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Crop Storage

Potatoes

Potato storage facilities require air movement through the pile of potatoes to remove field heat immediately after harvest and to remove the products of respiration during the storage period. Traditionally, banks of single speed fans have been used to circulate air through the pile. The highest ventilation rate is required at cool down thus the fan capacity is sized accordingly. Once the potatoes are cooled to storage temperature, the ventilation requirement is significantly less but since the fans were sized for cool down, the ventilation rate is much higher than necessary. Operators usually operated the fans for periods of several hours per day to remove respiration products instead of running the fans continuously which saves energy.

Research by the University of Idaho suggests that a low constant air flow is more desirable than periods of high air flow followed by periods of no air flow. Variable speed drive (VSD) controllers on fans allow continuous air circulation at a lower rate during the holding periods which saves a significant amount of energy and reduces demand loads. A 1995 study in Maine estimated a 55-60% energy savings was possible with VSD fans. A recently completed study (2003) in Idaho reported energy savings ranging from 33% for potatoes stored for 60 days, up to 45% energy savings for potatoes stored more than 125 days. Other data from storage facilities in Idaho indicated savings of up to 60%.

The electrical demand will be less during holding periods when VSD fans are operated a slower speeds. If the fans are operated at lower speeds during an entire electrical company billing period there will be a savings in the demand charge (\$ per kilowatt (KW) used) as well as kWh (kilowatt-hours). Currently, the demand charges in Wisconsin range from about \$6.00 to \$8.00 per kilowatt (KW) depending on the time of year (more in summer) and utility company. The demand charge savings can be 15-20% of the overall savings when comparing a VSD fan system to a conventional system.

After the potatoes are cooled to the holding temperature, high ventilation rates can cause drying of the potatoes and increase shrinkage losses. The relative humidity (RH) of the air is very important and should be 95% to 98% to keep shrinkage losses low. Shrinkage losses are two times higher at 90% RH than at 95% RH. If potatoes are stored for 6 months at 90% RH versus 95%, the shrinkage difference would likely be 3% which on a 100,000 cwt of potatoes at \$5.00 /cwt market price would result in \$15,000 less income. Continuous air circulation and proper humidification can reduce shrinkage and aid in maintaining the quality of the potatoes in storage. The Idaho VSD study reported 0.4% to 1.7% lower shrinkage losses in a side by side comparison of storage facilities with constant speed fans and variable speed fans. The percentage may seem small but on a 100,000 cwt storage facility the reduction in shrinkage would provide an additional \$2000-\$8000 in income. No differences in potato quality were observed with the use of VSD controls in any of the studies.

Other non-energy benefits of using VSD fans and operating them continuously include fewer problems with condensation on walls and ceiling during cold weather, reduced air flow through evaporative coolers results in cooler air with a high relative humidity and infinite control of fan speeds. There are cultural and climatic differences between Idaho and Maine, and Wisconsin but the overall savings would be expected to be similar. The savings at any particular facility will depend on the air flow design rate, the design of the air flow distribution system and how the system is currently being operated.

A variable speed drive system will cost from \$150 to \$325 per fan horsepower and in many cases pays off in 2 to 3 years or less. Many electric utilities have programs and grants to encourage demand load reduced and energy conservation including Wisconsin's Focus on Energy program. The Focus on Energy program is a public benefits/energy conservation program that provides free energy audits for agricultural enterprises. If you have a storage facility that you would like to consider installing VSD controls in, call your local utility or Focus on Energy (1-800-762-7077).

Additional Resources

Articles of Interest

- [Potato Fan VFDs - Phase 2 report](#), S.Koski, N.Oberg, Cascade Energy Engineering, Inc., October 2003.
- [Relative Humidity: A Key to Successful Potato Storage](#), N.Oberg, N.Olsen, G.Kleinkopf, University of Idaho.
- [Temperature and Airflow: Two Aspects of Potato Storage Management](#), N.Oberg, N.Olsen, G.Kleinkopf, University of Idaho.
- [Potato Storage Research shows promise for boosting grower profits](#), AgKnowledge, University of Idaho.
- [Benefits of Adjustable Speed Fans for Bulk Potato Storage](#), S.Sanford, University of Wisconsin.

Links

- University of Idaho - Kimberly Potato Storage Research Facility - <http://www.kimberly.uidaho.edu/potatoes/>
- Oregon State University - Potato Information Exchange, <http://oregonstate.edu/potatoes/> - Malheur Experiment Station, <http://www.cropinfo.net/>
- Manitoba Agriculture Ministry - <http://www.gov.mb.ca/agriculture/crops/potatoes/index.html>

If you have information you think would be useful to this site please contact
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