

When it comes to evaporator fan VFDs, we can talk till we're blue in the face about the details: fan input power versus speed, load profiles, temperature radiants, control algorithms and so on. But what you really care about is



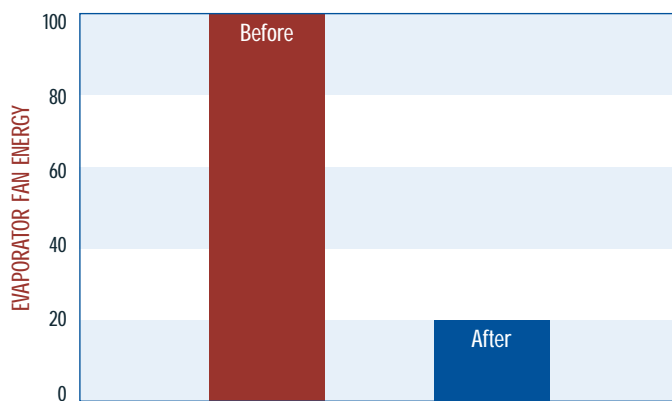
Evaporator Fan VFDs

"What's in it for a CA operator?"

Variable Frequency Drives (VFDs) allow an operator to slow evaporator fans when the refrigeration load is low in controlled atmosphere (CA) fruit storage rooms. Room temperatures are held constant, air movement in the room is reduced and fan energy usage drops off dramatically. It's a natural fit for refrigeration systems designed for fall harvest loads that idle for the rest of the year.

Although speed control is simple in concept, discerning CA operators will want to know more before making the investment. How much energy can be saved? What effect does the reduced air movement have on fruit quality? What is the payback? Which rooms are right for the application?

EVAPORATOR FAN VFD ENERGY SAVINGS POTENTIAL



The engineers at Cascade Energy Engineering spent two years researching this application under contract with the Northwest Energy Efficiency Alliance. To answer the above questions, they ran room versus room tests in 17 commercial CA rooms. The tests encompassed multiple varieties: Reds, Goldens, Braeburns and D' Anjou pears. Types of CA rooms

ran the gamut: new rooms, old rooms, large rooms, highly controlled research rooms, rooms with small horsepower fan motors, fan-cycled rooms, full-speed rooms, conventional stacking, tight stacking, 2-way bins and 4-way bins.

Highlights of their study revealed that VFDs:

- Reduced evaporator fan energy consumption by 24%-78%.
- Produced a lower average mass loss in all bin fruit tests with savings ranging from 0.06 % - 0.58%.
- Yielded simple paybacks on the investment between 1.1 and 2.9 years when considering both energy savings and mass loss improvements.

For more information on the research, check Cascade's web site at www.CascadeEnergy.com.

"Savings in energy, less compressor needed, everything I've seen makes me think it's a good deal. I highly recommend it. I think it should be the standard for apple storage and freezers."

Ken Adams, Doubl-Kold Yakima



What about the skeptics?

Concerns with VFD control have been raised about cost and fruit quality. On the positive side, the research showed no evidence of warm spots or CO2 variations associated with low fan speeds. Higher humidity was measured in the VFD rooms, which helps cut mass loss and shrivel.

In some cases, VFDs are simply not cost effective. And care should be exercised for varieties such as Fujis and Braeburns which are prone to internal browning.

However, with future economic trends suggesting higher energy costs, evaporator fan VFDs merit consideration in the vast majority of CA rooms.

Are VFDs right for my rooms?

As a consulting engineering firm specializing in industrial refrigeration and energy efficiency, Cascade recognizes that no two sites are alike. The firm develops an "engineering solution" for evaporator fans for each of its customers.

CA rooms ideally suited for evaporator fan VFDs would include many of the following attributes:

- Long storage season (six months or more of total use).
- Evaporator fan cycling delayed until Mexican export requirements are satisfied (or all fans operate throughout the holding season).
- Energy rates greater the 3 cents per kWh (or lower if utilities offer programs that help offset the cost of the VFDs).
- Recent construction.
- Bin stacking practices that promote good air circulation.

What is Cascade's technical approach?

There is a lot to sort out. In a typical project, Cascade engineers will:

- Review the schedules and use for each controlled atmosphere room.



"It's the best of all worlds; I think most everyone agrees with that. It achieves constant air movement and uses the entire coil."

Dan Black, Techni-systems



"In our experience, evaporator fan VFDs are the number one energy efficiency opportunity in CA warehouses."

Marcus Wilcox, Cascade Energy

- Install monitoring equipment to observe variations in refrigeration system operations and measure power consumption.
- Measure fan input power for each evaporator zone.
- Check the suitability of the rooms, evaporator fans and coils, refrigeration systems and electrical system for VFDs.
- Develop detailed computer models of systems operations with and without VFDs to accurately predict energy savings.
- Obtain equipment and installation costs from customer-preferred contractors and vendors (and work with these same vendors to develop a VFD solution that operates dependably).
- Work with vendors and contractor to define a cost-effective dependable solution.
- Determine eligibility for utility financial incentives or state tax credits.
- Summarize the findings in a report geared to answer three critical questions:
 - What is recommended?
 - What will it cost?
 - What are the benefits?

Are there other opportunities?

Evaporator VFDs typically represent the largest energy savings opportunity in CA facilities. However, several other options exist including refrigeration control systems, screw compressor thermal siphon oil cooling, screw compressor VFDs, condenser fan VFDs, fast acting doors, lighting upgrades, and nitrogen and CO2 system opportunities.

To learn more about evaporator fan VFDs and other energy efficiency opportunities in your CA facility, contact Marcus Wilcox at Cascade Energy Engineering:

E-mail Marcus.Wilcox@CascadeEnergy.com

Phone 509-529-8040

To learn more about other energy efficiency opportunities, check out the Northwest Energy Efficiency Alliance's web site at www.nwalliance.org.