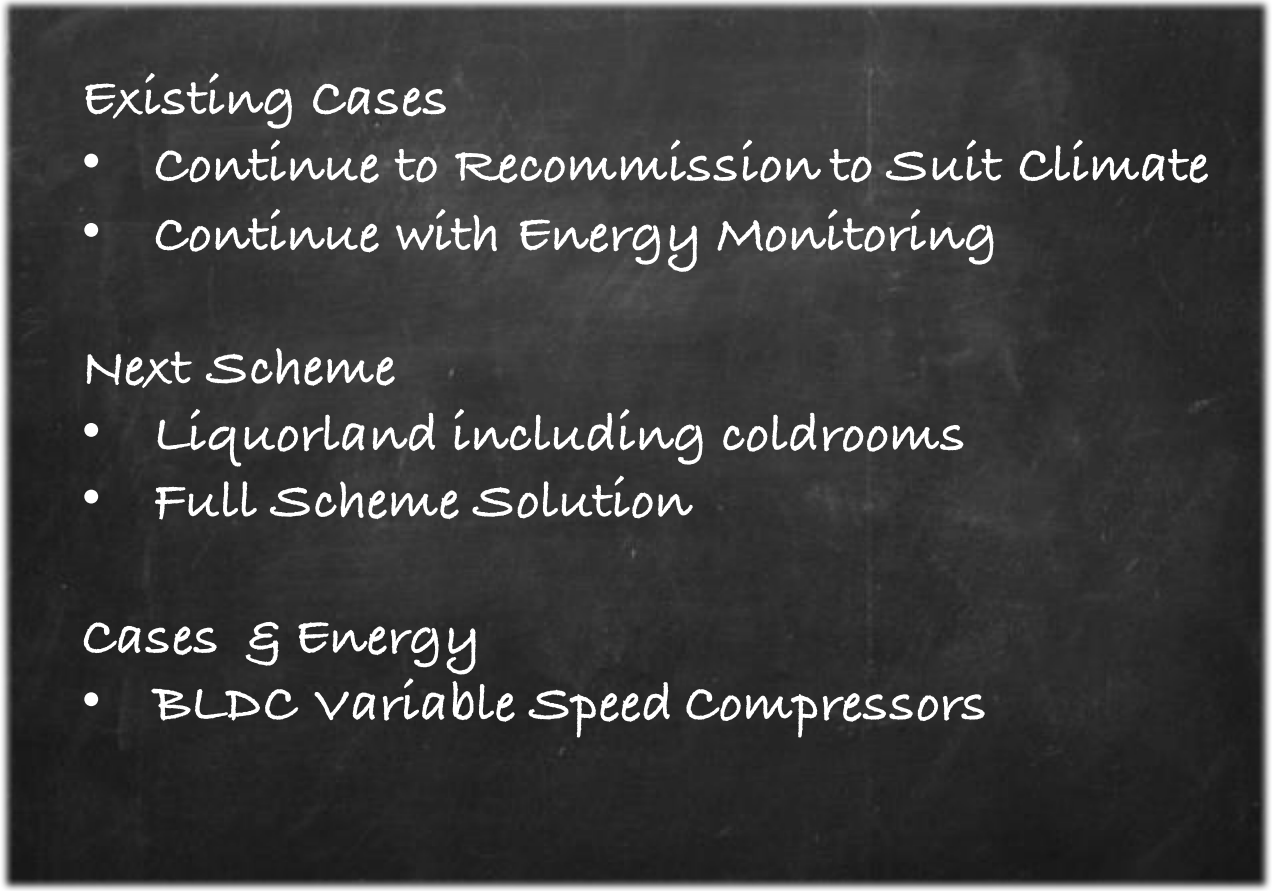


Initial Energy Comparison



6% Energy Reduction – further savings expected by commissioning system

Next Steps


Existing Cases
• Continue to Recommission to Suit Climate
• Continue with Energy Monitoring
Next Scheme
• Liquorland including coldrooms
• Full Scheme Solution
Cases & Energy
• BLDC Variable Speed Compressors