

# GLACIEM

COOLING TECHNOLOGIES



CARBON DIOXIDE REFRIGERATION

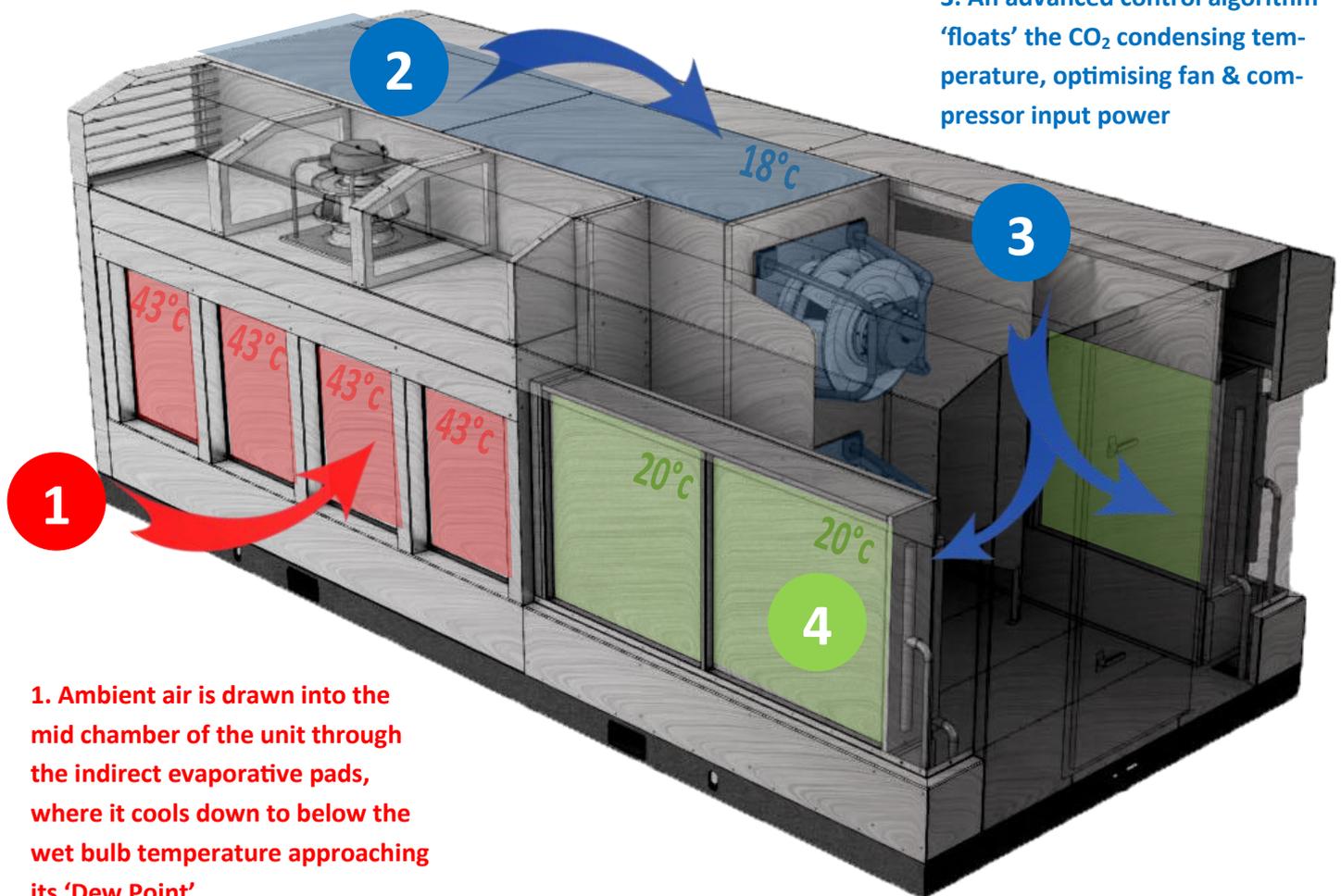
# DEW POINT TECHNOLOGY



Glaciem's patented DPCO<sub>2</sub> technology delivers outstanding performance in high ambient temperatures compared to existing refrigeration systems. The integration of Indirect evaporative cooling guarantees a supply of cool, dry air to the condenser coils, even in extreme ambient temperatures. This allows the CO<sub>2</sub> system to remain in subcritical mode, meaning greater efficiency over a wider ambient temperature range.

2. This cooled air is then supplied to gas cooler chamber via precision controlled centrifugal fans

3. An advanced control algorithm 'floats' the CO<sub>2</sub> condensing temperature, optimising fan & compressor input power



1. Ambient air is drawn into the mid chamber of the unit through the indirect evaporative pads, where it cools down to below the wet bulb temperature approaching its 'Dew Point'.

4. CO<sub>2</sub> condensing temperatures remain significantly below the critical point of 31°C, ensuring subcritical operation and high operational efficiency .

*'World's most efficient air cooled CO<sub>2</sub> refrigeration system in hot climates'*

*Professor Frank Bruno*

*South Australian Chair in Energy, University of*



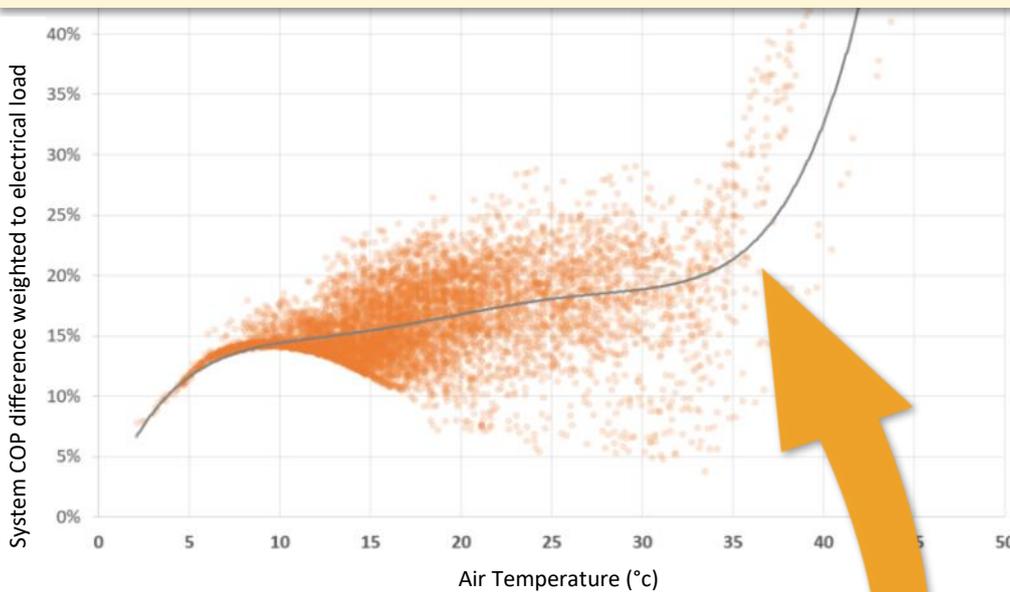
# CO<sub>2</sub> COOLING UNDER ALL CONDITIONS

With a global shift away from HFC refrigerants, and Australia in the HFC phase down period, the development of efficient natural refrigeration systems becomes an important future step. Moreover, there is a growing need for refrigeration for food production and storage globally.

Carbon dioxide (R744) is the most attractive natural refrigerant, being non-toxic, non-flammable and highly efficient. However its use has been limited to lower temperature climatic zones due to drops in its efficiency if exposed to elevated ambient temperatures.

Glacem's patented DPCO<sub>2</sub> technology offers a viable cost effective solution in high ambient temperatures.

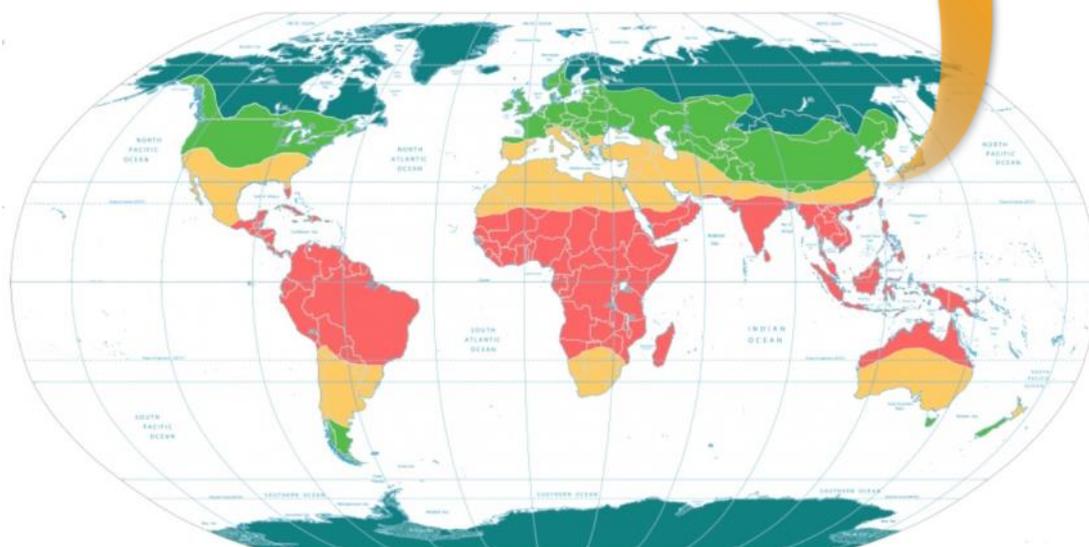
**System COP Difference — DPCO<sub>2</sub> vs R404a System**



The Figure to the left shows relative electrical energy saving between the DPCO<sub>2</sub> system and conventional parallel R404A system for each hour of the year. It is clear that the DPCO<sub>2</sub> offers greater efficiencies all year round and as the ambient air temperature increases, so does the efficiency.

This defies the current Status Quo with traditional CO<sub>2</sub> only systems, their efficiencies decrease as the ambient temperature increases limiting their use in regions with high ambient temperatures.

In simple terms, the higher the air temperature, the greater the efficiency gain using DPCO<sub>2</sub> over current systems. Enabling CO<sub>2</sub> systems to be used efficiently in hot climates where it is currently commercially impractical.

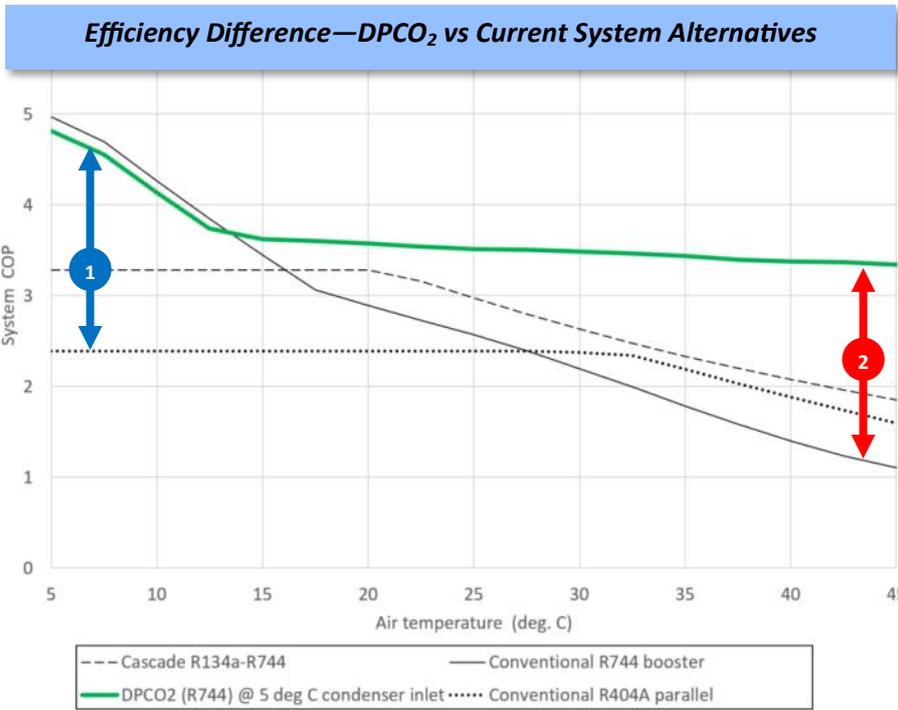


- Tropical Zone
- Subtropical Zone
- Temperate Zone
- Polar and subpolar zone

# PERFORMANCE



DPCO<sub>2</sub> is more efficient than current synthetic cascade and booster CO<sub>2</sub> systems, across a wide range of climatic conditions. The figure below shows the coefficient of performance (COP) of current technologies vs DPCO<sub>2</sub>.



**1— At cooler ambient temperatures, DPCO<sub>2</sub>;**

- achieves a 50% improvement in COP versus a R404A parallel compression system
- achieves a 31% improvement in COP versus a Hybrid Cascade 134a—CO<sub>2</sub> (R744) system

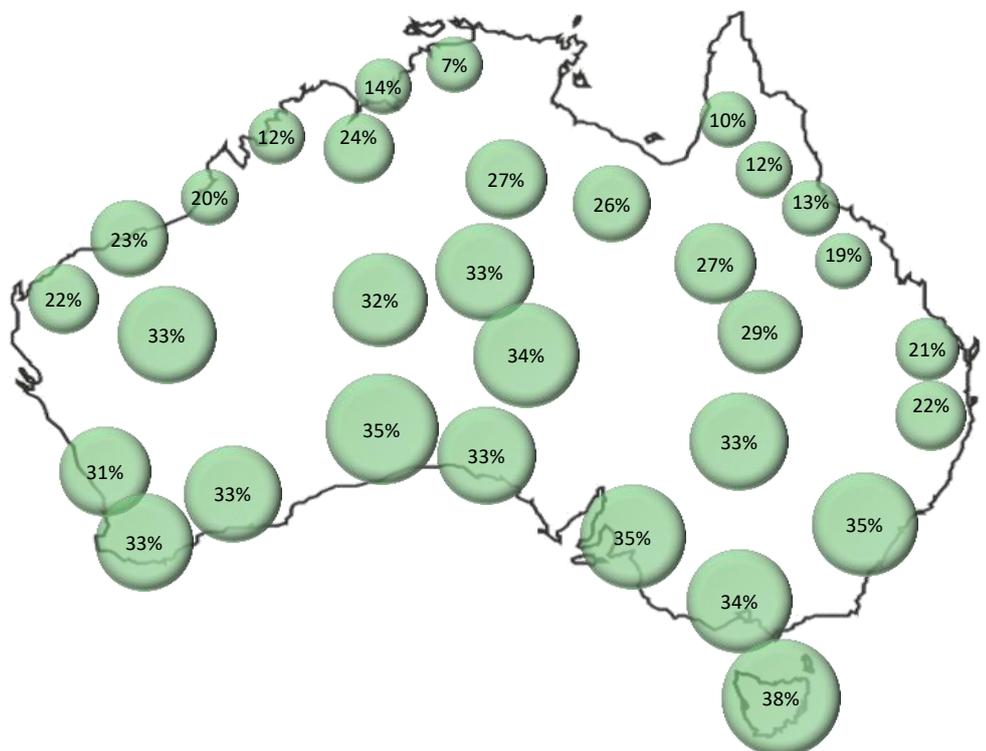
**2— At higher ambient temperatures, DPCO<sub>2</sub>;**

- achieves a 52% improvement in COP versus a R404A parallel compression system
- achieves a 44% improvement in COP versus a Hybrid Cascade 134a—CO<sub>2</sub> (R744) system
- achieves a 67% improvement in COP versus a conventional CO<sub>2</sub> (R744) Booster system

This substantial increase in system efficiency translates directly into significantly lower annual running costs.

The figure at right shows the relative annual energy and cost savings across Australia of DPCO<sub>2</sub> versus a conventional R404A system.

**Cost Savings —DPCO<sub>2</sub> vs R404a System**



System modelling carried out by the University of South Australia also shows a significant reduction in peak demand. The significance in reduction of energy demand during hot conditions corresponding to peak grid electrical cannot be understated. During the transition to renewable energy, the price of energy during peak demand times will rise.

End users of DPCO<sub>2</sub> can expect significant savings versus 404A technology, particularly in the regions unaffected by year round elevated humidity.

# APPLICATIONS / SPECIFICATIONS

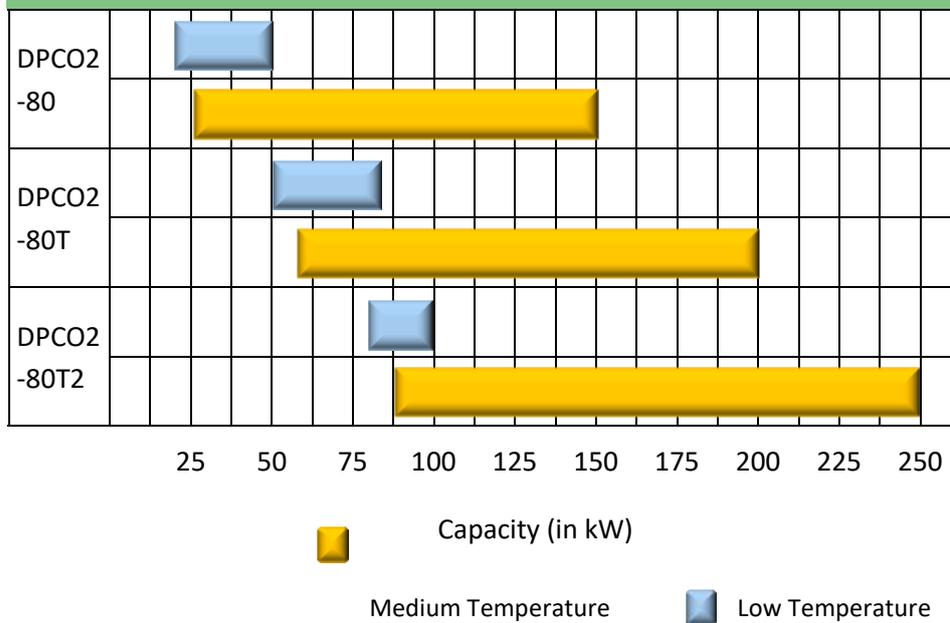


DPCO<sub>2</sub> is designed and built to provide refrigeration for a wide range of Commercial and Industrial cooling applications, ideal cooling solutions for the following industries and sectors:



Glaciem Cooling Technologies take great pride in working closely with end users to deliver cooling systems that are finely tuned to their requirements. Systems will always be configured to ensure highly efficient cooling tailored to production / storage requirements. System capacities / components for base DPCO<sub>2</sub> models are provided below.

**DPCO<sub>2</sub> System Capacities\***



**DPCO<sub>2</sub> Components**

- Seeley Indirect Evaporative Cooling
- Bitzer or GEA Bock high quality and robust CO<sub>2</sub> compressors
- Alfa Laval or Swep Heat Exchangers
- EBM Commercial / Industrial Fans
- All main lines in K65 Copper
- Temprite / Henry coalesce oil separators
- Trax oil management system
- Stainless steel CO<sub>2</sub> liquid receivers; eliminates the risk of vessel failure in the event of dry ice formation com-

\*Other custom system sizes are available on request

\*\* All vessels manufactured to AS1210 standard

Glaciem Cooling Technologies proudly work with the following suppliers to ensure DPCO<sub>2</sub> component effectiveness and quality is second to none.



## About Glaciem Cooling Technologies

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Glaciem Cooling Technologies provide cutting edge refrigeration technologies to the commercial and industrial sectors.

Glaciem specialize in the design and manufacture of CO<sub>2</sub> only refrigeration systems ideally suited to the harsh Australian climate, and Thermcold thermal storage solutions, incorporating award winning phase change materials.

As a Senior Industry Partner to the Barbara Hardy Institute, Glaciem are participants in the Low Carbon Living CRC, an organisation working towards lowering carbon emissions in the built environment.

Glaciem are proud Founding Members of Carbon Neutral Adelaide and the recipients of the 2017 Award



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