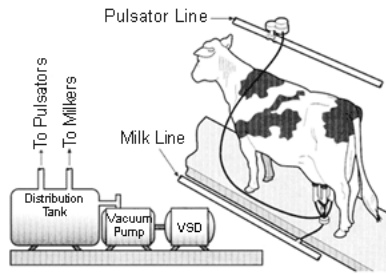


The Importance of Accurate Savings Estimates When Deciding to Install a Milking Vacuum Pump Variable Speed Drive (VSD)

Figure 1. Vacuum Pump VSD System reproduced with permission from EPRI



Introduction

In many respects the milking vacuum pump is the heart of a dairy operation. If it doesn't work, the cows can't be milked. Missing a milking can create financial repercussions for the dairy producer in terms of lost milk production and herd health problems. Therefore, for years, dairy producers had been reluctant to change their milking vacuum pump system.

Most dairy producers will invest in milking equipment only after it has proven to be reliable and to make them more money. The vacuum pump VSD is an example of such a technology. With thousands of installations over the past ten years, it is a "tried and true" reliable technology that saves dairy producers approximately 67% in their vacuum pump electricity costs. But because individual dairies' savings vary, it makes sense to have an agricultural energy consultant calculate the actual savings a milking vacuum pump VSD would provide. This is often a free service.

How the Vacuum Pump VSD Saves Money

If you can slow down a motor to meet the workload, you can often save a significant amount of energy and money. Milking vacuum pumps have motors that are sized to meet the high vacuum demands of the wash cycles, yet often have much lower horsepower requirements for milking. Before VSDs were used for vacuum pumps, dairy producers ran their pumps at maximum speed and maintained vacuum by "bleeding" air through a regulator. A VSD regulates the speed of the vacuum pump motor (see Figure 1) to meet the vacuum demand. This enables the motor to operate at a much lower horsepower (and wattage) during most of the milking process.

Milking vacuum pump VSDs savings can be significant. Participants in the 2003–2004 California VSD Farm Program operated by EnSave, Inc. for Southern California Edison, Pacific Gas and Electric, and San Diego Gas and Electric, experienced average annual electricity savings of \$8,450. In general, the equipment paid for itself in about a year. But the electricity cost savings varies substantially. Figure 2 and Table 1 illustrate the significant yet wide ranging electricity costs and savings of a sampling of dairies that participated in this program.

Figure 2. Annual Vacuum Pump Motor Electricity Costs Before and After Installation

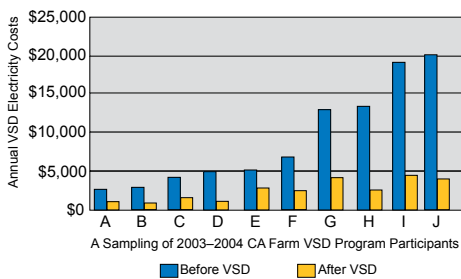


Table 1. A Sampling of 2003–4 California Farm VSD Program Participants: Annual Electricity Costs and Savings

Dairy	Annual Electricity Cost Before VSD	Annual Electricity Cost After VSD	Annual Electricity Savings After VSD
A	\$2,385	\$1,032	\$1,353
B	\$2,746	\$897	\$1,849
C	\$4,106	\$1,370	\$2,736
D	\$4,967	\$1,060	\$3,907
E	\$5,091	\$2,727	\$2,364
F	\$6,841	\$2,626	\$4,215
G	\$12,767	\$4,138	\$8,630
H	\$12,988	\$2,892	\$10,096
I	\$18,817	\$4,430	\$14,387
J	\$20,002	\$3,959	\$16,043

The Value of Knowing What the Savings Will Be

In general, dairies operate within tight budgets. Although the cost savings can be substantial, the investment in a milking vacuum pump VSD is significant. Dairy producers can spend \$4,500 or more for this equipment. It is important for dairies to have an accurate picture of what their savings will be.

Although the 67% savings is a good approximation of what dairy producers should expect to save, it is an average: some dairy producers will save more, others will save less. For the dairy producers who experience savings greater than expected, this isn't an issue. But for those whose savings is lower than estimated, this can be a serious problem. It is important for many dairy producers to have a site-specific analysis of their individual dairy. Table 2 illustrates why this is so.

Savings Calculators

There are many variables of a milking pumping system: differing milking system setups, pounds of milk produced per year, number of milkings per day, and vacuum pump horse-

Table 2. 2003–4 CA VSD Farm Program Payback Comparison

Pump Size	7.5 HP	10 HP	15 HP	20 HP	25 HP
Equip. Costs After Rebate	\$3,706	\$3,970	\$4,849	\$4,187	\$9,621
Avg. Savings/Year	\$2,492	\$4,015	\$6,596	\$10,662	\$13,599
Avg. Payback	1.5	1.0	0.7	0.4	0.7
Shortest Payback*	0.4	0.4	0.3	0.2	0.5
Longest Payback	4.3	5.2	1.4	0.7	1.0

* Of the 10 HP VSDs, although the average payback was 1.0 yr, among this group paybacks ranged from .4 yr. to 5.2 years.

This table summarizes results from the 2003–2004 California Farm VSD Program for dairies with varying vacuum pump sizes. Although average paybacks were relatively attractive across all motor sizes, there were fairly wide swings in costs and savings within these ranges. In other words, for some dairies their paybacks were very short, but for others their paybacks were relatively long. Therefore, obtaining site-specific information to calculate savings is important.

Table 3. Calculation Accuracy

	EnSave Calculated Savings	Verified Savings	Percent Accuracy
kWh	2,648,429	2,582,180	97%
kW	451	446	99%

power ratings among others. Therefore, the savings calculations need to be quite complex to produce accurate results. Not only is accuracy important to dairy producers, utilities, and state regulators also rely on the accuracy of these calculations. At the conclusion of many energy efficiency programs, utilities often require evaluation, measurement, and verification (EM&V) to be conducted to ensure the program has delivered the desired results. The accuracy of the savings calculator is of utmost importance.

An example of an agricultural energy savings calculator that calculates vacuum pump VSD energy savings accurately is AutoAudit™, a proprietary software program developed by EnSave, Inc. EnSave is an energy efficiency program designer and implementer that works exclusively in agriculture. AutoAudit™ calculates savings using site-specific information provided by the dairy producer. The tool models existing energy usage and compares it to the proposed energy usage that would occur through the installation of cost effective energy savings measures. The results of AutoAudit™ regarding vacuum pump VSDs have been favorably evaluated by independent EM&V firms.

California’s 2003–2004 VSD Program

In 2004, EnSave, using AutoAudit™, completed its 2003–2004 California VSD Farm Program. This program, in the first year, saved dairy producers a total of 2,582,000 kWh, 446 kW and at an average cost per kWh of \$0.15, \$387,000 through the installation of 52 milking vacuum pump VSDs. kW Engineering of Oakland California, an independent engineering firm, conducted EM&V to determine the accuracy of AutoAudit™ savings estimates. kW Engineering found that EnSave’s savings projections were within 99% accuracy for kW savings and 97% for kWh savings (see Table 3). This is an extremely high accuracy rate for the industry. To verify the baseline or “before” data, kW Engineering surveyed program participants and asked about equipment, hours of operation, and other usage patterns. To check savings, they metered 19% of the participating dairies after the control was installed and compared the metered data to the AutoAudit™ calculations.

What Makes One Savings Calculator Better than Another?

It is important for tools that calculate milking vacuum pump VSD energy savings to take into account several factors that vary depending on the dairy. For example, dairy operations with larger herds in general have larger milking systems, use more power, and have greater potential for energy savings than do smaller dairies. California dairy producers who participated in EnSave’s 2000–2004 California VSD Farm program installed vacuum pump VSDs ranging in size from 7.5 to 50 horsepower with savings from \$1,517 to \$32,858 per year. The configuration of the milking system also affects energy usage. The number of milking units for example, directly affects the vacuum pump energy usage and the energy savings potential. Similarly, hours per year that the vacuum pump operates and the number of milkings per day varies per dairy, causing differences in vacuum pump energy usage.

Conclusion

Milking vacuum pump VSDs can provide significant energy cost savings to dairy producers. These cost savings after utility rebates are applied, often pay for the equipment in about a year. However, because different dairies have wide ranging operating characteristics, savings vary. Because milking vacuum pump VSDs require a significant up-front investment, it is important for dairy producers to have an accurate picture of what they should expect to save. Utilities often hire agricultural consultants who, using accurate savings calculators, can provide this service to their customers for free. It is paramount for many dairy producers that they not rely on estimates but seek firms that will accurately calculate their expected individual savings.