ENERGY-RELATED AGRICULTURAL BEST PRACTICES

Ventilation

For Vegetable 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 vegetable farms reduce energy use and save money. Vegetable farms include single-item farms such as onions or potatoes as well as multi-product farms growing vegetables such as tomatoes, peppers, cucumbers, cabbages, green peas, snap beans, squash, sweet corn and more.

Ventilation Recommendations

You need a good ventilating system that can help you move air in and out of product storage areas on your farm, and the less energy that system needs, the cheaper, more reliable, and environmentally friendlier it will be to operate. Energy-saving upgrades require capital expenditures, and these best practices are most economically feasible 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

Using controls to run fans only when needed is one of the cheapest ways to reduce ventilation energy costs. 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 are already met. To manage larger facilities, computer-based systems can monitor and automate ventilation for optimal efficiency. Computer-based ventilation controls require tthe 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). Most of the time, 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. Variable frequency drives greatly reduce this 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 demand, VFDs need to be installed with sensors to monitor conditions affecting fan power requirements, such as ambient temperature and humidity.

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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. These can be costly to purchase, but better fan design and construction is very effective for reduced annual costs and improved performance over time. 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 (you can view independent tests from BESS Lab). Visit AgEnergyNY.org to connect with experts who can share guidance specific to your farm and to learn about rebates that might be available for appropriate technologies.

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 produce quality and animal health.
Industry Information and References	BESS Lab 2021, Bartok 2001, Sanford 2011, Sanford 2006.

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.*
- *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
- Easy access to funding resources
- Conservation practices to optimize energy use

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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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