Case Study

Grading in packing sheds

The 'Watts in Your Business' project has completed energy audits of 30 packhouses and orchards Australia-wide. This fact sheet shows how grading equipment changes can cut energy use and save money.

Packing lines take up a large amount of space but don't consume that much energy. Packing lines only consume around 8% of total business electricity usage (orchard plus packhouse). Due to the specific purpose of the motors and other electrical components of packing lines, it is not beneficial or economical to manipulate them for energy efficiency.

Nevertheless there are some areas where the energy efficiency of packing lines can be improved easily with a small upfront investment.

Top tips to cut energy costs:

- Fix air compressor leaks.
- Improve dryer tunnel efficiency.
- Install solar hot water heaters.
- Insulate water chiller tanks on cherry graders.

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Advanced drying technologies in apple packing lines can reduce energy costs and ensure apples are perfectly dried.

Grader inefficiencies

Leaks in air compressor lines

In the audited businesses, multiple air leaks were observed across the grading lines. Continual air leaks result in unnecessary operation of air compressors, which causes increased electricity consumption and maintenance requirements.

Poorly designed and operated dryer tunnels

Temperature sensors for drying tunnels in grading systems are rarely calibrated and operation is poorly understood by site staff. Undetected changes in dryer temperatures can result in damage to the fruit's condition and quality. In addition, many sites have the older style 'once

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through' dryers (often called 'rocket' systems) that when compared to more recent drying tunnel designs, result in higher than necessary heat loss and inefficient use of LPG.

Poor utilisation of solar hot water

The majority of orchards audited used either an LPG instantaneous hot water heater or electric heater to generate hot water for the fruit washer. There are opportunities to reduce LPG or electricity usage by installing a solar hot water system (with LPG boosters).

Lack of insulation of chilled water tanks

Most cherry grading systems have large tanks that store chilled water as part of the grading system. These tanks vary in size and utility but many of them are uninsulated. The average temperature of the water in these tanks is 2°C, resulting in a large temperature difference between the grading system water temperature requirement and the ambient temperature. As a result of no insulation, there is an unwanted heat flow into the chilled water tanks, increasing the amount of electricity needed to maintain the water at the desired temperature.

Installing solar panels on packing sheds to heat water can save energy. (Image source: www.solarswitchaustralia.com.au)

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	Ave cost of upgrade (once off)	Value of average annual energy saving	Average simple payback period (years)
Air compressor leaks	$380	$109	3.5
Utilising solar hot water	$5989	$1196	5.0

For cherry graders			
Insulating chilled water tanks	$1,383	$456	$3.0

Solutions and opportunities

Air compressor leaks

Identifying and repairing air leaks is a constant maintenance requirement of any grading system and offers a simple opportunity to prevent excess electricity consumption by compressors. To reduce air compressor leaks, an orchard should inform staff on how to identify air leaks (i.e. listen for a 'hissing' sound on the grader when all other equipment in the pack house is shut off) as well as develop a log or register to have any leaks quickly repaired. A regular maintenance program should also be developed to help proactively prevent leaks from occurring.

Identifying and repairing air compressors leaks promptly prevents

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Furthermore, central shut-off valves can be installed on equipment to ensure leaks are minimised when not operating. The 'Watts in Your Business' project identified this opportunity at 17% of audited businesses.

Improved dryer tunnel efficiency

The purpose of the dryer is to generate heat to drive off the solvents in the wax formulations and set the wax to the fruit. There are three ways to improve the efficiency of grading system's drying equipment:

1. Dryer temperatures can often be adjusted based on weather conditions. By adjusting the dryer temperature to accommodate climatic conditions, the amount of LPG consumed to still achieve the desired outcome can be reduced. For example efficiencies can be achieved if the dryer temperatures are reduced on warm days with low relative humidity.
2. It is recommended to calibrate the temperature sensors every six months.
3. Many of the older drying systems are 'once through' systems that have a large opening at the end of the dryer tunnel. Unfortunately from an efficiency perspective, this large opening allows the majority of heated air to escape the tunnel in the location where the fruit leaves the dryer. There is an opportunity to replace the 'once through' system with a heated air recovery dyer system. This design allows heated air to be captured and then recirculated throughout the system to either preheat the apples prior to waxing or recirculate it within the wax drying tunnel. This prevents heated air from being lost and greatly improves the overall efficiency of the system. Some sites that have replaced the once through systems with a heated air recovery system have noticed a 30% reduction in LPG usage for their dryers.

Insulate water chiller tanks on cherry graders

Installing insulation on chilled water tanks for cherry graders reduces the heat flow from the warmer ambient air into the chilled water in the tanks and improves the efficiency. There are many different types of insulation available including fiberglass, mineral wool, cellulose and polyurethane. A packhouse should choose which insulation is suitable for them based on their thermal resistance values (R- values) and implementation practicalities (i.e. spray on foam vs batts). The 'Watts in Your Business' project found that this opportunity occurred at 33% of the audited sites that produce and pack cherries.

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Costs and savings of different grading improvement options from audited businesses:

	Range	National Average
Solar Hot Water Heater		
LPG Savings (Litres)	399 – 8,544	1,851
Capital Costs	$5,000 - $15,000	$5,989
Annual Cost Savings	$299 – $2,487	$1,196
Simple payback (years)	2.0 – 17.3	5.0
Air compressor leaks		
Electricity Savings (kWh)	111 – 2,076	825
Capital Costs	$150 - $750	$380
Annual Cost Savings	$17 - $228	$109
Simple payback (years)	2.5 – 10.0	3.5
Insulation for cherry grader chilled water tanks		
Electricity Savings (kWh)	350 – 7,250	2,650
Capital Costs	$200 – $3,750	$1,383
Annual Cost Savings	$90 - $1,160	$456
Simple payback (years)	1.7 – 3.0	3.0

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Solar hot water heater

A solar water heater system consists of a solar collector that is coated with a dark coloured surface that absorbs the sun's radiant heat (energy) and uses it to heat water. The heated water rises to the top of the collectors and then moves to the storage tank. The heated water is replaced by cooler water at the bottom of the collectors and the process is continually repeated. Closed circuit systems are recommended for frost-prone areas to prevent frost damage.

In most packhouses, hot water for the washer is generated through a water heater using LPG or electricity as the energy source. The volume of hot water that could be off-set through a solar hot water heater varies depending on the orchards location, hot water consumption and size of solar hot water system. However, on average, a typical solar water heater system would provide energy for the generation of 10 -15% of the orchard's current hot water needs. The 'Watts in Your Business' project identified this opportunity at 40% of the audited sites.

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