ENERGY-RELATED AGRICULTURAL BEST PRACTICES

Ventilation

For Livestock Farms

Farms can use less energy, save money, and be more resilient through equipment upgrades that pay for themselves

There are several measures and technologies available to help livestock farms reduce energy use and save money while maintaining or enhancing production. These recommendations were developed for cattle and swine operations and can benefit other types of livestock farms, both very small farms with few animals and much larger operation with more than 1,000 animals.

Ventilation Recommendations

Ventilation on livestock farms includes any systems that circulate air in and out of animal housing and within barns. The less energy those systems need, the cheaper, more reliable, and environmentally friendlier it will be to operate. Energy-saving system upgrades require capital expenditures and are most appropriate in areas where fans operate more than 20 hours per week on average. The following technologies and practices can help reduce energy and costs, without harming productivity.

1. Ventilation Controls

The most cost-efficient way to reduce ventilation energy expenses is often to manage fan schedules by using controls. Controls can be a simple time switch or a computer-based system. Most farmers use time switches because of lower installation costs and ease-of-use. Some farmers add a simple thermostat with the time switch to avoid running fans when desired temperatures have been met. To manage larger facilities, computer-based systems can monitor and automate ventilation for optimal efficiency. Computer-based ventilation controls tend to require the help of an energy professional or a professional contractor to assess costs and benefits for a specific farm and to design and install such systems.

2. Variable Speed Drives

Another effective way to reduce motor energy costs is to install variable speed drives (also known as Variable Frequency Drives, or VFDs). Generally, motors do not need to run at full capacity. Motors without VFDs run at full capacity even when loads do not require that. Motors operating at a capacity that exceeds the load requirement can waste large amounts of energy. VFDs significantly reduce energy loss by properly matching the motor speed to the required load and are available for a wide range of applications and horsepower ratings. Because VFDs change motor speeds based on required power, they need to be installed alongside sensors to monitor relevant conditions that affect motor loads. For fan motors on farms, those sensors could monitor temperature and humidity.

3. High-Efficiency Fans

The most substantial and impactful upgrade to reduce energy costs is buying high-efficiency fans when old fans need replacement. These can be expensive to purchase, but better fan design and construction is very effective for reduced annual costs and improved long-term performance. Before buying high-efficiency fans, be sure to obtain the Ventilation Efficiency Rating (cfm/Watt) from the manufacturer and choose the highest-rated fans (as tested by BESS Lab, see references).

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4. General Measures for Ventilation Efficiency

- Establish a periodic fan cleaning schedule (every 3 to 4 weeks).
- Inspect and replace worn belts and pulleys.
- Install fan covers or use roll-up vent louvers or doors on unused fans during the heating season.
- Straighten bent discharge cones and repair shutters that are not closing properly.

Energy Best Practice: High-efficiency Ventilation with VFDs	
Description	High efficiency fans with VFDs and controls optimized for required humidity, temperature, and air circulation.
General Operational Requirements	Average weekly use more than 20 hours.
Potential Energy Savings[1]	20–80%
Typical Simple Payback[2]	3–12 years
Possible Barriers	Cost; building design and farm context may limit what fan and control options are appropriate.
Non-Energy Benefits	Improved crop quality and animal health.
Industry Information and References	BESS Lab 2021, Bartok 2001, MFEP 2012, Sanford 2011, Wisconsin Focus on Energy 2020.

Table Notes:

*1. The row for **Potential Energy Savings** represents the potential savings as a percentage of the total energy use for each technology category. For example, if ventilation was 10% of a farmer's electricity usage, and the table showed a Potential Energy Savings of 25%, the net effect would be a 2.5% overall electricity energy savings. A farmer can then predict **Annual Cost Savings** by estimating 2.5% off their annual bill. If that farmer's annual electricity bill is $10,000, then the potential cost savings for implementing HE ventilation would be $250 per year.*

*2. Simple Payback is the installation costs divided by the potential energy cost savings, showing how long it takes for annual cost-savings from an upgrade to pay for the initial costs. A farmer can use this information to predict the **Expected Implementation Cost** by taking the annual cost savings from note #1 and multiplying it by the Simple Payback for the technology being investigated. If the HE ventilation example had an annual cost savings of $250 and had a Typical Simple Payback of 3.0 years, then the estimated implementation cost for that upgrade would be $750.*

References:

- *Bioenvironmental and Structural Systems Laboratory (BESS Lab). 2021. Agricultural Ventilation Fans. University of Illinois, Urbana, IL. Available at: http://www.bess.illinois.edu/index2.htm*
- *Bartok, Jr., John W. 2001. Energy Conservation for Commercial Greenhouses. NRAES-3. Cornell University, Ithaca, NY. 84 p.*
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- *Sanford, S.A. 2011. Greenhouse Energy Efficiency. A3907-01. University of Wisconsin Extension, Madison, WI. Available at: https://learningstore.extension.wisc.edu/Assets/pdfs/A3907-01.pdf*
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- *Wisconsin Focus on Energy. 2020. Energy Best Practices Guide: Agricultural Facilities. 2020. Madison, WI. Pages 16-17. Available at: https://www.focusonenergy.com/sites/default/files/inline-files/2020_Energy_Efficiency_Best_Practices_Guide-Agriculture.pdf*

Resources

Energy efficiency resources are being developed for farmers by Cornell Cooperative Extension and the New York State Energy Research and Development Authority, in collaboration with topic-experts in NYS. Visit AgEnergyNY.org to find cost-saving resources for farms:

- Recommendations for energy-efficient technologies
- Conservation practices to optimize energy use
- Easy access to funding resource

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Ready to get started?

Visit AgEnergyNY.org to learn more and to get advice on energy efficiency and farm operations, learn about available grants and incentives, or obtain a free energy audit of your farm operations.

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