

Case Study:

RETAIL WHOLE OF SYSTEM HVAC&R OPTIMISATION

A leading Retailer in Townsville achieved a 22.6% reduction in air conditioning electricity costs with Aeris SmartENERGY™ optimisation. At the asset level, this translates to a projected saving of \$137,800 per unit over a 15 year product life.

The performance of HVAC&R systems is affected by a number of factors. System maintenance, cleanliness, and poorly implemented system control can increase energy consumption, reduce internal comfort conditions and create indoor air quality issues.

Over a 4 week period, data loggers were used to measure the baseline and post-optimisation performance of a 160kW DX Package unit.

Project deliverables:

- Energy consumption was reduced by 22.6% with projected savings of \$9,276 p.a.
- Improved coil heat transfer efficiency
 - Reduced coil temperature differential whilst still maintaining internal conditions
 - Increased air flow through the coil by 113%
 - Reduce system pressure loss through the coil by 48.8%
- Improved occupant comfort
 - Better control of temperature
 - Better control of relative humidity, even in systems without direct humidity control
- Improved indoor air quality
 - Prevention of > 98% of bacterial regrowth over a 12-month period compared to untreated coils¹

RETAIL SmartEnergy™ CASE STUDY

INTRODUCTION

The implementation of the Aeris SmartEnergy platform within a large, self-contained bulky goods retail tenancy in provided a unique opportunity to demonstrate the capability of the Aeris SmartEnergy platform in practice.

THE PROJECT

The retail tenancy is part of a large bulky goods and factory outlet facility in Townsville. Each tenancy is located at ground level with direct external access. The tenancy itself was predominately a large open plan format of approximately 300 sqm.

Hours of operation

9 am – 5.30 pm weekdays (9 pm Thursdays)

9 am to 4.30 pm Saturday and 10 am – 4.30 pm Sunday.

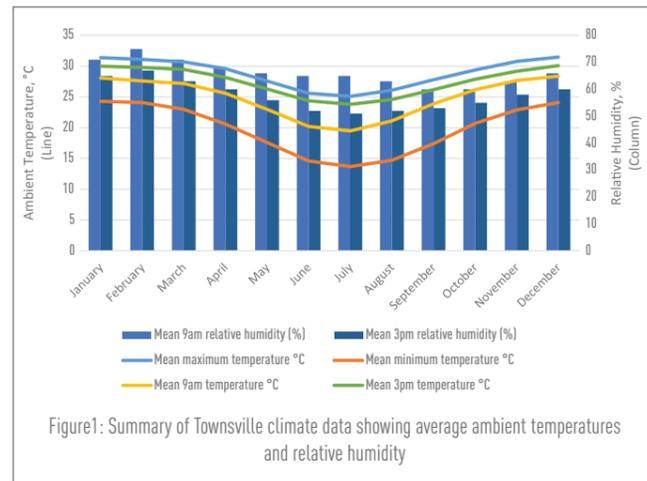
THE EQUIPMENT

A dedicated custom built 160 kW Temperzone DX packaged unit, with high humidity coil AC plant served the tenancy.

CLIMATE

Townsville is a tropical climate characterised by hot, humid summers and warm winters. High levels of sunshine throughout the year contribute further to HVAC loads through the building fabric.

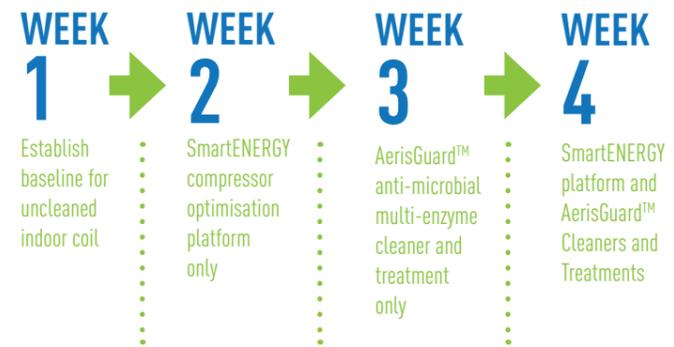
Tropical conditions also create the perfect environment for biofilms and microbial growth to occur. The combination of high relative humidity and high ambient temperatures provide an ideal breeding ground for mould and bacteria to thrive in HVAC&R equipment. This biofilm build up on the coil fin surface restricts air flow and reduces heat transfer efficiency.



THE PROCESS

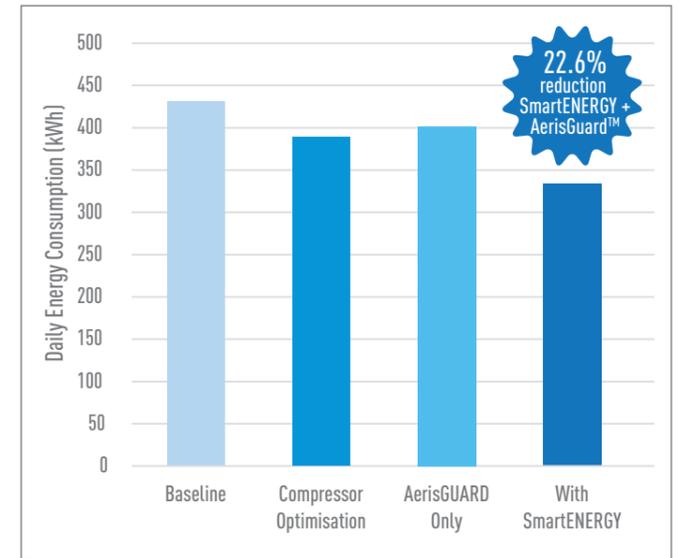
Over a 4 week period, data loggers were set up on the Package Unit to record the following variables:

- Energy consumption kWh
- Air on and air off temperature of the coil.
- Temperature and humidity of the Return Air.
- Temperature and air flow of the coil.



To enable a meaningful comparison, it was important to compare data from similar days. The EVO International Performance Measurement and Verification Protocol (IPMVP) methodology was used to demonstrate the benefits of using the Aeris SmartEnergy whole-of-system approach.

Using the IPMVP methodology, weather data was analysed to select a day in each of the four weeks that had similar ambient conditions.



Self Learn

The proprietary AERIS SmartENERGY platform measures and records the historical operating patterns of the system.

The self-learn mode applies the best fit control algorithm to determine the most effective operating conditions to achieve the desired temperature.



Adaptive Control

SmartENERGY uses real time dynamic demand and energy management control.

As the room temperature approaches set point, it intuitively turns the compressor off or unloads stages (for fixed speed compressors) or reduces the capacity load (for digital scroll compressors).

As the temperature moves away from set point, it re-engages compressor operation to minimise temperature fluctuations, whilst maximising the compressor efficiency.



Optimises

The real time dynamic demand management cycle is repeated up to 4 times per hour.

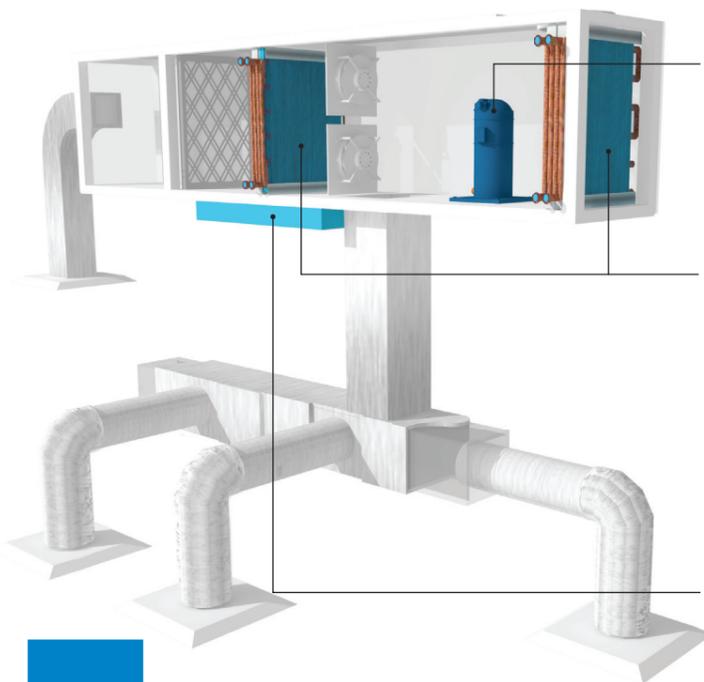
This minimises energy consumption and reduces running costs.

IMPROVED AIRFLOW

In this case study, the air velocity was measured exiting the coil. Prior to the application of the AerisGuard™ enzymatic cleaner the velocity was 2.09 m/s. Post cleaning it had increased to an average of 4.45 m/s or 113%.

Assuming a standard duct velocity of 6 m/s before the coil, this provides a 48.8% reduction in pressure drop across the coil. This is consistent with other installations where the application of AerisGuard™ provided a 54.2% reduction in pressure drop across a coil.

Equipment and retrofit



The SmartENERGY Platform for compressor optimisation

- Optimises compressor performance by better matching heatload using real time dynamic demand management
- Improves energy efficiency and reduces running costs
- Retrofit solution for most HVAC&R systems

Coil Cleaners and Treatments

- Safely cleans and removes biofilm and other contaminants from air cooled coils
- Optimises heat exchanger performance by removing contaminant build-up and preventing re-contamination
- Improves energy efficiency and reduces running costs
- Improves indoor air quality
- Up to 12 months protection from mould, mildew and bacterial growth

Condensate Pan Treatments

- Reduces risk of water damage from blockages due to biofilm build-up
- Up to 6 months protection from mould, mildew and bacterial growth

UP TO 22.6% ENERGY CONSUMPTION REDUCTION - SMART ENERGY + AERISGUARD

Measured energy consumption shows that the application of Aeris SmartEnergy technologies reduces energy in operation. When data from individual days with similar ambient conditions and operational parameters, energy consumption drops by up over 22.6% with a combination of SmartENERGY Compressor Optimisation and AerisGuard™ cleaners and treatments.

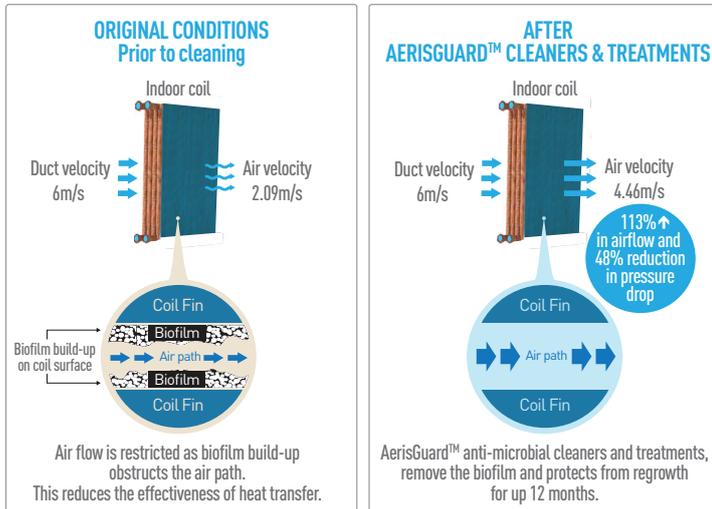
PARAMETER	WEEK 1 BASELINE	WEEK 2	WEEK 3	WEEK 4
Aeris SmartEnergy Application	-	SmartEnergy Compressor Optimisation	AerisGuard™ Cleaners & Treatments only	SmartENERGY whole of system SmartENERGY + Aeris Guard
Daily Energy Consumption	431 kWh	389 kWh	401 kWh	333 kWh
Reduction compared to baseline	-	12.8 % (9.8% raw improvement then adjusted for higher relative humidity)	6.9%	22.6%
Projected annual electricity savings @ 26c per kWh	-	20,095 kWh \$5,224	10,777 kWh \$2,802	35,680 kWh \$9,276

Projected savings are based on reduction in energy consumption, assuming consistent energy use for 3,000 hours per year at 26 cents per kilowatt hour.



Effective heating and cooling relies on a combination of convection and conductive heat transfer between the air stream, the coil itself and the fluid in the coil. As coils become blocked with dust particles and biofilm, pressure across the coil increases and airflow decreases. This reduces the convective heat transfer efficiency of the system.

In addition, biofilm on the coil can provide a level of insulation reducing the conductive heat transfer efficiency and further reduce overall system performance.



IMPROVED TEMPERATURE CONTROL

The temperature on and off the coil was measured for the duration of the study. Increased airflow through the coil improves the heat transfer efficiency of the coil. This results in better control of internal temperature and humidity.

PARAMETER	WEEK 1 BASELINE	WEEK 2	WEEK 3	WEEK 4
Aeris SmartEnergy Application	-	SmartEnergy Compressor Optimisation only	AerisGuard™ Cleaners & Treatments only	SmartENERGY + Aeris Guard
Coil Air On (return air temperature)	22.99 °C	23.29 °C	23.07 °C	22.96 °C
Coil Air Off (supply air temperature)	14.97 °C	17.06 °C	15.74 °C	18.28 °C
ΔT°C	8.02 °C	6.23 °C	7.33 °C	4.68 °C

The SmartEnergy Compressor Optimisation uses its intuitive algorithm with a set point reset strategy based on feedback from the system. By allowing the compressor to cycle off longer, the system can utilise a higher coil air off temperature and still maintain internal conditions. As the data shows, with the combination of Compressor Optimisation and AerisGuard™ coil treatment, the temperature differential across the coil was able to be reduced to 4.68 °C, a reduction of 41.6%.

IMPROVED HUMIDITY CONTROL

SmartEnergy can reduce energy consumption by smart compressor control without impacting on internal humidity control. The table shows humidity for the four-week optimisation study.

PARAMETER	WEEK 1 BASELINE	WEEK 2	WEEK 3	WEEK 4
Aeris SmartEnergy Application	-	SmartEnergy Compressor Optimisation only	AerisGuard™ Cleaners & Treatments only	SmartENERGY + Aeris Guard
Average Ambient Relative Humidity	71.7%	89.0%	71.4%	76%
Average Internal Relative Humidity (8am - 6pm daily)	71.8%	75.5%	69.8%	68.7%

PROJECT DELIVERABLES

ENERGY CONSUMPTION WAS
REDUCED 22.6%↓
 using SmartENERGY and AERISGUARD
 SAVING of \$9,276.70 p.a

IMPROVED COIL HEAT TRANSFER EFFICIENCY

- Reduced coil temperature differential whilst still maintaining internal conditions
- Increased air flow through the coil by 113%
- Reduce system pressure loss through the coil by 48.8%table

IMPROVED OCCUPANT COMFORT

- Better control of temperature
- Better control of relative humidity, even in systems without direct humidity control



IMPROVED INDOOR AIR QUALITY

Prevention of > 98% of bacterial regrowth over a 12-month period compared to untreated coils¹

¹ Field Assessment of Fungistatic and Bacteriostatic Efficacy of AerisGuard™ Bioactive Coil Treatent, June 2006, Novapharm Research (Australia) Pty Ltd