

Decrease Power Costs on Dairy Farms with Energy Efficient Equipment

With the current depressed milk-prices, dairy producers are looking for ways to reduce costs on the farm without sacrificing the quality of their product. One way to reduce costs is to analyze the way farm equipment utilizes electricity. With a few changes to equipment and proper maintenance to existing electrical devices, producers may find substantial savings on the farm's electrical bill.

"Some farm operations consume large amounts of energy," says Keith Tinsey, Michigan State University Agricultural Engineering Specialist and Director of the Michigan Agricultural Electric Council. "Designing and selecting the right equipment systems for energy savings can save producers money in the long term."

Electric Motors

Electric motors are vital to all farm and agribusiness operations. To begin analyzing electric motor use, make a list of all motors on the farmstead, including sizes, locations, and dates they were installed. This inventory will be valuable in comparing the amount of energy used by motors with other end-uses on the farm. Concentrate on larger horsepower motors or those with run times averaging six or more hours per day.

"One of the easiest ways to increase energy efficiency and save money is by properly maintaining existing equipment, in particular, maintaining proper belt tension so that motors will do the same amount of work more efficiently but in a shorter amount of time," Keith says.

Simple lubrication and cleaning can improve efficiency and add years to the life of a motor. Changing motors to high-efficiency models is another option, but they reduce consumption by only 3 to 8 percent and should be considered only for higher horsepower motors that operate 2,500 hours or more per year. Simple maintenance and proper selection of efficient motor-driven equipment can yield much higher savings.

Don't overlook routine maintenance if motors seem to be operating adequately. Just because a motor is running doesn't mean it is running efficiently. For example, dirty blades on ventilation fans can reduce airflow up to 40 percent. Other trouble spots often causing motors to waste energy include: Rusty or corroded moving parts on motor-driven equipment; clogged condenser coils on refrigeration systems; dry or worn bearings; belt drives that are too loose, too tight, or misaligned; incorrect tolerances on irrigation pump impellers and improper modifications made after installation.

Variable Speed Drives

Milking equipment is one of the biggest energy users on dairy farms. By changing to a variable speed drive (VSD), dairy producers may be able to cut milking equipment energy costs in half. A VSD attaches to the existing vacuum pump to constantly monitor the airflow and alter the motor speed accordingly. With the addition of a VSD, the motor runs only fast enough to meet the instantaneous vacuum need.

"When a speed control system is installed, generally a single

phase vacuum pump motor is replaced with a three phase motor and a VSD is installed," Keith says. "Three phase motors are less expensive, easier to achieve speed control and work better with a VSD."

There are many advantages to using a VSD:

- **The milk pump uses less electricity.** Typically, dairy producers experience a savings of up to 65-75 percent on the electricity needed to run the vacuum pump. The VSD determines how much energy is necessary to keep a steady airflow through the vacuum system.

- **The motor runs only as fast as necessary.** Before the variable-speed vacuum pumps were developed, dairy operators had no choice but to run the pumps at a constantly high speed—often 7 to 10 cubic feet per meter (cfm) per milking unit. But recent scientific research has found that the amount of airflow needed for "steady state" milking—when all milking units are attached without any squawking teat cups or air leaks—is as little as 1 or 2 cfm. per unit.

- **Stable vacuum is maintained.** A vacuum pump hooked up to a VSD responds quickly and always produces a reliable vacuum with very little variability, keeping the vacuum level constant as the motor speed changes. If a milking unit falls off or if the system has a leak, the VSD immediately speeds up the vacuum pump motor to remove excess air. A constant vacuum speed is necessary to prevent bacteria from accessing the teats. VSD pumps maintain the vacuum level as well as conventional systems.

- **The vacuum pump will last longer.** A motor running at full speed will have a shorter life span than a motor that regularly runs at a lower speed. Operating a vacuum pump at reduced RPMs is easier on bearings and other internal components, which may extend the pump's operating life.

- **Less noise is produced by the motor.** A vacuum pump equipped with a VSD will frequently operate at only half the RPMs that it would have taken without a VSD, and fewer RPMs is easier on the ears.

- **A VSD can pay for itself in two years or less.** The money saved by installing a VSD depends on many factors. These include size and type of vacuum pump, size and type of milking system and time required for milking, which includes the number of milkings per day. More than likely the VSD will pay for itself in the form of reduced electric bills in less than two years.

Scroll Compressors

The compressor may be the most essential parts of the milk cooling system by pumping and cycling refrigerant through the cooling system. A scroll compressor is a new technology with the simple design of dual spinning scrolls that compress and move refrigerant more efficiently and reliably than traditional compressors.

In a scroll compressor, gas refrigerant is compressed when one spiral orbits around a second stationary spiral, creating smaller and smaller gas pockets and higher gas pressures. By the time the refrigerant is discharged, it's fully pressurized. Suction is continuous and pulse-free because all gas pockets are in various stages of compression at all times.

By installing a scroll compressor, producers can reduce costs and streamline operations. Some

of the advantages of scroll compressors are:

- **Uses less energy.** Scroll compressors use about 30 percent less electricity than conventional compressors. They require much less current than conventional compressors and are even able to run on single-phase electricity.

- **Runs more quietly.** Since there is only one moving part - no pistons, rods, pins, or valves - it runs at a lower decibel level and vibrates less than a reciprocating compressor.

- **More durable and reliable.** With only one moving part and no metal-to-metal contact, there are no seals to tear and no lubrication needed. Scroll compressors operate very well in cool weather and don't require crankcase heaters. They can also start under any system load without a start kit.

In-line Milk Cooling

In-line cooling uses 50 percent less electricity and cools milk faster. By installing an in-line plate cooler, milk temperature is lowered before entering the bulk tank to be cooled further. This technology has proven its worth for two decades, and recent studies find it can reduce cooling costs by almost 50 percent. Some advantages to in-line milk cooling are:

- **Uses less electricity.** By partially pre-cooling milk before it hits the refrigerated bulk tank, the bulk tank compressors don't need to work as hard to cool milk down to storage temperature. This savings is possible because milk is pre-cooled up to 30 degrees or more, requiring that the compressors run approximately 10 to 15 minutes. Conventional cooling, in which all cooling is done in a bulk tank, requires that the compressors run approximately 30 to 45 minutes to cool the milk.

By using well water to partially cool milk prior to entering

the bulk tank, an in-line cooling system can pay for itself in two years.

- **Milk is cooled faster.** In-line pre-cooling significantly reduces cooling and agitation time. When pre-cooled milk is pumped in, the bulk tank compressors finish the cooling in only 10 to 15 minutes. Faster cooling increases the capacity of the bulk tank because a higher volume of milk can be cooled at once.

Lighting

Another important factor in saving energy costs can be the type of lighting used on the farm, especially in areas that remain lit for long periods of time, such as milking parlors. Money can be saved by simply changing out incandescent bulbs with longer lasting more efficient compact fluorescent bulbs as well as changing mercury vapor yard lights to high-pressure sodium yard lights.

"There are many areas on the farm where producers can lower their energy costs," Keith says. "Each producer should assess his or her farm to decide what energy saving practices are appropriate for them."

Information for this story thanks to: Michigan Agricultural Electric Council, Consumers Energy Agricultural Services Department, National Food and Energy Council and the Wisconsin Public Service Corp.

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