West Holm Farm

QMDC completed an energy audit on West Holm farm, near Stanthorpe, Queensland and subsequently helped to identify some easy ways to halve the farm's energy costs. The farm grows pears, plums, apricots and tomatoes and has two sheds for packing and storage as well as a cold room. The farm is irrigated from a small dam on the property.

During the financial year 2013/14, the farm consumed 22,615 kWh of electricity at a cost of $6,684. The energy audit identified potential energy efficiency cost savings worth approximately $3,993 per annum with an average payback period of 3.4 years. These savings represent over 50% of the electricity currently used on the farm.

Current energy usage

Currently energy is used on the farm for:

- pumping
- refrigeration
- lighting
- washing and sorting machines.

Pumping is used for the irrigation system on site, which consists of two centrifugal pumps with motors of 15kW each and a total of 1 km of pipes. Water is supplied by an artificial dam, which collects rainwater.

Refrigeration (one cold room) is used to store the produce until it is dispatched. This occurs on a daily basis. It is only used during the months when harvesting occurs.

Lighting consists of 4 x 400W metal halides in the packing shed and 10 x single 36W T8 fluorescent tubes installed on the sorting machine.

The sorting machine works by taking 8 photos of each product and sorting them by colour, size and weight.

Proposed solutions

Three potential energy saving opportunities were identified in the audit report: irrigation system upgrade; lighting upgrade and implementation of a solar PV system.

Irrigation system upgrade

Upgrading the irrigation system has positive outcomes for water usage as well as energy usage. A number of opportunities for reducing energy consumption were identified as follows.

1. **Reducing the required hydraulic horsepower:** hydraulic horsepower is defined as the power required to move a volume of liquid at a specified pressure and flow rate. There are several ways this can be reduced:
    - **Eliminate unnecessary water loss:** water can be lost through leaks in pipes, valves, fittings, connections and so on. Ensure leaks are repaired in a timely manner to reduce loss of water and energy.
    - **Measure soil water content:** adopt watering schedules based on soil moisture measurements. Devices such as evaporation pans, gypsum blocks and tensiometers can be used to measure soil moisture and to aid in irrigation scheduling using computers.
2. **Increasing system efficiency:** efficiency is defined as the ratio of output to the input of any system. The following can improve pumping system efficiency:
    - **Overhaul motor:** Premium Efficiency (PE) motors are between 2 and 10 % more efficient than standard efficiency motors, and the savings commonly justify the greater initial cost.
    - **Consider Variable Speed Drive:** most irrigation pumps run at full speed regardless of

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the load on the system. Flow requirements are usually achieved by throttling and then reducing the flow rates; this technique wastes surplus energy through friction. Variable speed drives (VSD) are a more efficient way to control the motor speed and then the flow rate of the water. This also reduces the power consumption. Using the VSD, flow can be adjusted quickly and accurately to match changes in irrigation requirements.

3. Consider solar pumps: photovoltaic water pumps are viable. Solar pumps are highly efficient, but may not be economically practical for large irrigation needs. However as energy costs rise and as photovoltaic technology matures these systems are becoming more feasible.

Lighting upgrade

Light Emitting Diodes (LEDs) could replace the existing lights used in the in the washing and sorting machine and the shed. The current T8 fluorescent lamps could be replaced by equivalent T8 LED 18W, while the current high bays could be replaced by equivalent 250W LED high bays. The upgrade to LED lights can achieve a substantial saving of up to 60% of the current electricity consumption of the existing lighting. This option has a longer payback period, being around seven years, however, this is still a viable long-term option as the LED bulbs could last for up to 20 years.

In addition, the installation of motion sensors in the cold room would ensure that lights are not being left on unnecessarily.

Solar PV system

The implementation of a Solar Photovoltaic (PV) system could achieve energy and cost reductions for the farm. A solar system of 5 kW could generate up to 7,300 kWh annually which can be used by the farm. Due to site operations occurring predominantly during the day, this option has the greatest potential to reduce energy consumption and costs for the farm, with the payback period predicted to be less than 2.5 years.

Behaviour management

In addition to these structural modifications, there are additional changes in behaviour management that can be undertaken to contribute to energy efficiency.

- The site's electricity agreement is Tariff 62 time of use which incorporates different charges at different times of the day. The irrigation is currently carried out during the day but some irrigation could be done at night-time. Irrigating during these off-peak periods would incur lower charges as well as benefiting from lower evaporation.
- Currently, the harvested produce is picked, stored in the cold room, then sorted in the sorting shed (where it warms up again) then washed and returned to the cold room. If the fruit was immediately sorted after picking, it could then be washed which would pre-cool it before being stored in the cold room.
- During the audit site visit, it was noted that one of the irrigation pipes was damaged close to the extraction point from the dam and water was spraying out. Although most of the water was going back into the dam, the pump would still have been working harder to carry the required amount of water along the pipe. Fixing damage as well as general maintenance of pumping equipment can make a significant impact on running costs:
    - regularly inspect and repair bearings, lip seals, packing and mechanical seals
    - replace worn impellers, especially in caustic or semi-solid applications
    - reduce or control pump speed by trimming the impeller, or changing gear drives to lower gear ratios.

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