Right-sizing minimum ventilation

Farm Energy

By DANA PETERSEN

THE Farm Energy team met with undergraduate students last month at the Ag 450 teaching farm near Ames to talk about energy efficiency in the farm's swine facilities. Although energy costs are small compared to other expenses in a confinement barn, annual energy consumption is directly influenced by management decisions including those made by the Ag 450 student swine committee.

Several students had firsthand experience working in confinement barns. With cold weather approaching, we discussed the value of understanding how ventilation controllers function to ensure a healthy environment for pig growth.

Wean-to-finish buildings present one of the top challenges to efficient winter heating, says Jay Harmon, ISU professor in ag and biosystems engineering. For example, a reasonable target for annual liquefied petroleum, or LP, consumption is 2 gallons per pig space per year. But actual consumption is directly affected by the time of year the weaned pigs are placed in the building. This year, new pigs will be loaded into the Ag 450 finisher during winter.

Harmon notes that overventilating by as little as 10% can increase estimated annual LP consumption by 27%. Overventilating by 40% can double estimated annual LP consumption.

Overventilating is costly

"Overventilation is responsible for 80% to 90% of heat loss in swine housing during the winter months," he says. "Unfortunately, overventilating is more common than expected because it's difficult to gauge exactly how much air is actually being exchanged by the ventilation system."

In Harmon's example, a 1,000-head wean-to-finish building with newly placed pigs should be ventilated at 1,500 cfm during the coldest weather. As pigs grow larger, this rate is adjusted. To meet the changing needs of the pigs and to reduce the number of fans, a controller is used to slow fan speed and reduce air delivery. These variable-speed fans should be used to fine-tune the ventilation rate, especially during cold weather, he says. "This optimizes minimum ventilation and overall energy efficiency."

When selecting variable-speed fans, don't expect them to deliver less than half their rated airflow at 0.10 inch of water. From the example above, if 1,500 cfm is needed, select a fan rated at 3,000 cfm. This fan can then be used with a variable-speed controller to deliver half its rated amount. More airflow and possibly another fan are needed when pigs grow larger than 75 pounds. In most cases, electricity costs to operate variable-speed fans are less than heating costs for heated air forced out of the building due to overventilation.

There are limits to how much a fan can be slowed down using variable speed and still be effective. Fans operating at low speed cannot operate against much pressure. Fans facing prevailing winds should be protected with diverter cones or wind hoods. Also, fan motors receiving less than half voltage may chronically overheat.

For information, see the fact sheet "Sizing minimum ventilation to save heating energy in swine housing," PM 2089J, at *farmenergy.exnet.iastate.edu*.

Points to remember:

- Understand your ventilation controller and how it interacts with variable-speed fans.
- In colder months, the energy cost of wasted heat exiting the building is greater than the electricity required to operate variable-speed fans.
- Size variable-speed fans to run no lower than half of the full-speed capacity.
- Adjust fan speed based on air quality. If the relative humidity is higher than 60% or ammonia seems high, increase the speed. If relative humidity and gases are low, try reducing fan speed slightly.
- Protect variable-speed fans from prevailing winds.

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