ENERGY-RELATED AGRICULTURAL BEST PRACTICES

Ventilation

For Orchards and Vineyards

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 orchards and vineyards reduce energy use and save money. Orchards and vineyards include single-item farms such as apples or grapes as well as multi-product farms like those producing commodity and value-added products like juices, ciders, craft beverages, and more.

Ventilation Best Practices

A good ventilation system can help move air in and out of product storage areas on the farm. The less energy that a system needs, the cheaper, more reliable, and environmentally friendlier it will be to operate. Energy-saving upgrades require capital expenditures, so these best practices are most appropriate in areas where fans operate more than 20 hours per week on average. The following technologies and practices can help save energy and money without harming productivity.

1. Ventilation Controls

The most cost-effective way to reduce ventilation energy expenses is often to manage fan schedules with controls. Controls can be a simple time switch or a sophisticated computer-based system. Most farmers use time switches because of lower costs to install and ease-of-use. Some farmers add a simple thermostat to the time switch to avoid running fans while desired temperatures have been met. To manage larger facilities, computer-based systems can monitor and automate ventilation for optimal efficiency. Computer-based ventilation controls 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 without spending a lot of money 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 a large amount of energy. VFDs greatly reduce energy loss by properly matching the motor speed to the required load. VFDs are available for a wide range of applications and horsepower ratings. Because VFDs change motor speeds based on power required, VFDs need to be installed alongside sensors to monitor relevant conditions such as temperature and humidity.

3. High-Efficiency Fans

The most substantial and impactful upgrade to reduce energy costs is buying high-efficiency (HE) fans when old fans need replacement. HE fans can be costly to purchase, but better fan design and construction is very effective for reduced annual costs and improved long-term performance. Before buying HE fans, make sure you obtain the Ventilation Efficiency Rating (cfm/Watt) from the manufacturer, and choose the fans with the highest ratings (these can be viewed in independent tests from BESS Lab).

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 over 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 sensors / controls to optimize 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 occupant comfort.
Industry Information and References	BESS Lab 2021, Bartok 2001, Sanford 2011, Sanford 2006.

Table Notes:

1. The ***Potential Energy Savings*** *row 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. For example, 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.*
- *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*
- *Sanford, S.A. 2006. Benefits of Adjustable Speed Fans for Bulk Potato Storage Ventilation Systems. University of Wisconsin-Madison, Biological Systems Engineering.*

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

SCAN ME

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.

NEW YORK STATE | NYSERDA