Conservation Practices that Save: Energy Conservation in Confined Animal Operations

Simple changes in confined animal operations can help farmers and ranchers achieve significant cost and energy savings.

Confined animal operations require a great deal of energy for lighting; heating of barns and brooders; fans for ventilation and cooling of facilities; pumps for moving water, waste, or milk; electric motors to run feeders; and electricity for cooling milk and eggs. Because confined animal operations must be intensively managed, it is relatively easy to make energy-saving changes to the operation.

All of agriculture, and particularly confined animal production, makes wide use of electric motors. With simple, regular maintenance, producers can save significant amounts of energy and money. Often, if a motor is working, it gets very little thought or attention from the farmer. Just because it is working, however, does not mean that it is working as efficiently as possible. Certain trouble spots often cause a motor to waste energy, including rusty or corroded moving parts on motor-driven equipment, dry or worn bearings, or belt drives that are too loose, too tight, or not aligned. Worn pulleys and belts need to be checked and replaced often. Even if a fan belt is tight, it may still need replacing. The belt or the pulley itself might be worn, reducing the speed of the fan and the efficiency with which it runs. A worn belt can easily reduce output by 20 percent or more. Considering the current cost of energy, producers might want to think about replacing aging motors. A bank of seven, well-maintained 48" fans in a broiler house will cost an average of $13.20 per day to operate at eight cents per kilowatt hour. These same fans, if poorly maintained, may cost 20 percent more, or $15.84 per day to operate. Over a year, this difference for fan maintenance can amount to nearly one thousand dollars per broiler house.

In swine operations, electric motors may be used to pump water for drinking and for the manure flushing system, move feed from the feed bulk tank to the feeder line, and run the powerful exhaust fans. Worn or inefficient motors, belts, or fans can add significantly to the cost of operation.

High-efficiency motors can reduce energy consumption by 3 to 8 percent and might be substituted for other motors. Because of their high cost, high-efficiency motors might only make sense for high horsepower motors operating at least 2,500 hours per year[1].

The swine and poultry industries rely very heavily on fans and ventilation systems to remove gases from the tightly built production buildings, and maintain proper temperatures for the animals. To help mitigate energy use, the broiler industry has largely adopted a system called "tunnel ventilation" where large banks of fans at one end of the house draw large amounts of air at relatively high speed over the birds.

This air provides air conditioning by a "wind-chill" effect. This usually is coupled with an evaporative cooling system which further reduces broiler house temperatures[2]. Dirty fans and shutters can reduce air-moving capacity of the fan by well over 30 percent[3], reducing the cooling effect and using more energy. Regular cleaning will maintain the efficiency of the fan, and guarantee that energy dollars are being used efficiently.

A number of commercial air-to-air heat exchanger systems are available for confined animal operations that transfer warmth from exhaust air to incoming air, resulting in large savings in heating costs. These systems are particularly applicable to swine nursery operations, and work has shown that these systems could save up to 40 percent of the energy needed for broiler brooding. Research has been done in swine and poultry operations, using "earth tubes" to utilize geothermal resources to heat and cool incoming air.

Dairy operations may benefit from adjustable speed drives in vacuum milking systems as a means of saving energy. Vacuum pumps run the milking machines that attach to the cow's udder, then pump the milk from the milking parlor to the holding tank. Vacuum pumps often are oversized and run at constant high speed to meet the maximum need of the operation. If less than maximum is needed, the excess is wasted. With an adjustable, computer-driven speed drive on the vacuum pump motor, the capacity of the pump is matched to the actual need for vacuum. The pump will run more efficiently, reducing energy needs and cost.

Dairy operations need to cool milk rapidly from 102 degrees Fahrenheit (the temperature at which it leaves the cow) to around 34° F in the holding tank[4]. Using heat exchangers to transfer this heat to cold water removes the heat from the milk and raises the temperature of the water, allowing the warmed water to be used for other things. The warmed water can be used for wash down of cattle and milking parlors, or it can be heated further to a point where it can be used for high temperature cleaning of milking equipment. On a 500-cow dairy, transfer of heat from milk to water saves the equivalent of 215,000 BTUs of energy that normally would be provided by purchased electricity. The economic advantages of installing heat exchangers in a milking operation can exceed $3,600 (at eight cents per kilowatt) in energy savings annually.

All confined animal operations rely heavily on electric lighting, often to increase the production of milk, eggs, and other commodities. Dairy cows given 16 hours of light continuously each day will increase milk production from 5 to 16 percent, increase feed intake by about 6 percent, and maintain reproductive performance, compared to cows receiving 13.5 hours or less of light[5]. Lights also physiologically stimulate egg production in chickens and turkeys.

Changing electric lighting from incandescent lights to fluorescent or to high pressure sodium lamps can provide all the lighting that farm animals need, at a reduced cost of operation and with a large increase in energy conservation. Switching from incandescent to U-tube fluorescent lights can save energy needed for lighting by 75 percent. In a 40,000-bird-broiler operation, for example, this equates to a savings of nearly 18,000 kilowatt-hours per year[6]. At a typical electric rate of eight cents per kilowatt, this becomes a savings of over $1,400 per year per broiler house.

Operators of confined livestock operations can be good stewards of the environment while saving on production costs by adopting these and other available methods of energy conservation.

NRCS supports conservation practices that save producers money and improve the environmental health of the Nation. For more information on energy-saving conservation practices, visit the NRCS "Save ENERGY, Save MONEY" Web site at www.nrcs.usda.gov.

[1]National Food and Energy Council, 1999; Http://www.nfec.org/electricmotors.htm.

[2]Auburn University, Poultry Engineering, Economics, and Management Newsletter, July, 2004.

[3]University of Georgia, Cooperative Extension Service, Poultry Housing Tips Volume 10, Number 2, February, 1998.

[4]University of Florida, Cooperative Extension Service, Fact Sheet EES-74, November, 1991.

[5]University of Minnesota, Cooperative Extension Service, Minnesota/Wisconsin Engineering Notes, Summer 1999, Lighting Dairy Facilities.

[6]Iowa State University, Extension Publication #AEN-138, May 1995, Livestock Efficiency.

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