

IMPROVING ENERGY USE EFFICIENCY

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INTRODUCTION

Producers need to know the basics of how their heating, ventilation and lighting systems function. While fuel and electricity are a small part of the overall cost of production, energy plays a significant role in feed conversion and overall animal output. It is possible through good design, management and maintenance to both reduce energy costs and improve pig performance. The three main energy users for swine facilities are heating, ventilation and lighting.

All ventilation systems operate on the principle of heat balance. That is, the heat produced by the animals must balance the heat lost through the building shell plus the ventilation system to maintain a good environment. Whenever there is a negative heat balance, supplementary heat is required to prevent the room temperature from dropping too much or allowing the ventilation system to shut off.

Supplementary heat must be added to many swine barns during the winter. Young pigs require heat year round. Heat is provided to ensure animals are kept above their lower critical temperature (LCT). This ensures they do not waste feed to keep warm. The temperature of the room alone does not necessarily mean the actual environment is above the LCT. Other factors affect it such as flooring type, insulation levels and ventilation system performance.

ENERGY AUDITS

An energy audit is aimed at identifying and evaluating energy management opportunities at the site. The goals of an energy audit are to:

- Identify the different sources of energy use
- Identify how much energy is used
- Identify alternatives to reduce energy costs
- Develop a plan, based upon an economic analysis of the alternatives that is cost effective to the farm owner/manager

The end result of an energy audit is to identify “energy management opportunities” (EMOs). EMO’s can be analyzed, implemented and then monitored as part of the farm’s energy reduction strategy.

Benefits of an Energy Audit

The immediate result is the identification of cost effective decisions that can be translated into a more efficient operation. The implementation of many EMOs is related to good maintenance practices that have the added benefits of decreasing other operating costs.

The benefits to the farmer of improving farm energy efficiency are as follows:

- On-going cost savings
- A better understanding of the operating cost of production
- Reduction of breakdowns and emergency repairs
- Improved barn environment

How to Conduct an Energy Audit

An energy audit is not a complicated process. The audit process can be divided into six steps:

- Preparing for the audit
- Performing the farm survey and inspection
- Analyzing the data
- Implementing the audit recommendations
- Documenting the audit activities
- Review the results

Energy Management Opportunities (EMOs)

Energy consumption related to ventilation on the farm is mostly concerned with heating and motors. Energy Management Opportunities (EMOs) result from a careful review of both use patterns and technology choices in the following areas:

Heating

- Insulate the building and other “hot” components (i.e. hot water storage tanks, hot water piping, etc.)
- Seal air leaks around doors and windows
- Use “set-back” or turn off equipment during non-use periods
- Creep heating
 - a. Install electric or hot water creep heat pads
 - b. Install creep heat controls
 - c. Install energy efficient heat lamps and controls
- Convert space heating in nurseries to infrared heating
- Maintain, calibrate and properly set ventilation controllers

Motors

- Install energy efficient exhaust fan and re-circulation fan systems
- Careful management of re-circulation fan systems
- Ensure ventilation controls are properly set and managed

ENERGY CONSERVATION

Energy conservation is the practice of reducing the amount of energy used. It is achieved by using more energy efficient technology, i.e. use less energy to achieve same result, or by changing management practices to reduce consumption of energy. Energy conservation may result in increased financial savings, environmental value, security, and increased comfort for the animals.

Fan Efficiency

All motors have a nameplate rating that shows its operating parameters. Most motors will have a horsepower (H.P.) rating. This refers to power at the shaft under steady state conditions. This number is not reliable for comparing the efficiency of various fans.

The motor nameplate also states the amperage and voltage that occur during steady state conditions. The combination of amperage and voltage can be used as part of the information needed to calculate fan efficiency. They should not be used separately for several reasons:

- Amperage is only one of many factors affecting motor performance. It is extremely unreliable for comparing fans.
- Wherever possible, wire motors to operate with 240 volts, rather than 120 volts, to increase energy use efficiency. Higher voltage will decrease losses that occur in the wire itself.
- All motor wiring should be a minimum of 12 gauge or larger to reduce line losses.

Lighting

Fluorescent lights are 5-6 times more efficient than incandescent, last longer and reduce the summer heat load. As the price of different technologies such as LED's becomes lower, these systems may become commonplace in future swine facilities.

There are programs available to assist with the conversion to more energy efficient lighting systems.

AVAILABLE RESOURCES

In the summer of 2009, OMAFRA is planning to release an updated ventilation guide. Topics covered are heating and ventilation basics, controllers, design information, different ventilation systems, energy efficiency, commissioning and calibration as well as troubleshooting. This manual is meant as a resource to educate producers on the importance of choosing a proper functioning system. While it will not replace the role of ventilation designers and commissioners, it will allow the producer to ask the proper questions to their ventilation suppliers and designers to obtain the best system for their needs.

OMAFRA has many factsheets available on the subject of energy efficiency at:
<http://www.omafra.gov.on.ca/english/engineer/energy.html> .

CONCLUSIONS

Producers and their employees should be aware of how the heating and ventilation system works and receive training on how to adjust it to obtain its maximum energy and pig performance. A properly designed and commissioned system will maximize pig performance while reducing energy input costs.