AUSTRALIAN Pork

Fact Sheet

FACT SHEET

IMPROVEMENTS TO ENERGY EFFICIENCY

Energy Efficiency Information
Fact Sheet Series
December 2014

Energy is a significant input cost for piggeries, and energy costs have risen by 25–40% in pig producing areas in recent years, these rising costs have placed a large burden on producers. Piggery operators also have a responsibility to minimise energy use to reduce pressure on energy reserves and to reduce contributions to Greenhouse Gas (GHG) via energy use. These issues make energy efficiency a growing priority for the industry. This fact sheet provides ideas and methods to improve energy efficiency within piggeries.

Heating Efficiency

The energy required for heat lamps in farrowing sheds is the greatest individual contributor to energy usage at a naturally ventilated farrow to finish piggery. The most effective way to reduce heating costs is to ensure excess heating or heat wastage is not occurring, thus reducing energy consumption. Heat lamps should be controlled by a thermostat to prevent unnecessary heating. Once the temperature inside the pens has exceeded a set interval the lamps will automatically dim or switch off saving large amounts of electricity. It is also recommended to investigate a gas water heating system for farrowing sheds.

It is vital to check that the ventilation system is working in tandem with the heating system. The ventilation system may counteract the shed heating resulting in unnecessary, increased heating costs. This won't affect air quality but will sharply increase energy use.

Heat will be lost if the shed is poorly insulated. The walls and ceiling should be insulated to achieve suitable heat retention (U values). Periodically check the insulation for any signs of degradation or damage. The temperature fluctuation (maximum and minimum temperatures) in the pig shed should also be monitored with temperature monitors.

A new approach is the installation of air pumps that heat pads in a farrowing pens. These systems extract heat from ambient air and heat water up to 55°C via heat exchange. These systems have a higher capital cost but are effective at reducing long term energy costs. Installing insulated huts in farrowing pens help retain heat for the piglets and reduce energy waste.

Ventilation and Cooling Efficiency

Modern tunnel ventilated sheds rely on two factors to keep the pigs comfortable and productive, the combination of air movement by the fan system and the evaporative air cooling by the cooling pads. A well insulated shed is equally important for cooling as heating, as it reduces the external heat load entering the shed during hot summer conditions.

Regular cleaning of fan shutters, blades and fan motors is required to ensure efficient fan operation. Fan belts and pulleys should be regularly checked, adjusted or replaced to make sure the fan belts are seated and tensioned properly. Proper fan maintenance can prevent up to 30% performance reduction. Regular cleaning of cooling pads to ensure air flow is not restricted minimises the load on the fan system. When in use, the cooling pump pads should be running continuously to keep the pads wet and as clean as possible.

Selecting energy efficient fans and cowling designs may prove to be the most cost effective option in the long run. Fan efficiency is measured with the following performance indicators:

- Air moving capacity (CFM – cubic feet per minute)
- Energy efficiency (CFM/watt)
- Airflow ratio (CFM @ 0.20 " / CFM @ 0.05 " static pressure).

Data from the US shows for every 2 CFM/watt increase, power usage is reduced by approximately 10%.

Lighting Efficiency

Energy use in lighting is an area which should be investigated to improve efficiency. Lighting technology is rapidly evolving. Incandescent bulbs should be replaced with energy efficient types such as, compact fluorescent lamps, triphosphor bulbs and fluorescent strips. These lighting types drastically use less energy and have a much longer lifetime.

LED (light emitting diodes) are a recent development in long lasting, energy efficient lighting (Figure 1). They are more expensive to install but will reduce long term energy costs. They are recommended for lighting of new pig sheds.

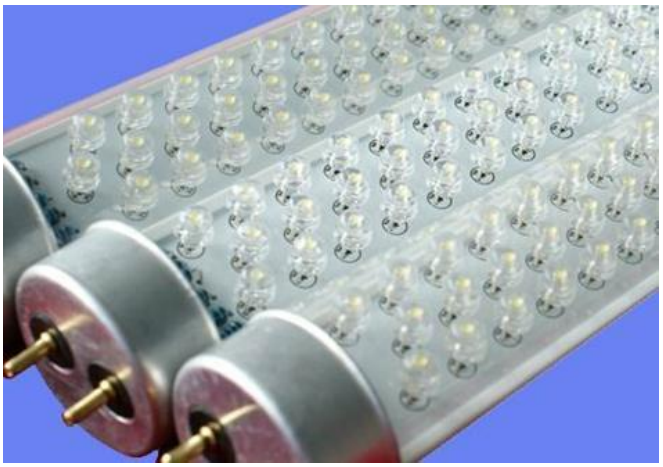

Figure 1: Image of an Energy Efficient LED Lighting Tube

Gas Use

Gas usage may be reduced by installing curtains inside the shed to restrict the area that requires heating. Gas usage can also be minimised by ensuring the shed is well sealed from cold air leaks.

Managing Peak Energy Load

Electricity costs can be reduced by managing peak energy usage. Peak electricity use periods can be monitored by installing electrical power meters on the power supply to each shed to monitor energy usage over the desired time period.

The results of an APL funded project that monitored energy use at several piggeries are shown in Figure 2. The study included both natural and tunnel ventilated sheds. Peak loads from Piggery B, C and D occur between 12:00 and 16:00 when temperatures are warmer and more ventilation is required. These were larger piggeries which used tunnel ventilated sheds and consumed the most energy. This does not represent their energy efficiency with regards to pork production. Small piggery's relied on natural ventilation and therefore did not experience a spike in energy use during the warmest part of the day. A small peak in energy was recorded during the morning hours, between 7:00 and 9:00. This is due to pump motors and other electrical machinery being switched on in preparation for the day's work.

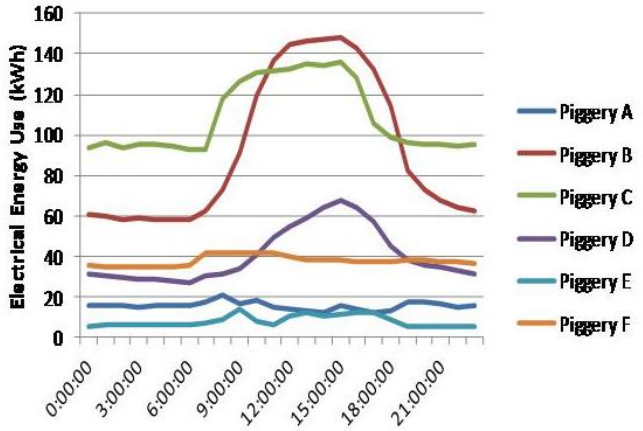

Figure 2: Graph Showing Times of Peak Energy Use During the Day at Six Monitored Piggeries

For piggeries with feedmills the peak energy use will likely occur when milling takes place. Peak energy loads at tunnel ventilated piggeries may be reduced by minimising the operation of any additional equipment while the system is operating at full capacity. At smaller piggeries the motors and electrical machinery can be switched on gradually or left on standby to reduce the peak load of several motors starting up simultaneously. Backup generators can be used to reduce the energy requirement on the grid during high tariff hours. Another option in reducing energy costs is running any high powered motors or pumps (bore pump, effluent reticulation pump etc.) during off peak hours.

Further options may be available on discussion with the energy suppliers. Talk to your local electrical contractor or other producers for advice.

Alternative Energy Sources

On-site production of electricity to reduce reliance on grid electricity during peak periods of use could be an option in some cases. For example, installing solar panels or wind turbines to reduce peak usage periods may be a financially viable option especially as the cost of this technology declines. Another attractive option is to cover anaerobic ponds and capture biogas to offset fossil fuel energy use (see below).

Biogas

A viable, alternative energy source for piggeries is biogas. Biogas can be captured by installing a covered effluent pond coupled with biogas generator as shown in Figure 3.

The covered pond captures methane emissions which are used produce energy at the piggery. The cost of installation of these systems can be substantial and it is left to each piggery to decide if the energy savings are economically feasible.

Figure 3: Covered Anaerobic Pond (above) and Biogas Generator (below)

Feasibility studies have reported a covered anaerobic pond-generator system had a payback period of 2.8–8 years for piggeries ranging in size from 3500–75000 SPU respectively. These results are based on revenue streams that are influenced by government legislation, and therefore subject to change. However, the installation of a covered pond, energy generation system has great potential for piggeries with high energy demand (intensive heating, tunnel ventilation, feed mills etc.), as offsetting fossil fuel energy use represents the greatest benefit. Piggeries of approximately 500 sows farrow to finish have potential to be viable for biogas capture and reuse. Smaller piggeries may still be viable so it is useful to conduct a biogas feasibility study to assess the economic feasibility.

Further Advice to Improve Energy Efficiency

- Monitoring Power Factor can be useful as many states have adopted penalties for power factor levels below 0.85, i.e. in-efficient use of power.
- When designing or constructing new plant and equipment, select quality motors that are the correct size for their intended use.
- Cleaning and maintenance of the electrical equipment assists in improving efficiency.
- Always check around the pumps and the water system for leaks that cause inefficiency and cycling of the motor.

Industry Benchmarking

The Australian Pork Limited (APL) pork energy efficiency program is currently funding a project that will supply energy usage benchmarking data for the industry. The information gathered will assist the industry by providing some typical benchmarks for growers to work towards and assist in tailoring management practices to improve energy efficiency on-farm. Results will be published in mid 2014.

Key Points

- **Electricity costs are likely to increase making energy efficiency an important consideration for the industry.**
- **To minimise energy usage look at insulation, good shed sealing and well maintained equipment.**
- **Installation of monitoring equipment may help identify inefficiency and peak loads, which can help to reduce costs.**
- **The feasibility of producing electricity on-site from renewable sources (i.e. Installing solar panels on shed roofs, wind turbines or biogas) for periods of peak electricity usage should be explored.**
- **Fan maintenance such as cleaning fans blades and shutters, and checking the motors, belts and pulleys can improve fan performance by 30%.**

Other Fact Sheets in this Series

- Identifying Energy Use Activities
- Energy Measurement Equipment
- Reading and Collecting Energy Data
- Piggery Total Energy Usage.

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