
AUSTRALIA
ATMO
sphere

TRANSCRITICAL CO_2 IN AUSTRALIAN SUPERMARKETS – A REALITY

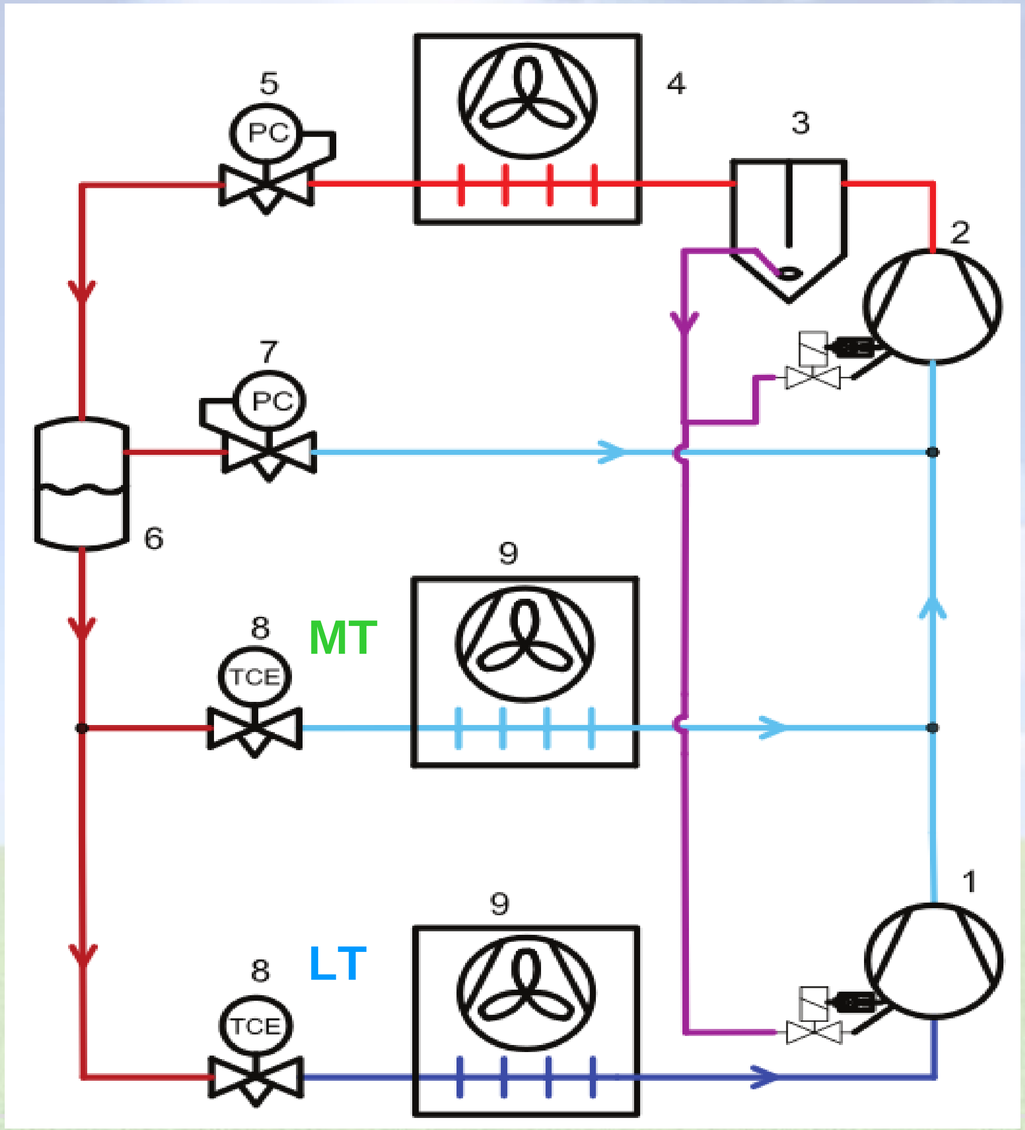
Mike Baker

AJ Baker & Sons

TRANSITION TO TRANSCRITICAL

- **Drakes Angle Vale, SA**
  - First Generation
- **Coles Coburg North, Vic**
  - Second Generation, Parallel
- **AJ Baker & Sons**
  - 10 sites completed
- **Legislation**
  - Australian & World Legislation promoting low GWP/Natural Refrigerants

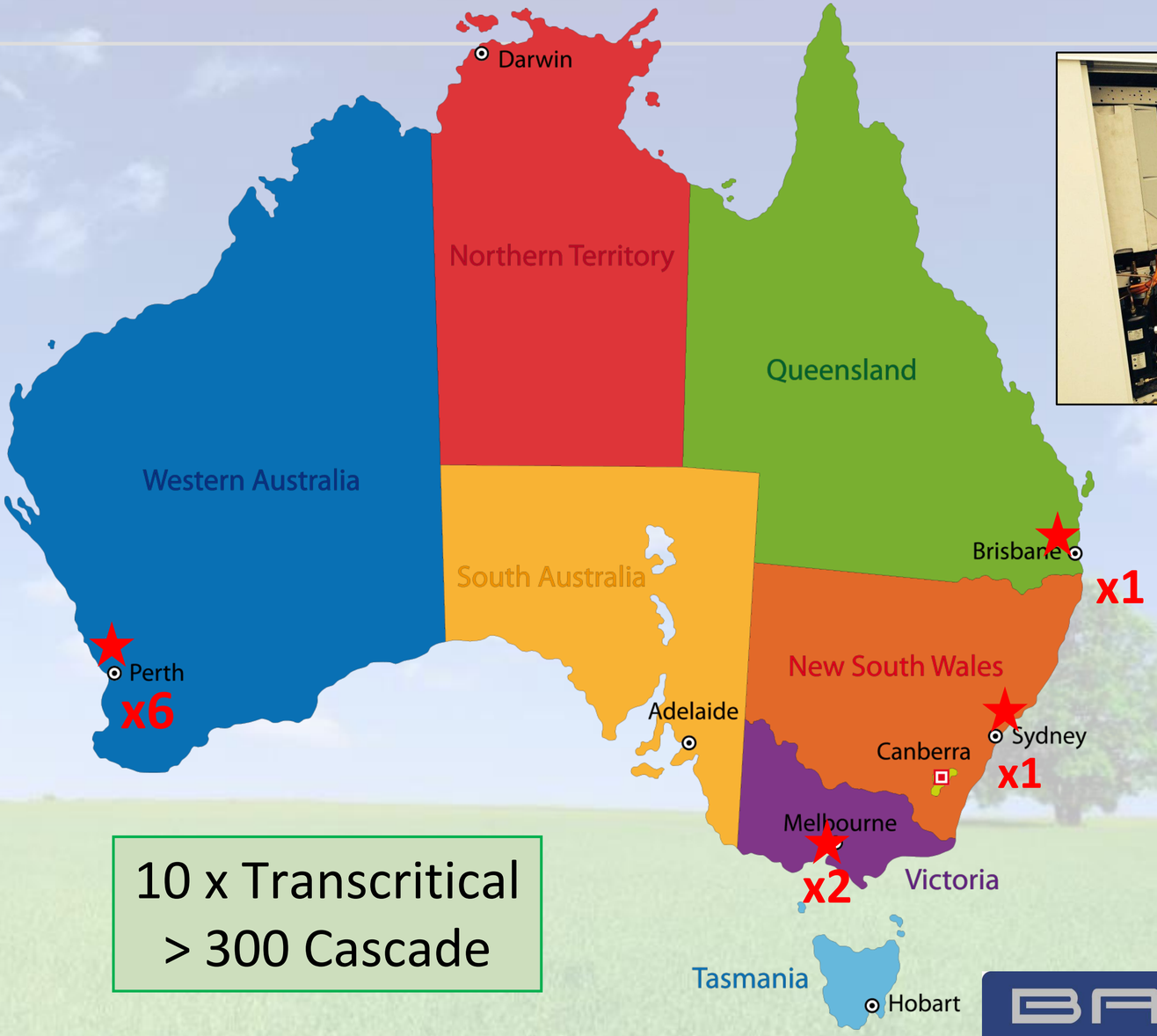
TRANSCRITICAL BOOSTER SCHEMATIC



Ref	Component
1	Low stage (LT) comp
2	High stage (MT) comp
3	Oil Separator & oil return system
4	Gas cooler
5	High pressure regulating valve
6	Liquid receiver
7	Receiver pressure reg (flash gas) v/v
8	Expansion device
9	System evaporators

AJ Baker Australian installations

City	Avg # days >30°C / yr
Perth	76
Brisbane	70
Sydney	54
Melbourne	30



10 x Transcritical
> 300 Cascade

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NATURAL REFRIGERANT SYSTEM

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Store Ref	LT load & # Comp	MT load & # Comp	Location	GCOT Control Method		
				Type	Refrigerant	Adiabatic Sprays
A	26kW x 3	111kW x 3	Perth	DX PHE	R134A	No
B	4kW x 1	77kW x 3	Melbourne	Water / PHE	R290 / Water	Yes
C	19kW x 2	77kW x 3	Perth	DX PHE	R134A	Yes
D	29kW x 3	118kW x 4	Perth	DX PHE	R513A	Yes
E	29kW x 3	121kW x 4	Perth	DX PHE	R513A	Yes
F	4kW x 1	81kW x 3	Sydney	Water / PHE	R290 / Water	Yes
G	4kW x 1	81kW x 3	Perth	Evap cooling on gas cooler intake		N/A
H	4kW x 1	79kW x 3	Brisbane	DX PHE	R134A	Yes
I	20kW x 3	148kW x 5	Perth	DX PHE	R513A	Yes
J	4kW x 1	81kW x 3	Melbourne	Evap cooling on gas cooler intake ** Parallel compression ** 60bar liquid system		N/A
	+ 3 more systems on order / under design					

Gas Cooler Outlet Temperature Control

- Sites utilising PHE for high pressure desuperheating
- Secondary system of adiabatic water sprays
- Two sites trialling evaporative pre-cooler system on gas cooler inlet

Gas Cooler Outlet Temperature Control

➢ High Pressure Desuperheating

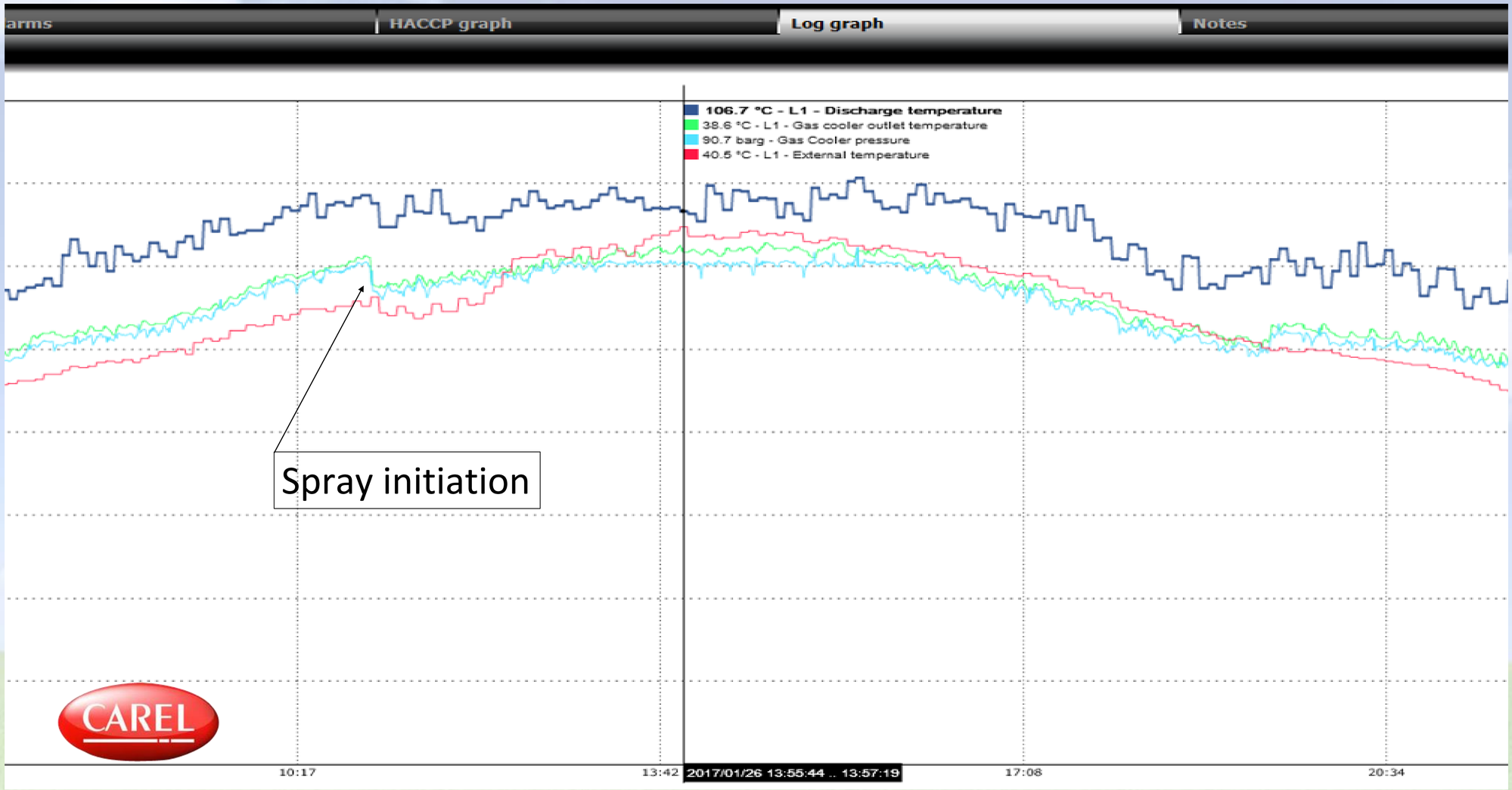
- Increases overall efficiency when Tamb>20°C
- Controls compressor discharge T & P
- Trials in service with a number of refrigerant options and designs: *HFC, HFC replacement, HC ; DX / water*
- A simple & effective solution in warm climates

Gas Cooler Outlet Temperature Control

➢ Adiabatic Sprays

- Effective for secondary GCOT control after desuperheater
- Can reduce GCOT by 3°C.
- Both proprietary and local manufactured units on trial.
- Water quality can be an issue, plus overspray

GAS COOLER OUTLET TEMPERATURE CONTROL



Gas Cooler Outlet Temperature Control

➢ Evaporative Pre-Cooling

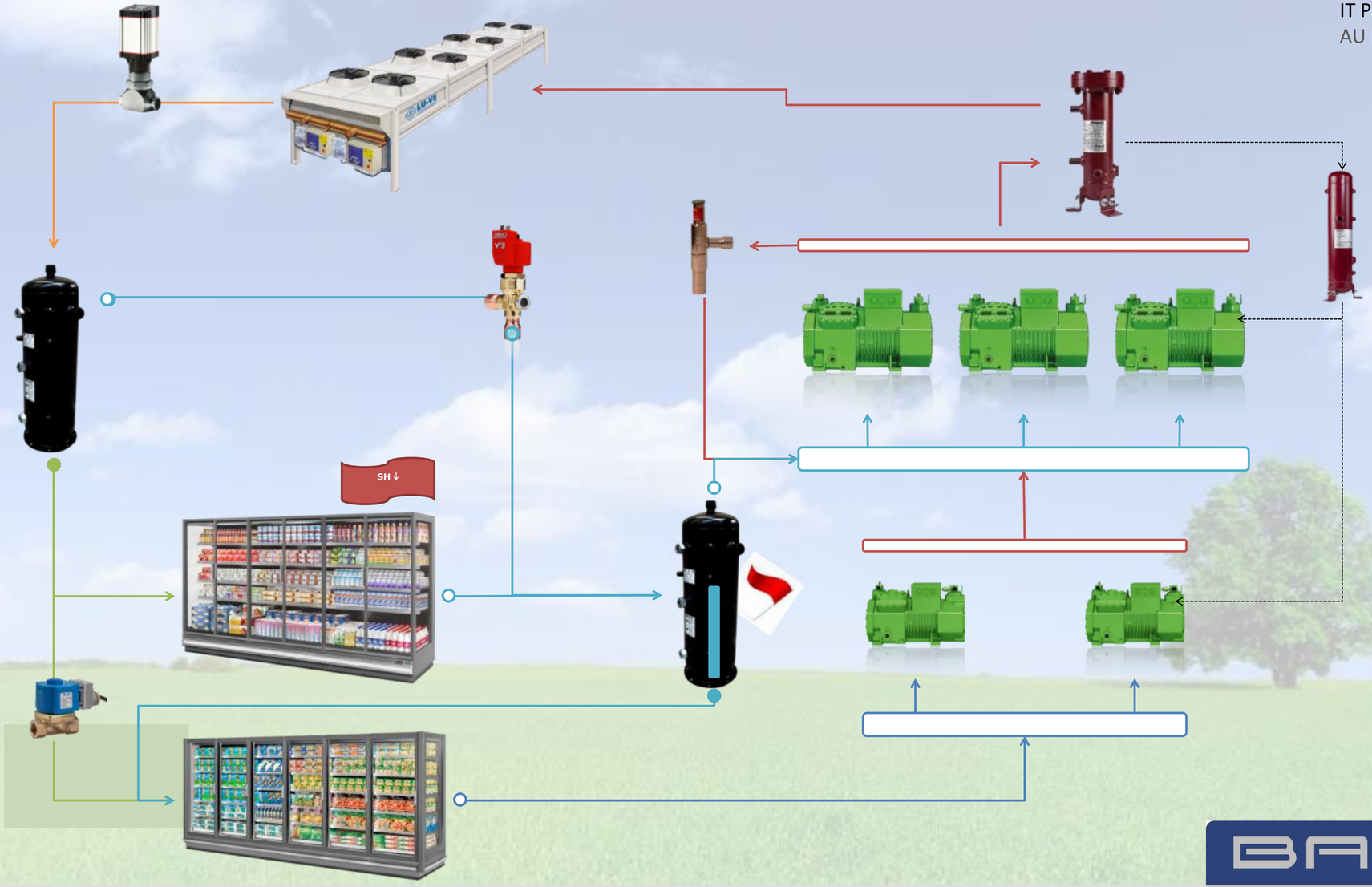
- Results have shown can be used without high pressure desuperheating
- Water usage is minimal
- Ideal where water quality is poor (no direct water contact with gas cooler coil)
- Only suitable in low RH climates

FTE – Full Transcritical Efficiency

- Uses liquid overfeed on MT cases to feed LT cases
- Has the benefit of reducing liquid temp to MT cases, and then MT comp discharge Temp.
- LT cases also aided by cooler liquid temp
- Oil return is uninterrupted in entire circuit
- Minimal need for MT suction liq injection
- Works both in sub & trans critical states.
- Europe studies → 10% gain; Australia → 7%

FTE – Full Transcritical Efficiency

IT Patent Pending: IT 102016000049985
AU Patent Issued: AU2016101310



FTE – Full Transcritical Efficiency

13 units in operation:

- Italy
- Germany &
- Australia

Other Energy Saving Initiatives

➢ Suction temperature optimisation

- Installing high performance display case evaporators
- Medium temp suction temperature floated up to -2.8°C.
- Coil diff temp reduced to 2K.
- Still achieving M1 (even M0) case conditions

Other Energy Saving Initiatives

➢ Defrost on Demand

- Utilising the intelligent control system
- LT case defrost intervals of up to 14 days
- No degradation of product quality
- Case TEC reduced by 3%

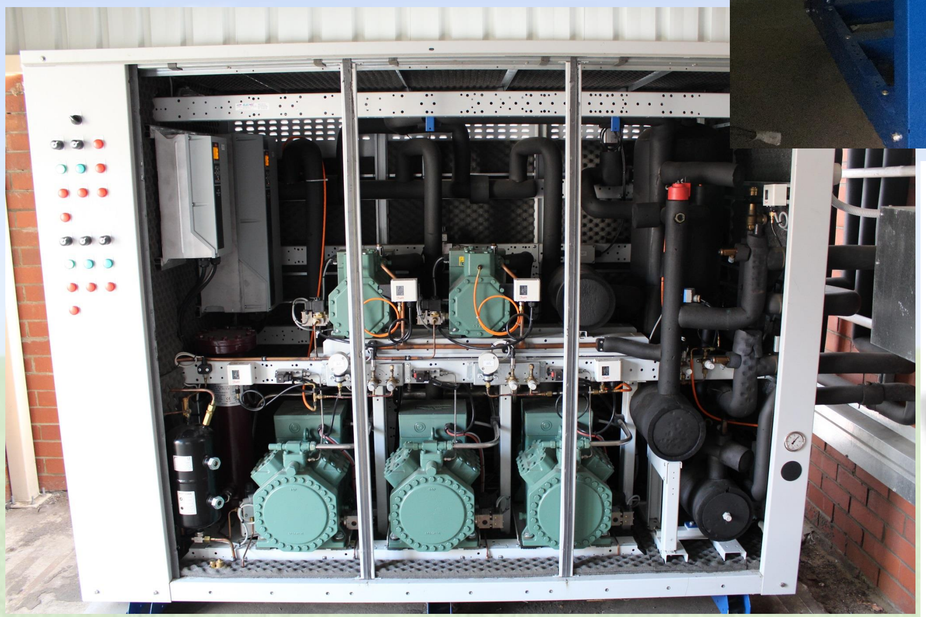
Other Energy Saving Initiatives

- **Defrost on Demand**

CONCLUSIONS

- TC CO_2 is being designed to allow operation in high ambient climates
- The number of installations in Australia is growing
  AJB: 3 on order, expect 3 to 4 per year. By 2020: > 25
- No major penalty in system efficiency or complexity
- Simple plant designs making the technology able to be understood by mechanics
- It **has to be** the system design of choice for supermarkets and other commercial installations.

AJ Baker Australian installations



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AUSTRALIA

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Thank you very much!