

Energy Savers Plus Program

targets significant energy savings for
Queensland meat processors

PROPOSED SOLUTION 

Potential site energy savings 

Key facts

Farm / Industry

Beef Cattle, Sheep & Pigs

Product

Meat processing

Production Metric:

Hot Standard Carcass Weight (HSCW)

Location

Southern Queensland

Case Study Focus

Refrigeration Systems

Solution

Proposed: Evaporator fan speed control

Site profiles

Energy audits were completed for several meat processors in Southern Queensland that process mainly beef cattle as well as sheep and pigs. Refrigeration accounts for between 46% and 55% of energy consumption at each site with multiple cold rooms and refrigerators in operation.

Cold rooms operate at different temperatures to accommodate meat in various stages of processing and storage prior to transport. Refrigerated cases are also used for display of processed meat for retail sale on site.

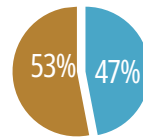
Typical energy demand

Typical Site Energy Consumption Breakdown

Refrigeration = 47%

Other (including air compressors and lighting) = 53%

*Hot water is gas (excluded from % calculation)



Total = 421 MWh p.a.

Post implementation total usage would reduce to 373MWh p.a. after evaporator speed fan controls introduced.

Refrigeration electricity consumption at the processing facilities typically consists of:

- Condensing units servicing cool rooms and freezer rooms
- Refrigerators and display cases
- Refrigerated containers

Action

Audits of site energy consumption evaluated:

- Evaporator fan speed control by variable speed drive
- New evaporator installation with electronically commutated fans

Long-term consolidation of refrigeration systems, or change to (Centralised 407F Rack) Transcritical CO₂ system a common recommendation with paybacks averaging 6.2 years.

Results

Many evaporator fans at the meat processing facilities are typically not speed controlled and either operate at full speed or cycle off as required. The heat from the fan motors is continuously introduced into the cold rooms which reflects as a load on the refrigeration system.

The savings available by reducing fan speed are significant as its electricity consumption or the fans power requirement is directly proportional to the cube of its speed. So, reducing the fan speed by 20%, for example, would reduce the fan power requirement by approximately 50% but only reduce flow rate by 20%. In this way, reducing the fan speed leads to energy cost savings due to the increased fan efficiency at lower speeds as well as reducing the heat load introduced to the room.

A common energy conservation measure recommended across several meat processing facilities is the implementation of variable speed controls on evaporator fans with temperature control logic allowing the fans to operate at a lower speed with significant electricity savings.


In cases where replacement of the entire evaporator assembly is required and for new installations, new evaporators with electronically commutated fans should be considered.

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



Recommendations

The energy audit recommendations are summarised below:

Solution	 Evaporator fan speed control by variable speed drive installation	
	Site A	Site B
Site		
Est. energy savings (kWh/annum)	89,997	6,215
Est. operating cost saving	\$19,331	\$1,392
Est. cost to implement	\$76,000	\$5,000
Payback period (years)	3.9	3.6
Est. energy savings	25%	37%

Two other sites were estimated to achieve payback in just over five years by implementing evaporator fan speed controls.

Forecast savings in production costs	Site A	Site B
Baseline Electricity consumption (kWh / tonne)	110	200
Electricity savings (kWh / tonne)	16 (14.5%)	22 (11%)

The audits have also recommended over the long-term, that the businesses consider consolidating multiple independent refrigeration units to a centralised rack system with a single air-cooled condenser or Glycol/Ammonia CO2 systems. These projects had a high capital cost, with payback period ranging between 5.7 and 9.8 years depending on the age and condition of the existing systems.

Quick Wins from audits for refrigeration systems:

- Increase air flow to condenser units – ideal location is south facing wall or a sheltered area and separating the units from each other and the wall by at least a condenser fan diameter
- Providing insulation to suction lines for condensing units
- Relocation of liquid line solenoid valves close to evaporator units

Update

Recommendations for improvements to evaporator speed controls as well as the quick wins recommendations are being implemented at one site already.

This case study was originally developed in 2016 as part of the Queensland Government funded Energy Savers Plus Program, delivered by the Queensland Farmers' Federation.