Climate Wizard: The innovation revolution in natural air conditioning

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Climate Wizard

SEELEY INTERNATIONAL

Evaporative cooling has come a long way….

From this…

Evaporative cooling has come a long way….

To this…

Cools for the running cost of a light globe

Up to 95% wet bulb efficiency

Non-corrodible cabinet

High-performance evaporative media

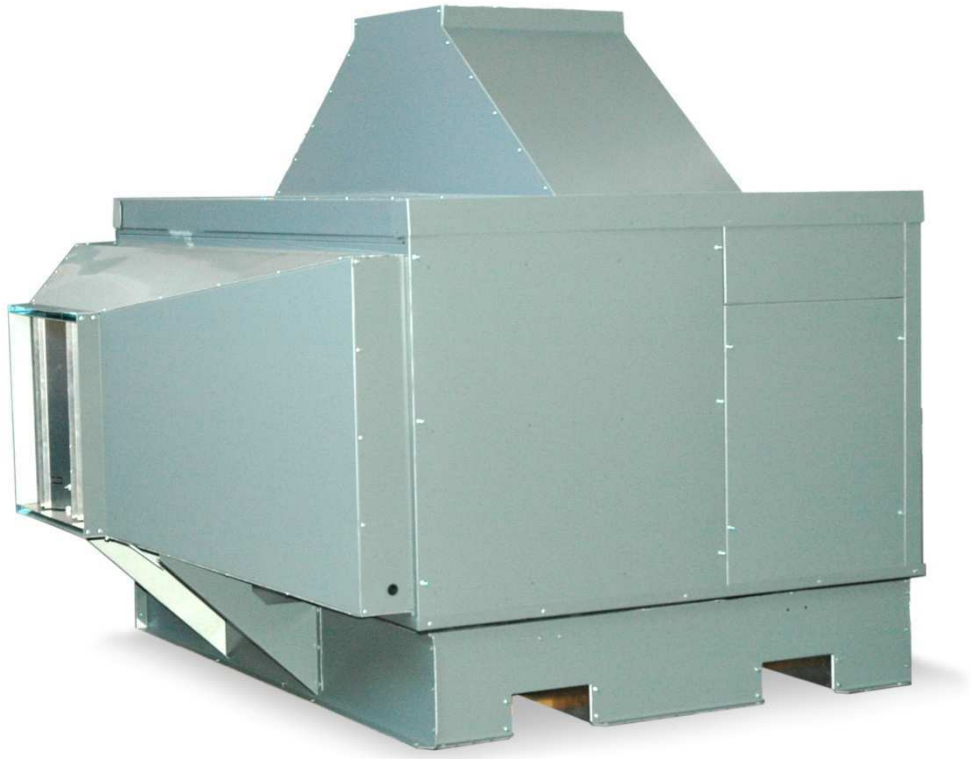
Water management system

Inverter motor

High efficiency fan and scroll

Evaporative cooling has come a long way….

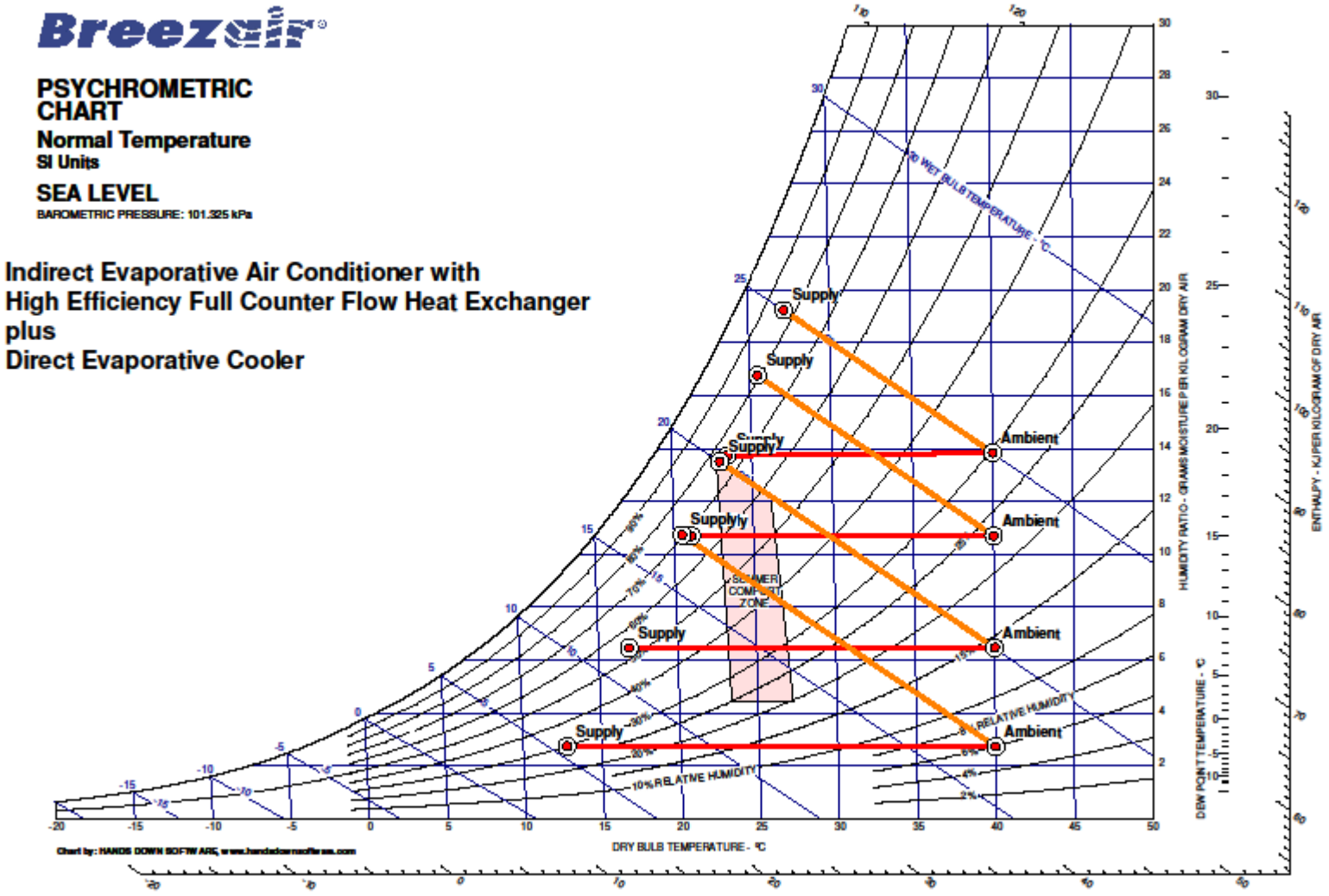
And now, **this**…

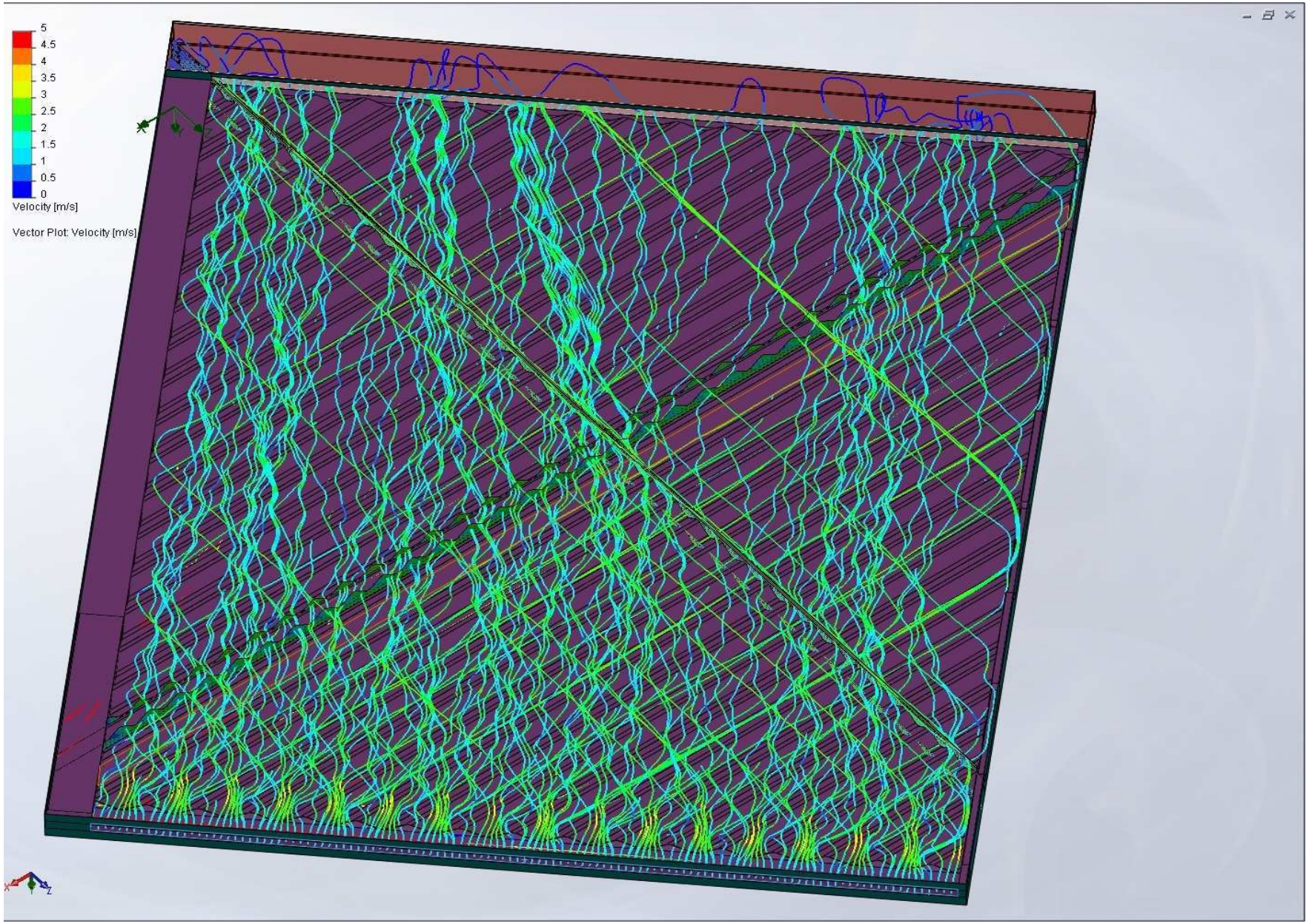


High Performance indirect evaporative cooler

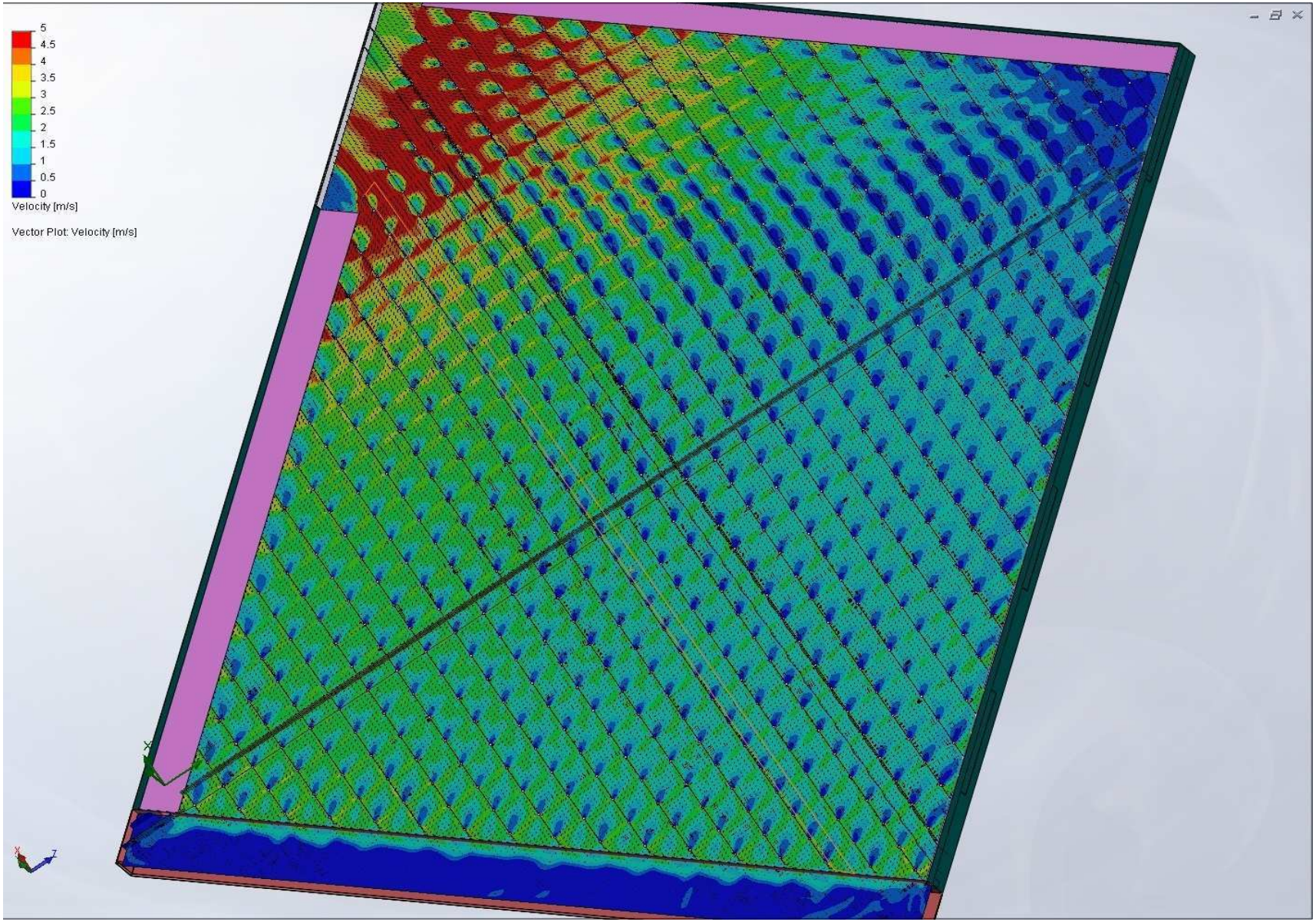
- 100% fresh air to the conditioned space
- Uses the principles of evaporative cooling…. in a new way
- Uses a world-first innovative heat exchange core
- Does not add moisture to the supply air
- Provides better air quality than refrigerated systems
- Uses same power as evaporative coolers

Indirect and Direct evaporative air conditioners

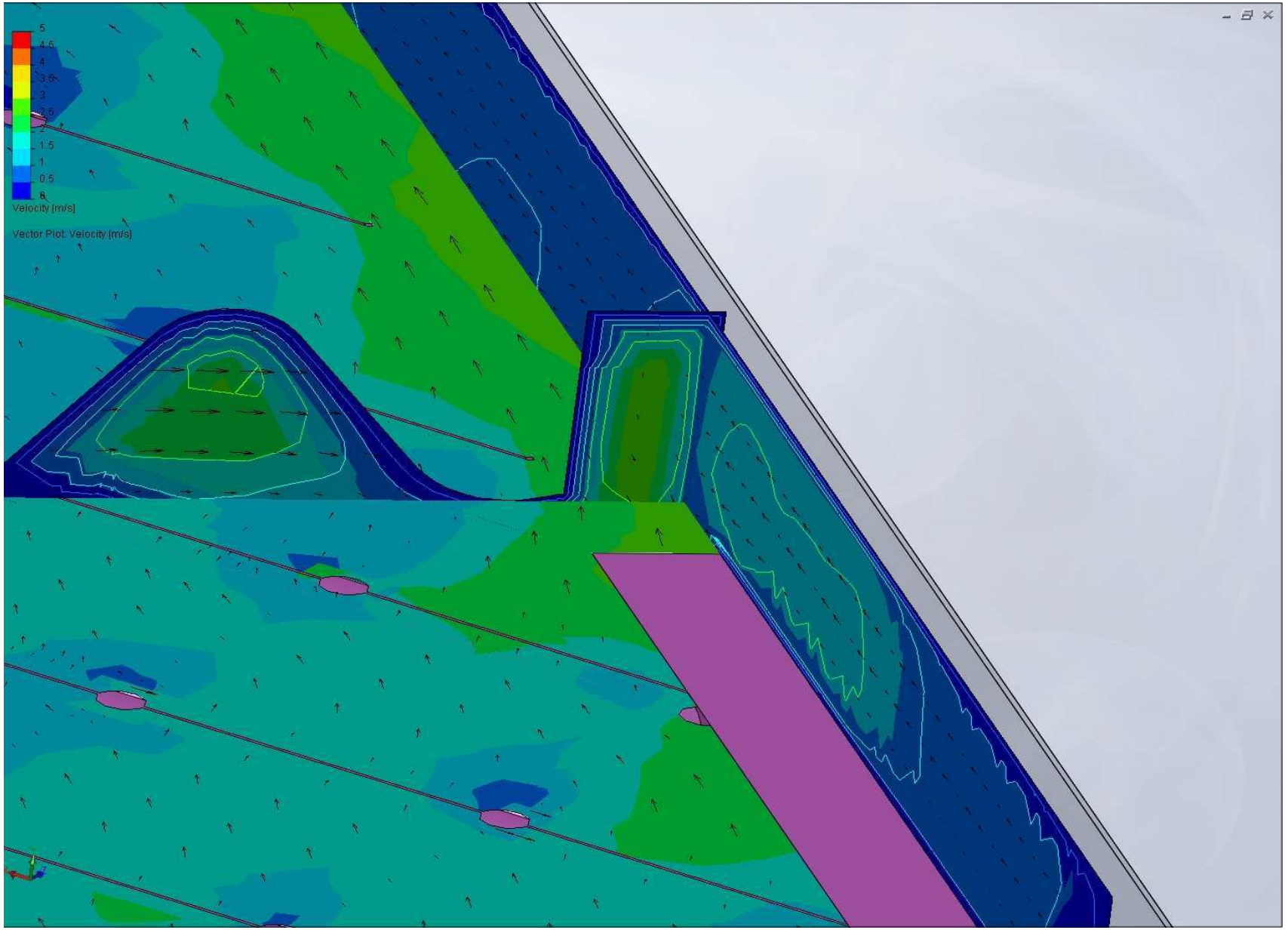




Velocity Streamlines



Mid Layer Velocity Plots



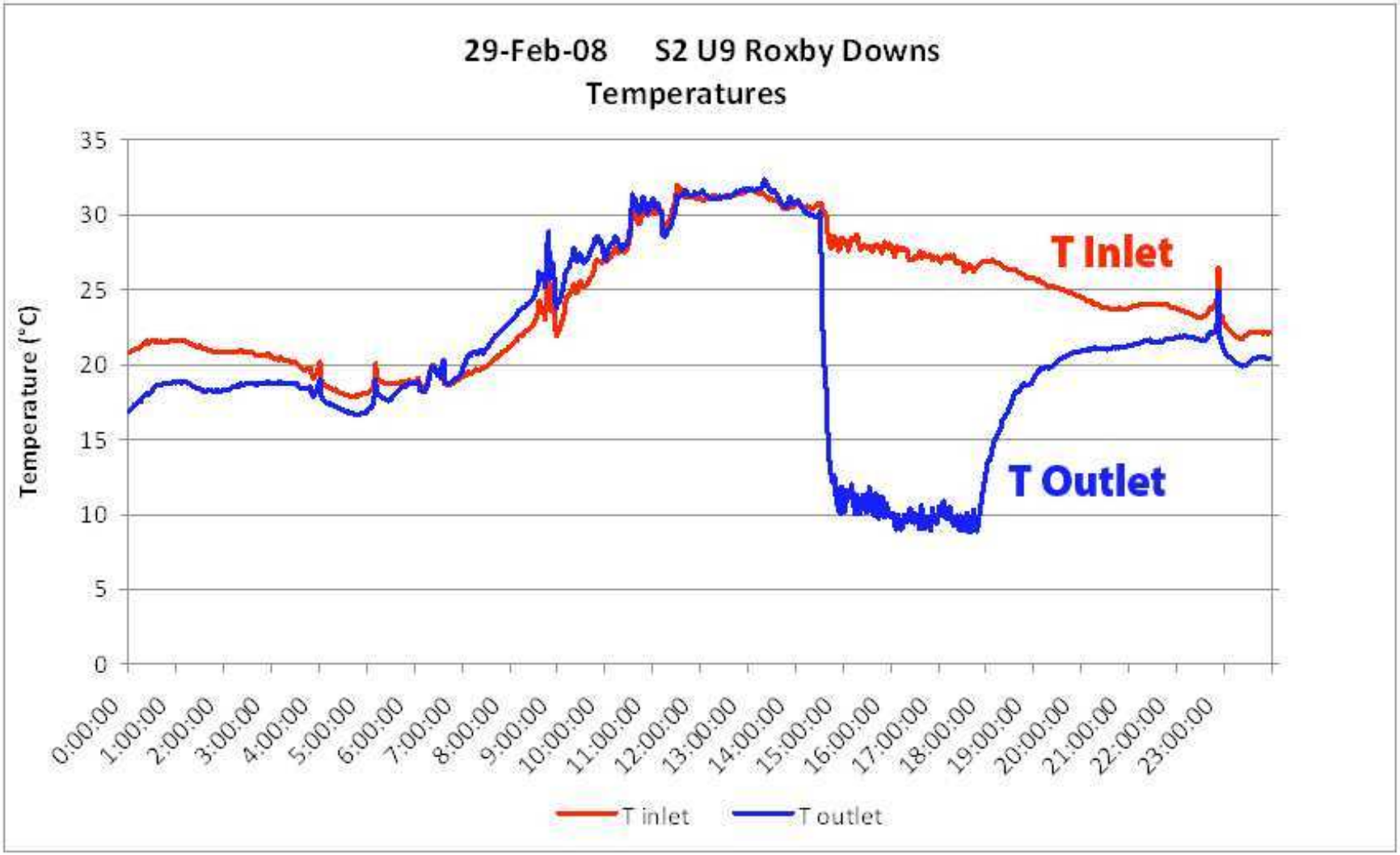
Mid Plane Duct Flow Characteristics

Residential field trial as stand-alone cooling – Roxby Downs, South Australia

- Installed November 2007
- Max Cooling Capacity = 10.8kW
- Max COP observed = 11.8 (EER 40)
- Supply Air Temp = 14.9C avg
- Independently monitored by Dr Frank Bruno, University of South Australia
- Source: University of South Australia Roxby Downs Report June 2009

Hot day performance

Moderate day performance



Cooling capacity equation

The cooling capacity is defined from the equation:

$$Q = V \times p \times Cp \times (Tdb,in - Tdb,out)$$

Where:

- ***Q*** = Cooling capacity (watts)
- ***V*** = Air flow rate delivered by cooler (litres/min)
- ***p*** = Air Density (kg/m^3)
- ***Cp*** = Specific heat of air = 1.023 (kJ/kgK)
- ***Tdb,in*** = Dry bulb temperature into the cooler (^oC)
- ***Tdb,out*** = Dry bulb temperature delivered by the cooler (^oC)

Coefficient of performance

$$COP = \frac{\dot{Q}}{\dot{W}_{in}}$$ in units of kW/kW

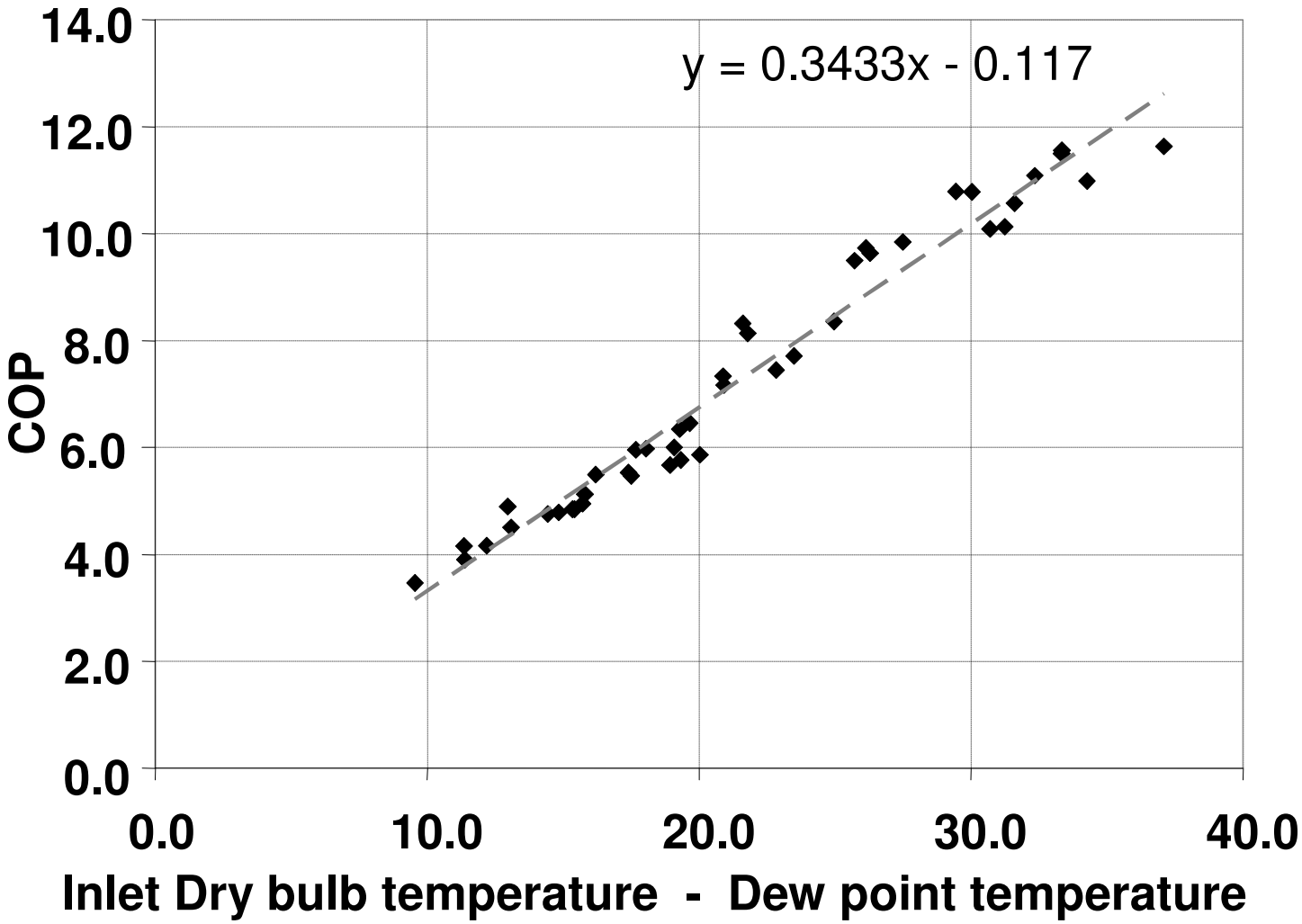
(EER = COP x 3.41)

The wet bulb effectiveness is defined as:

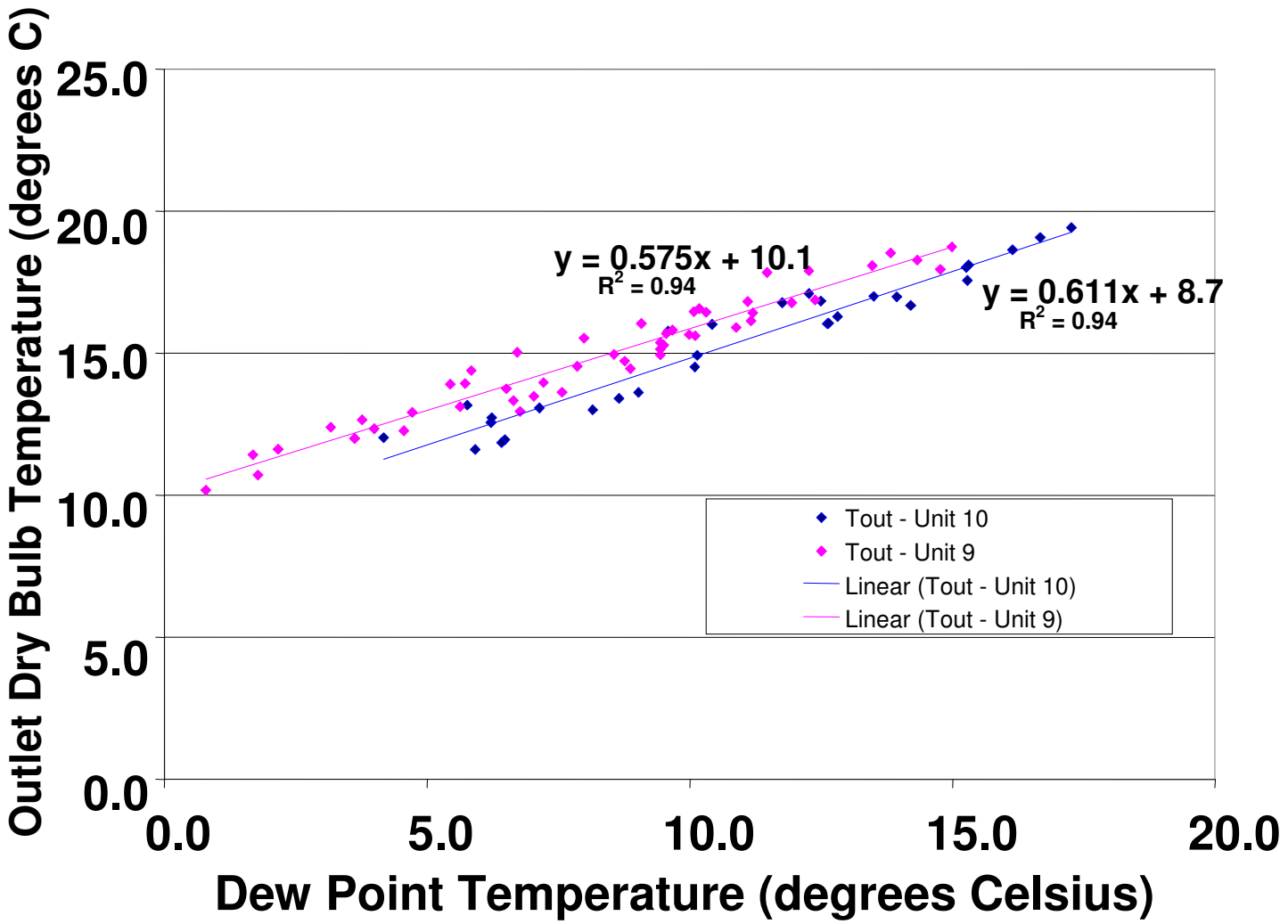
$$\varepsilon = \frac{\left(T_{db,in} - T_{db,out}\right)}{\left(T_{db,in} - T_{wb,in}\right)}$$

Where $T_{wb,in}$ is the wet bulb temperature of the air entering the cooler

COP v the difference of dry bulb and dew point temperature of ambient air



Average outlet air temperature v average ambient dew point temperature - January to March



Breezair®

PSYCHROMETRIC CHART

Normal Temperature
SI Units

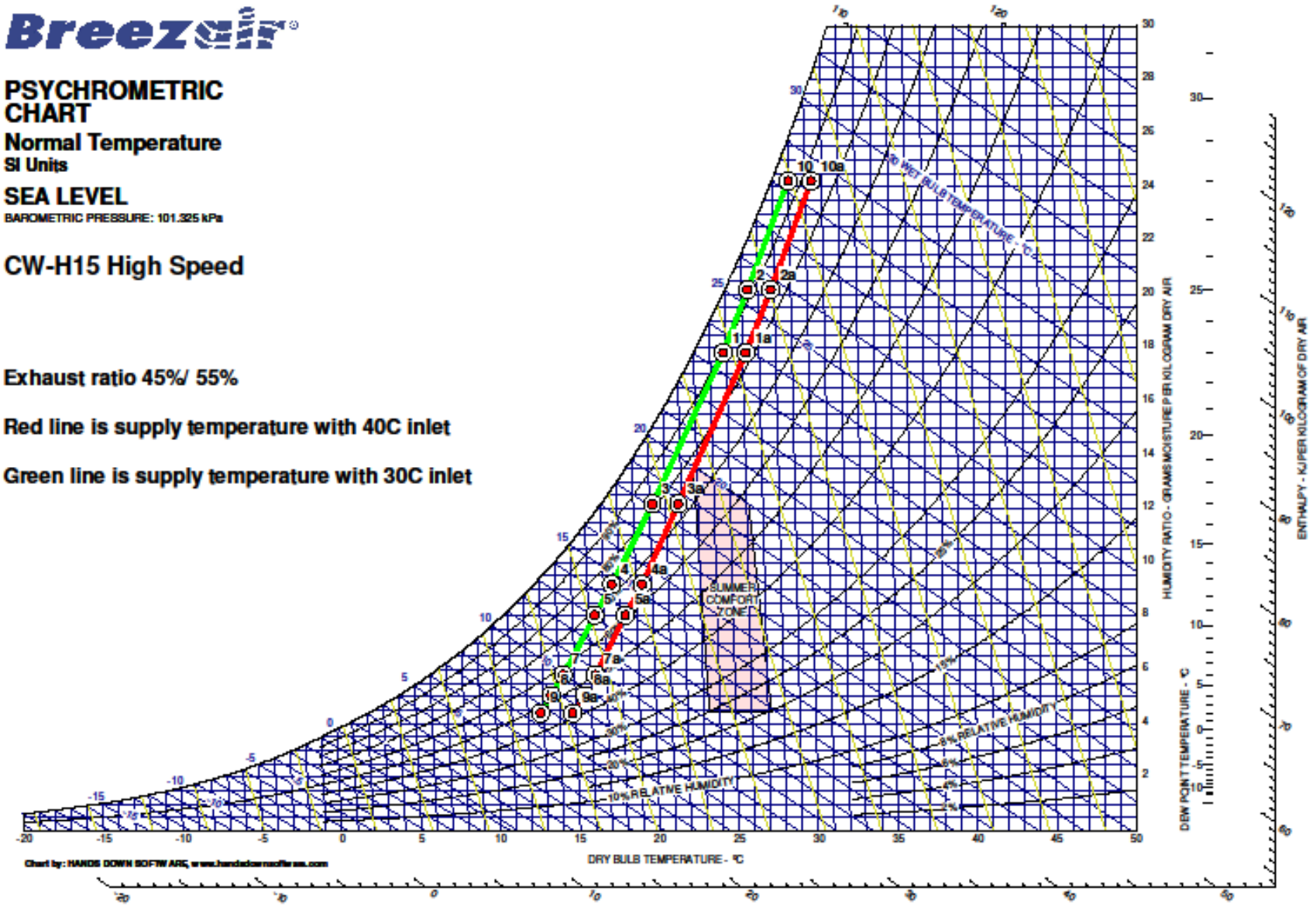
SEA LEVEL
BAROMETRIC PRESSURE: 101.325 kPa

CW-H15 High Speed

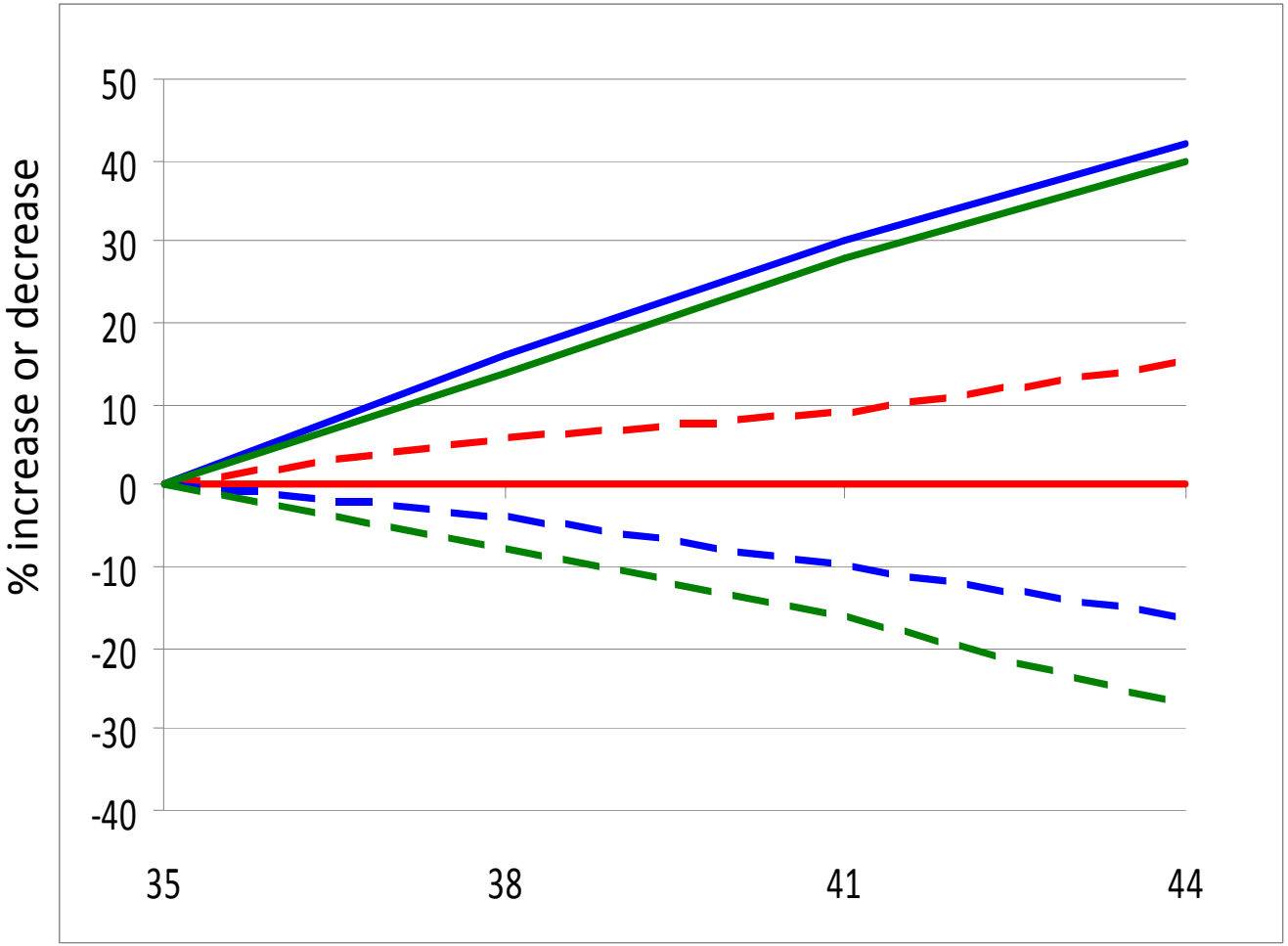
Exhaust ratio 45%/ 55%

Red line is supply temperature with 40C inlet

Green line is supply temperature with 30C inlet



Performance comparison
high performance indirect evaporative air conditioner and refrigerated cooling



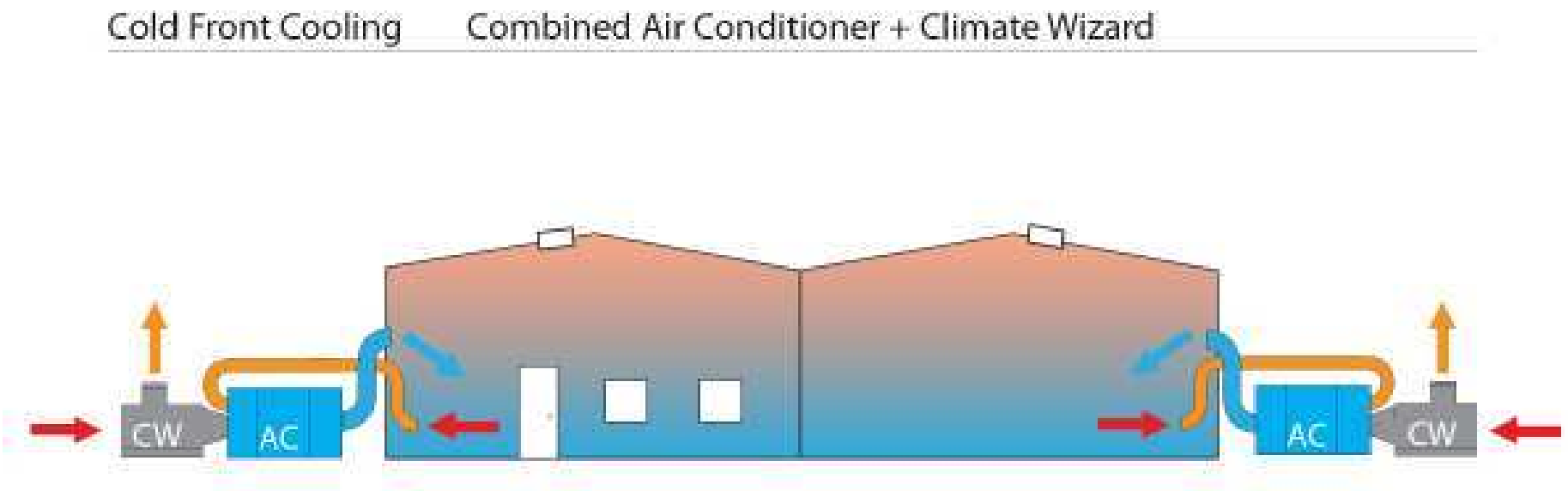
Outdoor Temperature (Degrees Celsius DB)

Source: Uni SA Roxby Downs Report June 2009

Climate Wizard applications

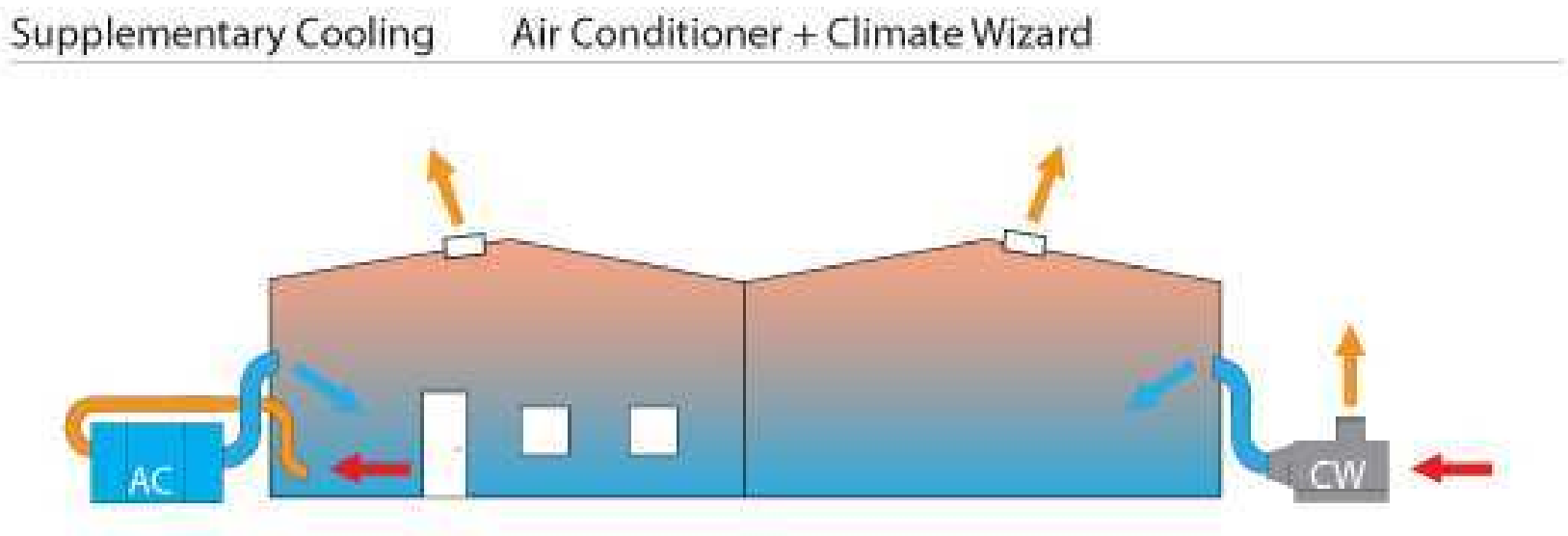
- Residential
- Commercial
- Industrial
- New or existing buildings

Cold Front Cooling



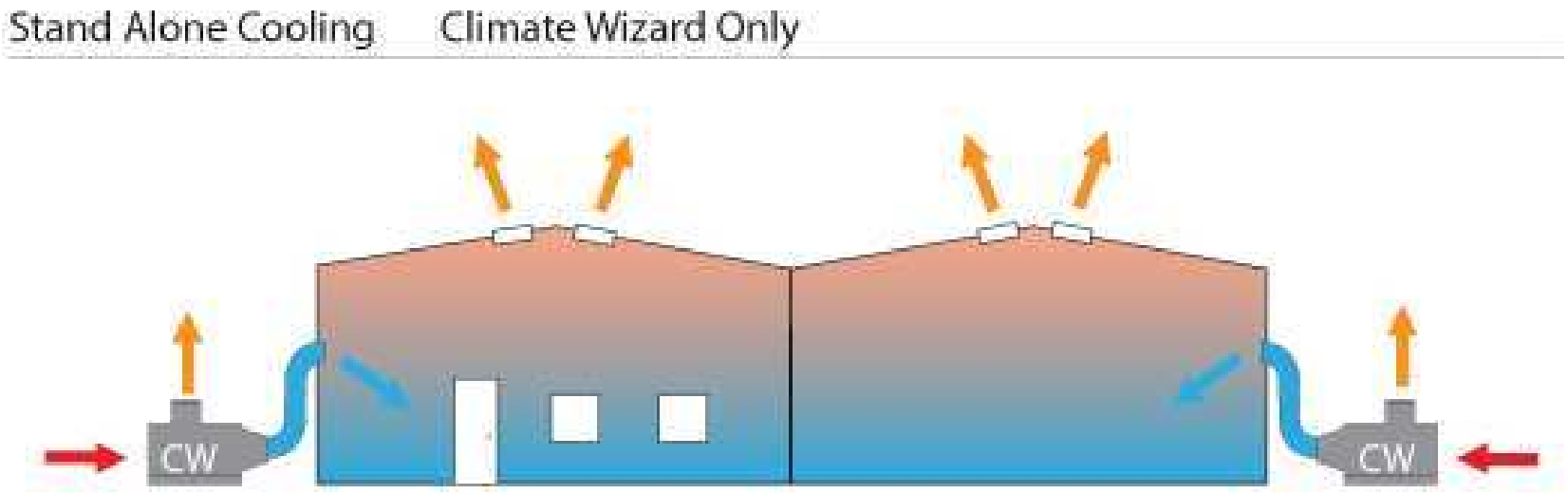
Energy savings of up to 35%

Supplementary Cooling



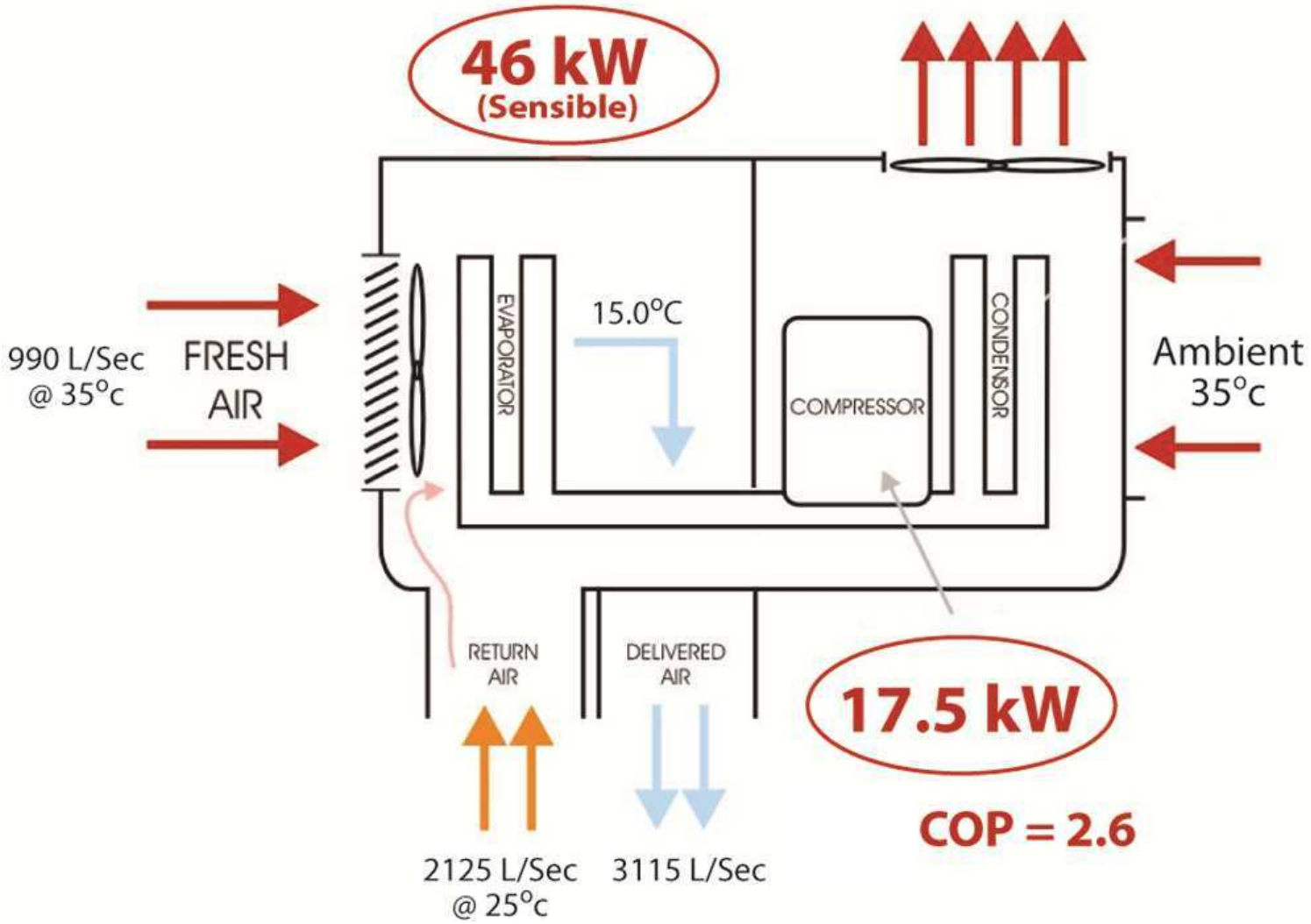
Energy savings of up to 35%

Stand Alone Cooling

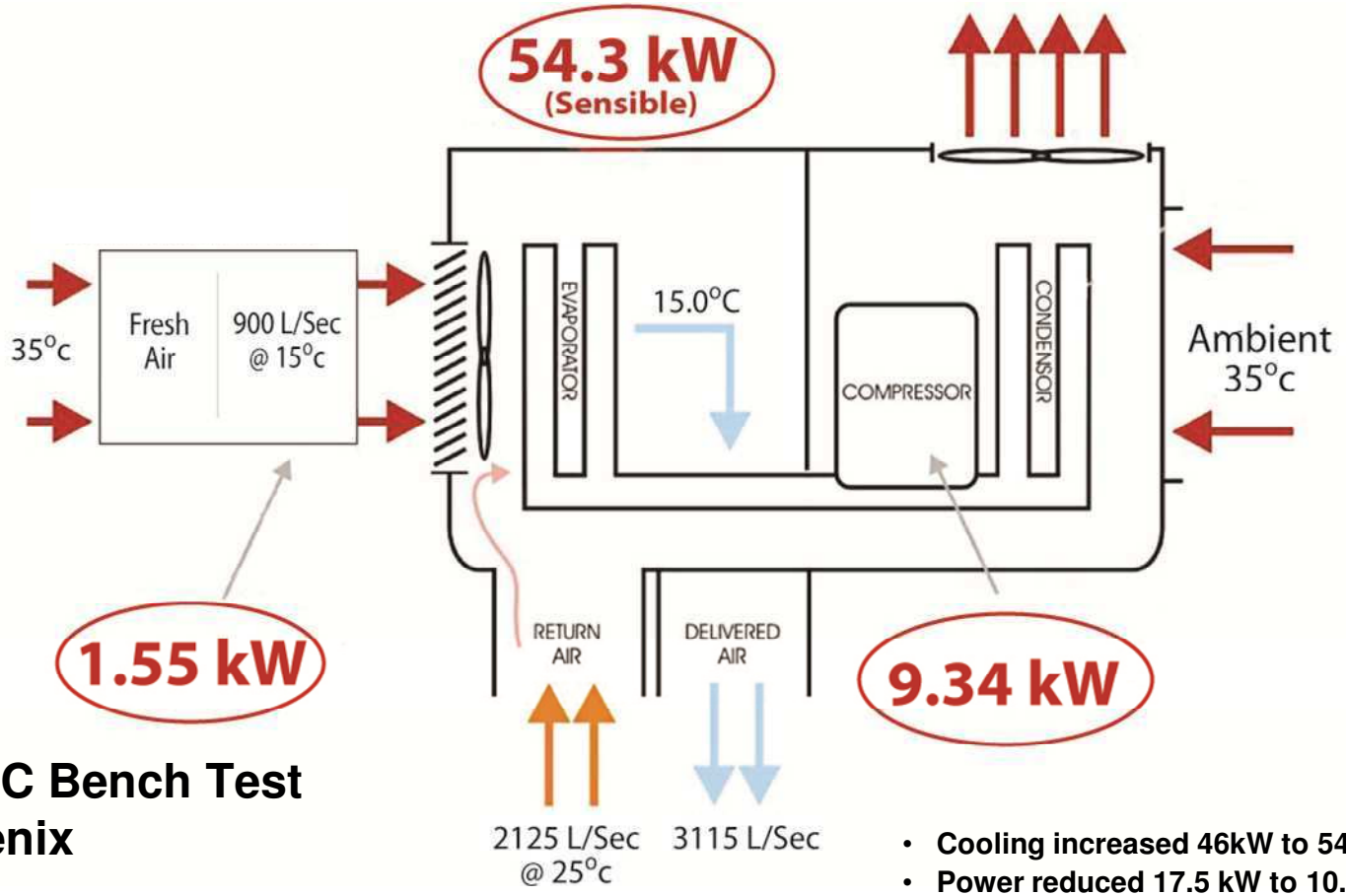


Up to 80% less energy than refrigerated air conditioning

WCEC Bench Test – Phoenix
17.5 ton, 4 compressor stage, packaged air conditioner sensible cooling capacity test



17.5 ton packaged air conditioner, 2 stages operating with condenser cooling and indirect evaporative air conditioner supplying fresh air



WCEC Bench Test
Phoenix

- **Cooling increased 46kW to 54.3kW = 18%Æ**
- **Power reduced 17.5 kW to 10.9kW = 38%**
- **COP increase from 2.6 to 5.0**

WCEC Bench Test Results

- Two stages cooling with condenser cooling and a high performance indirect evaporative air conditioner providing fresh air
- Indoor air circuit conditions remain the same
- Same quantity of fresh air supplied

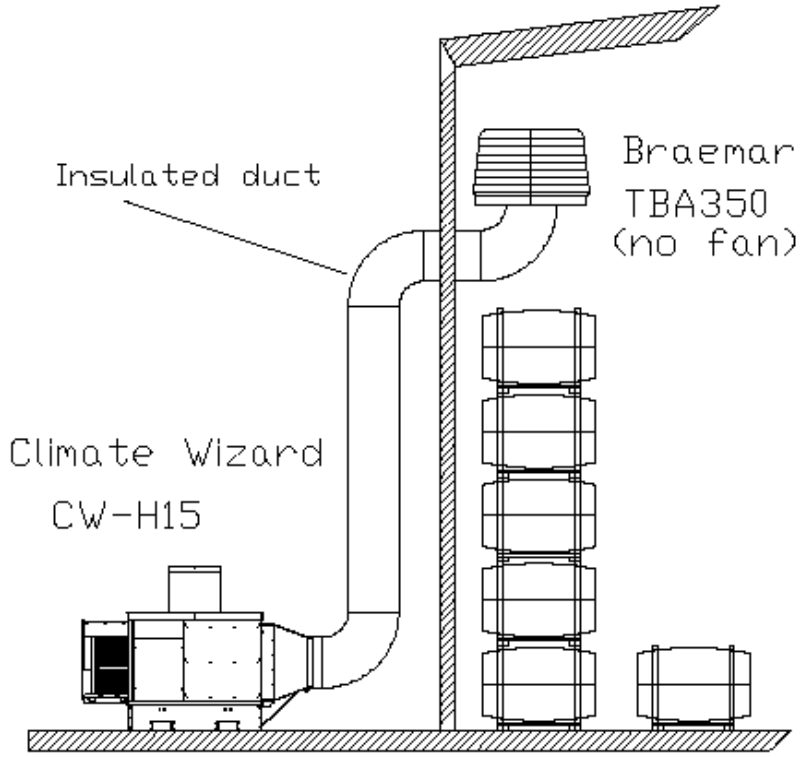
…BUT

- Cooling increased 46kW to 54.3kW = 18%Æ
- Power reduced 17.5 kW to 10.9kW = 38%
- COP increased from 2.6 to 5.0

Engineered Applications

- **Australian** manufacturers, in conjunction with specialist contracting organisations can engineer solutions targeted at specific conditions.

- The following example was developed to meet storage conditions that have unusual and special requirements



Climate Wizard
High Moisture level installation

Climate Wizard provides 100% cold air with no added moisture

Braemar provides additional cooling while building moisture in the air stream

Objective is air at 8C to 12C and 85% RH.

Barrel storage / fermentation hall

Breezair

PSYCHROMETRIC CHART

Normal Temperature

SI Units

SEA LEVEL

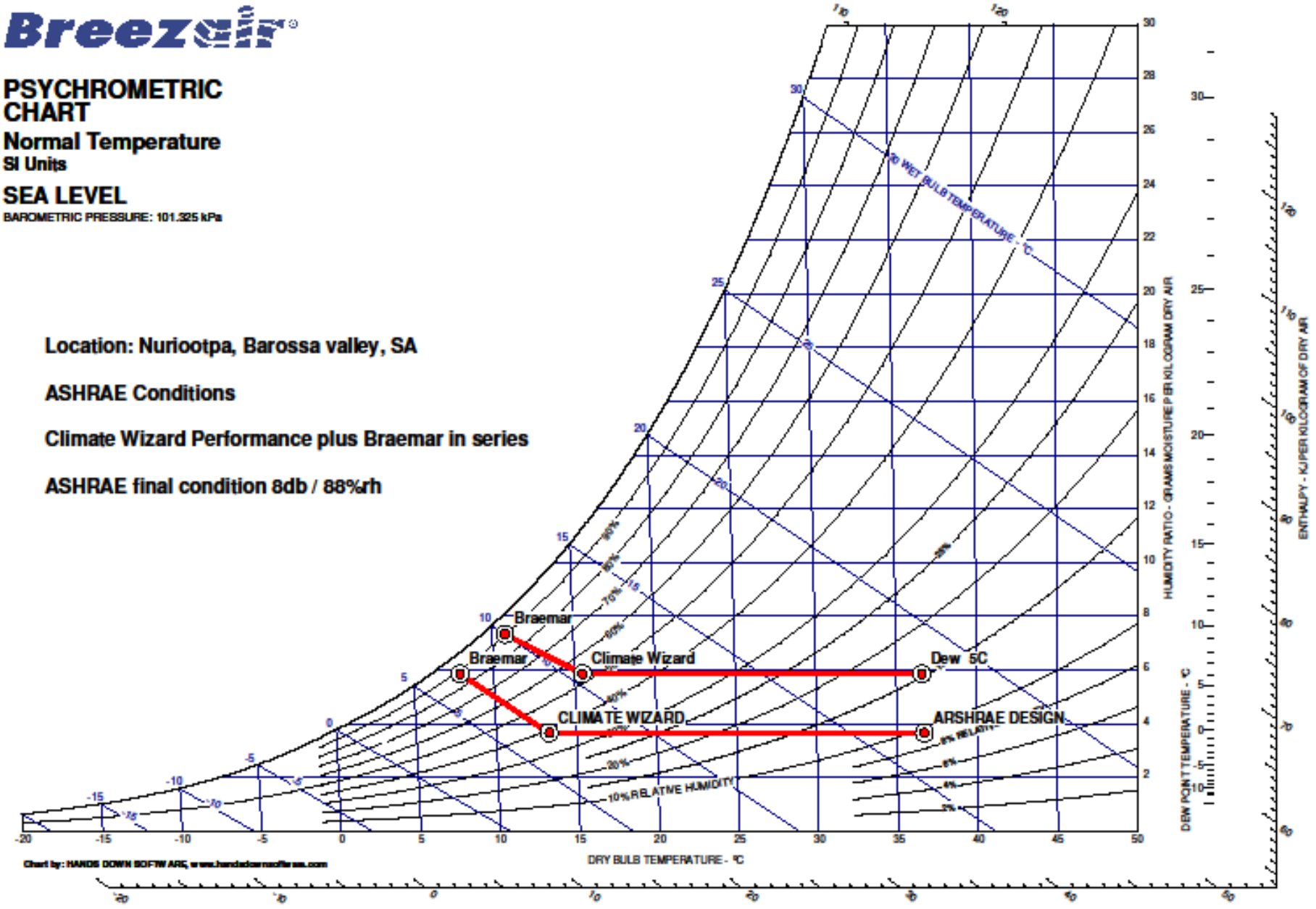
BAROMETRIC PRESSURE: 101.325 kPa

Location: Nuriootpa, Barossa valley, SA

ASHRAE Conditions

Climate Wizard Performance plus Braemar in series

ASHRAE final condition 8db / 88%rh



Applications – pumping station

Applications – olive oil factory

Applications – factory complex

Applications
– broadcast transmitter hall

Applications – university classrooms

UK university data centre

Summary

- Ground-breaking product design delivers altogether unique outcomes
- Huge *global* benefits through, reduction in power use
- Many applications - stand-alone or with refrigerated air conditioning
- New or existing installations
- Designed for long life, ease of installation and low maintenance

Thank You

Questions?