



Tri-Capacity™ delivers big savings for Big Box Retailers.

A side-by-side comparison of 2 Brisbane big box stores each with different technologies has shown ActronAir's Tri-Capacity™ units deliver significant energy savings.

Annual energy consumption savings of 37% were projected with operational cost savings of over \$400,000 per store over a 15 year lifetime.

Big Savings for Big Box Stores.

Big box retail spaces are known as being notoriously difficult to cool efficiently, due to their size, layout and typically exposed ceilings.

The performance of ActronAir's Tri-Capacity™ packaged air conditioning units at a major retailer's site in Brisbane has shown the significant energy efficiency gains achieved over comparable two-stage equipment offered by competitors.

Independent field testing and energy analysis was conducted by Ecosave for two Big Box Retail company-owned stores. ActronAir Tri-Capacity™ technology was installed at Rocklea and 2-stage fixed-speed technology was installed at Browns Plains.

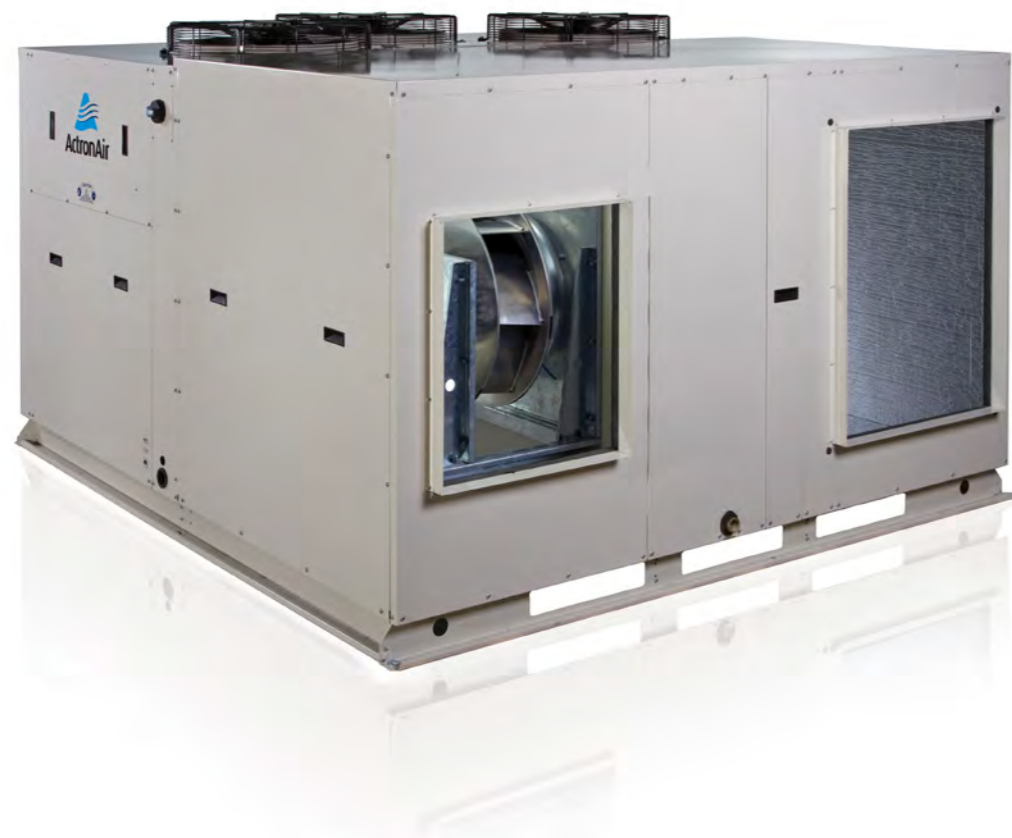
Both stores were commissioned within an 8 month period and located within close proximity.

Over the 43-day trial, it was found that Tri-Capacity™ technology delivered total energy consumption savings of 31%. On a daily basis, energy savings of between 10% and 50% were achieved.

Based on this data, Ecosave projected an annual energy consumption saving of 37%.

This energy saving equates to a (15 year) lifecycle saving of over \$400,000 and a payback period of just 2.02 years (calculated at \$0.15/kWh and on initial equipment capital cost difference).

TRI-CAPACITY



Brisbane Big Boxes.

In February 2013 a big box retailer in Browns Plains, an outer-southern suburb of Brisbane, had ten 96kW 2-stage fixed speed packaged air conditioning units installed and commissioned.

These units operate two symmetrical compressors and feature on-board controllers to respond to demand, with two stages of capacity (50% and 100%). Two-speed AC condenser fans service the units' air cooled coils; while the evaporator fans feature AC motors coupled to a belt and pulley driven, forward-curved fan.

Eight months later, at the retailer's nearby Rocklea store, the same mechanical contractor installed and commissioned eleven 96kW ActronAir PKY-series Tri-Capacity™ packaged air conditioning units.

These units utilise three similar-sized compressors with two units electronically interlocked to run together, coupled with on-board controllers to provide 3-stage operation (33%, 66% and 100% capacity).

The units' air cooled coil is served by three 2-speed AC condenser fans; while the evaporator fans feature EC motors with direct drive to a backward curved plug fan.

Both units are internally controlled.

Following a number of months of bedding in, independent energy auditor Ecosave was invited by ActronAir, in conjunction with the property owner, to conduct an energy efficiency and performance comparison of the two unit types at the two stores.

Given the relative close proximity of the two stores, just 12km apart, they were considered ideal for comparison as both operate under the same conditions.

As the design, fit, finish and layout of the stores are guided by a design brief applied at all stores, the two stores also have very similar layouts. Site inspections confirmed that the nature and size of area (and therefore cooling loads) to be similar, with physical measurements also showing the area conditioned per unit to be similar.

Over 43 days, from Tuesday January 21 2014 to Wednesday March 5 2014, data logging and analysis of both technologies was conducted at both stores.

This analysis focused on the total power consumption of the air conditioning systems in each store, which was measured to quantify the total electrical energy required to condition the entire space. The total air conditioning power consumption was metered by installing billing-grade current transformer-driven smart meters at the circuit supplying the total input load at both sites.

Concurrently, key components of each unit were also measured to identify the performance characteristics of individual components, so as to quantify where and how energy savings were being achieved. These units were located in the same position for each store.

Component trend logging was completed using high-accuracy ACR multi-channel data loggers that measured full current across all three phases of the specific component.

The operational hours, control set points and other control parameters affecting energy consumption were observed to be the same for both units where component measurements were taken.

	Rocklea Store	Browns Plain Store
Technology	Tri-Capacity™ with EC Plug fan	2 stage fixed speed compressor with AC fan
No. of units	11	10
Floor area (sqm)	8459	7515
Floor area per unit (sqm)	769	752

Table 1: Store Comparison

Full load vs. Part load.

Due to the summer-time conditions and location, both stores operated in cooling mode throughout the entire 43-day trial.

Over this period, the daily energy consumption was observed to be lower at the Rocklea store (ActronAir Tri-Capacity™), with total electrical energy consumption of 71,423kWh recorded (Figure 1).

This compared to 103,234kWh at the Browns Plains store. This represented an energy saving of 31% delivered by the ActronAir Tri-Capacity™ units (Figure 1).

Additionally, the daily energy saving achieved was between 10% and 50% (Figure 2).

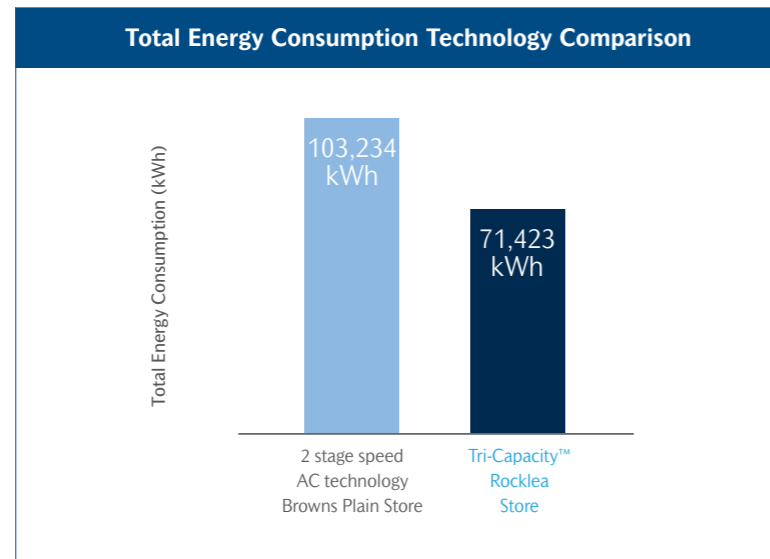


Figure 1: Total Consumption over Test Period

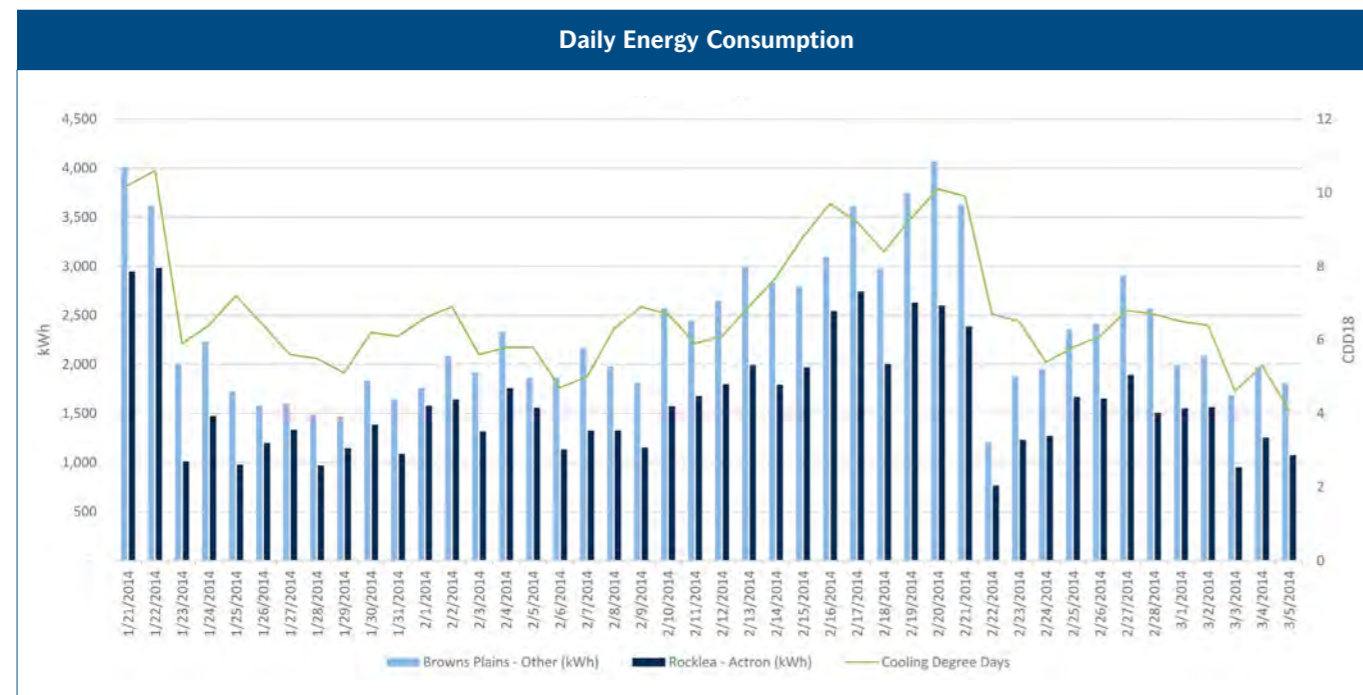


Figure 2: Daily Consumption over Test Period

Ecosave performed a simple regression analysis to assess the correlation between cooling degree days and energy consumption. This revealed that the units had different responses to cooling loads, with both stores showing a strong correlation to cooling load (Browns Plains, $R^2=0.69$ vs. Rocklea, $R^2=0.74$).

“This simple regression analysis shows that the savings would be achieved across a wide range of daily conditions,” said Ecosave.

Given the coolest day during the test period had a minimum of 19°C, a maximum of 27.9°C and a total of 4.1 cooling degree days (CDD), a complete analysis of part-load efficiency was not possible (as a CDD of less than 4 would be required).

However measurements taken at half-hour intervals between the hours of 7am and 7pm did find strong correlation between energy savings and the ambient temperature.

“Based on these observations, it can be concluded that there would be additional savings, above the observed 31%, if the monitored period had included a number of part-load conditions, with a CDD of less than 4,” said Ecosave.

However by using historical weather data for Brisbane from the preceding 12 months, Ecosave was able to estimate the annual cooling consumption of the units at both stores, finding the annual mechanical electrical energy consumption of the ActronAir Tri-Capacity™ units at the Rocklea store to be 37% lower than those at the Browns Plains site.

To evaluate the investment required to install these units, a payback period was also calculated based on initial equipment capital cost difference for a range of electricity rates.

Using the information supplied by the buildings' owner, consideration was given to the higher investment/purchase cost of the ActronAir Tri-Capacity™ units and their inherent lower annual operational costs.

Based on this data, the projected operational savings of the Tri-Capacity™ units would be in the order of \$407,891 per store over a 15-year lifecycle (\$0.15/kWh).

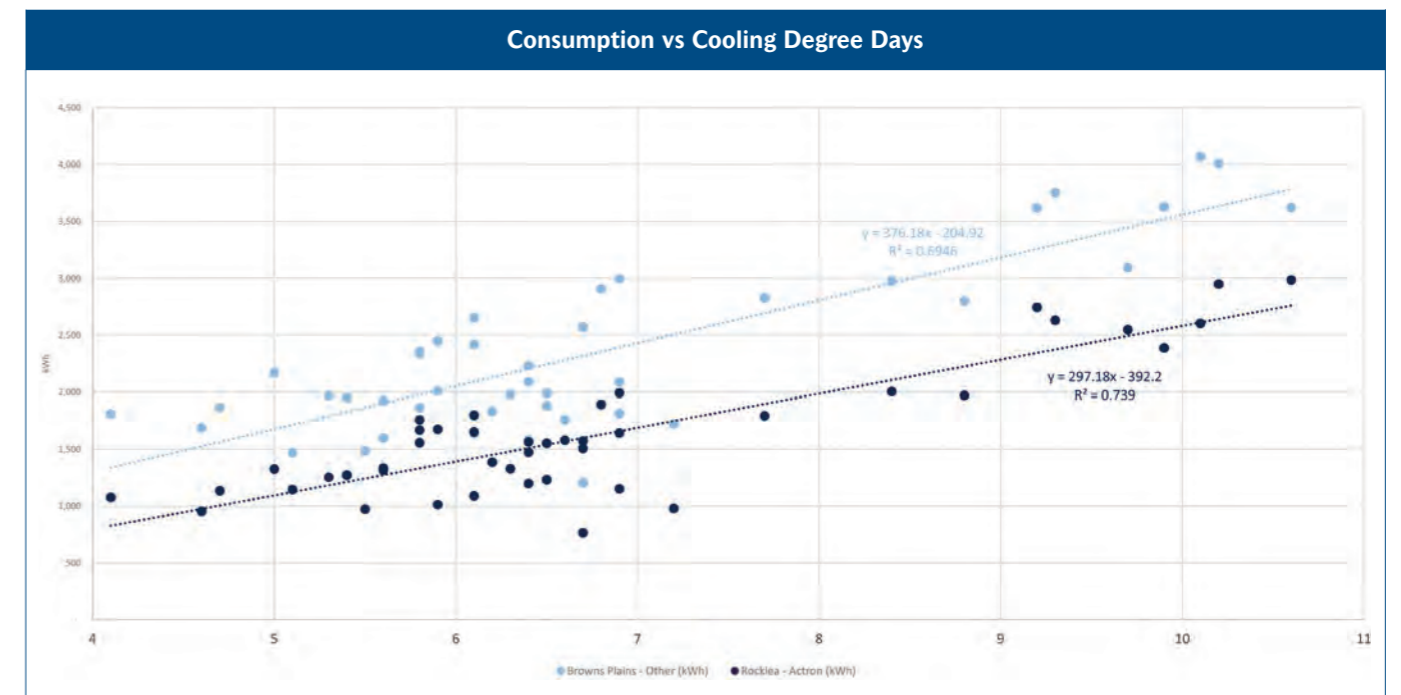


Figure 3: Consumption vs Cooling Degree Days

Proven performance.

This real-world, data energy analysis of ActronAir's Tri-Capacity™ series of packaged air conditioners shows that in new builds, retrofits and end-of-life replacement projects, the operational savings offered by these units are significant.

The projected annual electrical energy saving of 37% represents an operating cost saving of \$27,193 per annum (based on \$0.15/kWh) over the 2 stage fixed speed air conditioner technology.

Extrapolated over a 15 year lifecycle, the projected operational saving provided by the Tri-Capacity™ units would be in the order of \$407,891 and provides a payback period of approximately 2 years (based on \$0.15/kWh, cost information supplied by the buildings' owner, and initial equipment capital cost difference).

"The operational savings offered by the ActronAir Tri-Capacity™ package units are significant and perform true to design in real-world applications," says Ecosave.



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