

Energy Savers Plus Program

targets significant energy savings for a
Queensland horticulture farm

IMPLEMENTED SOLUTION 

Actual energy savings

49%

Key facts

Farm / Industry

Horticulture

Product

Pineapple processing

Location

Rollingstone

Main Focus of Audit

Refrigeration systems

Solution

Implemented:

Evaporator replacement and system refurbishment

Site profile

The site near Rollingstone in North Queensland processes and packages fruit from local pineapple producers. Pineapples carrying field heat arrive on site where they are then washed and cooled ready for distribution.

The facility requires a significant amount of energy to operate, particularly in relation to refrigeration systems, which account for 65% of site energy use.

The previous refrigeration system comprised:

- a 45kW Refrigeration Compressor with an average electrical energy input of 29.15kW during operation on R22 refrigerant
- 4 x 1.2kW Condenser Fan Motors
- 2 x 5.5kW Evaporator Fan Motors, 11kW total

The total average energy input during refrigeration is recorded at 46.14kW.

An audit of site energy consumption studied the viability of initiatives to reduce operating costs associated with produce packing facilities in the wet tropics, particularly refrigeration and packing shed energy utilisation.

Current energy demand

The site energy consumption currently consists of:

- Processing equipment
- Cold room
- Lighting
- Packaging equipment

Action

During an evaluation of the refrigeration equipment, an inspection of the evaporator showed that the system was not operating as designed. Due to water pump and trough failures, the evaporator no longer used water as a cooling medium but only air. This reduced the efficiency of the original non-finned evaporator as it does not have the required surface area to satisfy an air-only heat transfer method.

The original evaporator design allowed for rapid heat removal while maintaining high humidity within the storage room. It became clear after consulting with the onsite General Manager, that humidity was no longer a key requirement due to the characteristics of the 'hybrid' pineapples processed today.

After a period of data logging the refrigeration equipment, there was a clear need to increase evaporator heat transfer performance and it was deemed the original configuration was inefficient.

Following a review of the identified issues, the following were implemented:

1. Upgrading the existing evaporator to two (2) heavy-duty units equipped with electronic expansion valves (EEV) allowed for highly adaptive heat absorption.
2. Refrigerant conversion from R22 to R134A. Due to HCFC phase out, using R22 is no longer economical and any need to re-gas system could outweigh potential savings. While there is a performance penalty associated with the R22 to R134A conversion, the system will still satisfy new design requirements with an added benefit of lower compressor input power.
3. Additional condenser fan controls. Due to the R134A conversion, the condenser is now oversized and will require improved fan control with the added benefit of lower condenser fan runtime.

The Energy Savers Plus Program is funded by the Queensland Department of Energy and Water Supply



Results

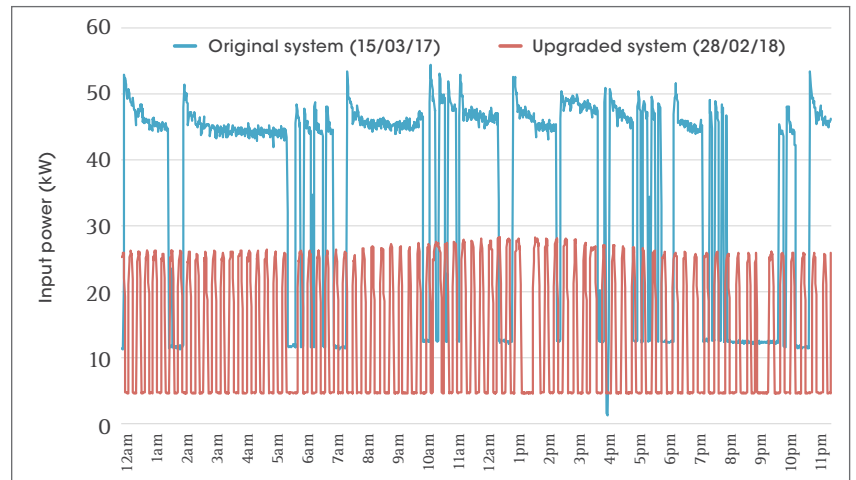
Analysing the recorded data collected before and after the upgrade confirms a reduction in compressor and evaporator input power. Field heat is removed from the pineapples at a greater rate and operation is reliably matched to the load. Along with the lower refrigeration input power, increased evaporator efficiency ensures compressor duty cycle is reduced resulting in further savings.

The new refrigeration system comprises:

- a 45kW Refrigeration Compressor with an average electrical energy input of 15.87kW during operation on R134A refrigerant
- 4 x 1.2kW Condenser Fan Motors
- 8 x 0.6kW Evaporator Fan Motors, 4.8kW total

The total average energy input during refrigeration is recorded at 24.22kW, a reduction of 21.92kW.

Operation Profile (24hr) - Original VS Upgraded System



Outcomes

Solution	Upgrade evaporator to increase heat absorption, convert refrigerant to R134A
Previous Refrigeration Energy Use (kWh/annum)	102,759.45
New Refrigeration Energy Use (kWh/annum)	52,658.61
Actual Refrigeration Energy Savings (kWh/annum)	50,100.85
Actual Cost Savings (\$/annum)	19,994.37
Actual Cost to Implement (\$)	26,456.66
Actual Demand Savings (kW)	21.92
Payback period (years)	1.32

Conclusion

With the upgraded system operating in year 2 (2017-18 season) onwards, the break-even point is within the same year due to the level of reduced operating costs. Return on investment will be achieved during the second year of operation (2018-19 season).

Farmer feedback

The Energy Savers Program provided Paradise Pines with a complete assessment of our energy systems and workable solutions that will see payback in under 2 years. The collaboration between Ergon and our Refrigeration and Air Conditioning contractor allowed Paradise Pines to benefit from the program by improving our energy productivity significantly.



Case studies

To see how other agriculture businesses are saving energy and costs, go to www.qff.org.au/energysavers