UMC
Science and Technology
GUIDE
Published by the University of Missouri - Columbia Extension Division

WAYS TO SAVE

Electric Energy in Milk Houses and Milking Parlors

Leslie L. Christianson and Kenneth L. McFate
Department of Agricultural Engineering
College of Agriculture

Dairy farmers use a lot of electricity producing clean, wholesome, Grade A milk. Electricity is clean and available, but the cost of it is going up. Yet, with prudent use, it is still likely to be your best farmstead energy source in the years ahead.

Farmers can reduce their use of electricity in many ways by careful planning and management. A few dollars invested now to save energy may be returned many times over in lower electric bills. Your local power supplier will help you plan an electrical system that allows you to save as much energy as possible.

Better Insulate Your Building

Wall and ceiling insulation saves energy and improves comfort by keeping inside surfaces warm. Less heat is lost, or radiated, by a person or an animal to walls that are already warm. Warm inside surfaces can be provided with the insulation guidelines in Table 1.

Many milk houses and milk parlor walls are concrete and difficult to insulate. Two inches of Styrofoam on the inside or outside, covered by a protective coating, is usually the best way to treat existing concrete buildings. Painted exterior plywood works well on either inside or outside. If inside, the paint should have good vapor-proof characteristics. Table 2 compares different wall materials that can be used for the inside. Note that fiberglass-reinforced plastic is two times as expensive as plywood, but the plastic resists stains and moisture better.

Fiber glass batts work well if you have conventional frame construction. Place a good 4- or 6-mil polyethelene vapor barrier between your insulation and the inside wall covering. This prevents water vapor in the air from condensing near the colder wall surface. Such condensation can deteriorate studs and wall components, often without visible effect.

Table 1. Insulation recommendations.

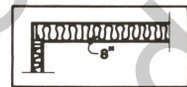
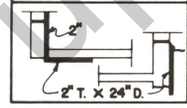
	Ceiling	8-in. wood fiber (R = 32) or 8-in. mineral wool (R = 28)
	Walls	Concrete wall: 2-in. styrofoam (R = 8)
		Stud wall: 3½-in. fiberglass (R = 13)
	Perimeter	2-in. perimeter insulation (R = 2.2)

Table 2. Comparison of Inside Wall Materials.

Materials are ranked from poor, good, better, to best.

Wall Material	Relative Cost	Ease of Cleaning	Resistance to		
			Stains	Impact	Moisture
Ext. plywood (painted)	1	good	good	best	good
Painted steel	1.1	better	better	good	best
Painted aluminum	.9	better	better	poor	best
Cement asbestos	1.5	good	poor	poor	good
Glazed tile	3	best	best	better	best
Concrete block	.9	poor	poor	best	better
Glazed concrete block	1.3	better	good	good	better
Prepainted hardboard	2	poor	good	poor	poor
Fiber glass-reinforced plastic	2	good	best	best	best

Ceilings also should have a 4- or 6-mil vapor barrier below the insulation. Eight inches of wood fiber mineral wool or fiber glass gives a low-cost but well-insulated ceiling.

As concrete is a good conductor, heat often moves from a concrete floor below the wall to the outdoors. Two-inch thick vapor resistant perimeter insulation will retard such heat loss and save money.

Milk House Heating

Avoid use of radiant space heaters in your milk house or milk room. This type of heater can waste energy because of excessive evaporation of moisture on milk house floors.

An electric wall or ceiling heater, with a fan to circulate air, saves energy. This type reduces water evaporation and allows for easy cleaning. Most Missouri milk houses can be handled with a 1,500-3,000 watt thermostatically controlled heater.

Use a thermostat that can be set as low as 40°F to control your heater. Mount it on an interior wall or suspend it from the ceiling for most efficient energy use. Check with your local extension agent or power supplier to find out what units are available.

Your milk cooler extracts heat from the milk and releases it across the condenser coils. This heat and heat from your compressor can be used in winter to provide some of your space heating needs. In new or modified construction, take care to exhaust this heat in summer. Also, special equipment is available that uses heat extracted from milk to warm water used for sanitizing.

Milking Parlor Heating

Milking parlors usually don't need to be as warm as milk houses. Radiant heat directed at the operator should provide satisfactory comfort without heating the whole parlor. A cluster of four 250-watt heat lamps, quartz tube heaters, or similar radiant-heat units, properly located above the operator, will serve a dual purpose. They provide both heat and light, which are especially important during winter months. Additional heat may be needed, depending on the type and size of the milking parlor.

A manual switch can control much of the milking parlor heat. However, where water lines are permanently installed in milking parlors, insulate such lines and provide sufficient room heat to prevent freezing. As an alternative, use thermostatically controlled electric heat tape on lines under pipe insulation. For optimum efficiency and to reduce heat requirements, plan to minimize length and number of fixed water lines, if local regulations allow.

Figure 1. Small thermostat-controlled electric space heater is suspended on the wall in the milk house.

Lavatory Heating

A 500-watt pump house heater will amply warm the lavatory. Either built-in or remote thermostatic control for this heater will quickly pay for itself in electricity savings. Again, do not locate the thermostat on an outside wall.

Water Heaters—Selection and Use

Water heating requires more energy than any other operation on most dairy farms. The average 50-cow dairy operation may use 8,000-9,000 kilowatt-hours of electricity for general water heating, plus 7,000-8,000 kwh in the prep stall each year. This may cost more than $500 annually, with 3¢/kwh electricity.

You can reduce energy for water heating in several ways. When purchasing water heaters, buy those with the greatest amount of insulation available, and set the thermostat as low as permissible. Purchase a specially designed hot water tank insulation-jacket to further reduce losses.

To maximize overall energy use efficiency and reduce line heat loss, buy two water heaters. One for the cow preparation area can be set at 110°F to reduce standby losses. The other, for milk house use, may be set at 140°F. Locate each unit near point of maximum use. Keep lines short. A standard-recovery water heater costs less initially and uses less electricity than a quick-recovery heater. Because of slower heating, the storage capacity of standard units often will need to be larger. The standard units, which have smaller heating elements, reduce

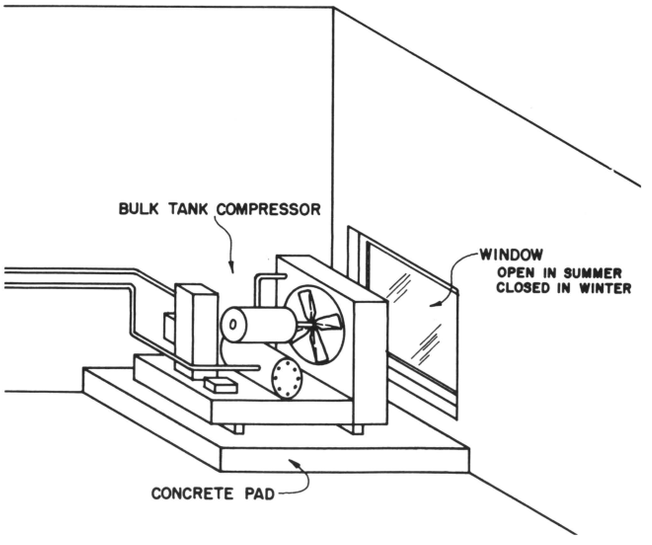


Figure 2. The bulk tank compressor should be located facing a window or vent. The window is closed in cold weather and open in warm weather.

electrical demand, which may be an important part of future electric bills.

Other Hot Water Saving Ideas

Put a loop or other mechanical device in your hot water line right above the water tank to prevent constant circulation of hot water through lines when not in use. Insulate all hot water lines.

Use the heat from your bulk milk cooler to heat your water. This may decrease cooling efficiency slightly, but you get essentially free hot water. Some companies manufacture equipment that will do this. For a 50-cow herd, this practice may save more than $150 per year, with 3¢/kwh electricity.

Minimizing hot water use saves money. So, use cold water for flushing equipment whenever feasible. Repair any leaky faucets (cold or hot) quickly.

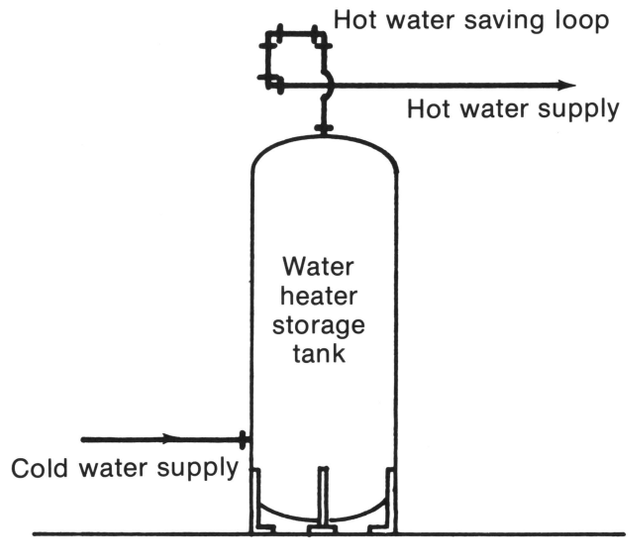


Figure 3. Loop above hot water tank prevents constant circulation of hot water, and thus, energy waste.

An old water heater tank painted black and set outdoors in the sun will preheat water from 50°F (ground water temperature) to 80 or 90°F in the summer. Install valves so this can be shut off and drained in winter. This can save $75 per year, with 3¢/kwh electricity.

Milk Cooling

Figures 2 and 5 show two ways to improve milk cooling efficiency and reduce total energy required. You can use heat extracted from milk (normally waste heat) to partially warm the milk house in winter, or you can use it to heat water all year round.

The energy required to cool milk can be reduced by running it through a ground water supply line heat exchanger. Use care to make sure the cooling process does not affect milk quality adversely.

Another way to save electricity used for milk cooling is through regular cleaning of compressor coils and air filters

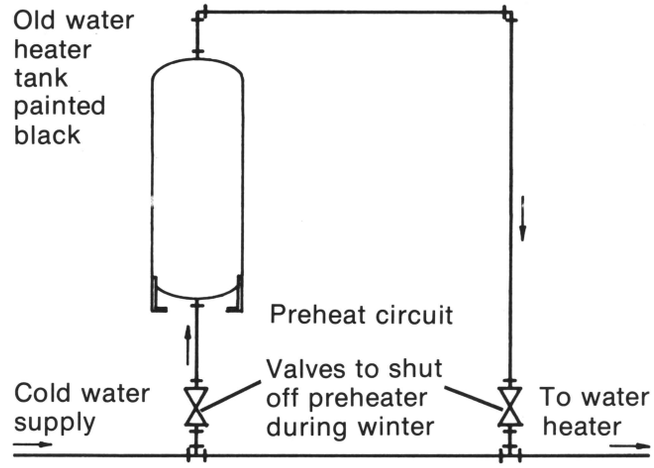


Figure 4. Solar preheating of intake water to the water heater. Note: Cold water should enter at the low point and hot water should exit at the high point of the preheater.

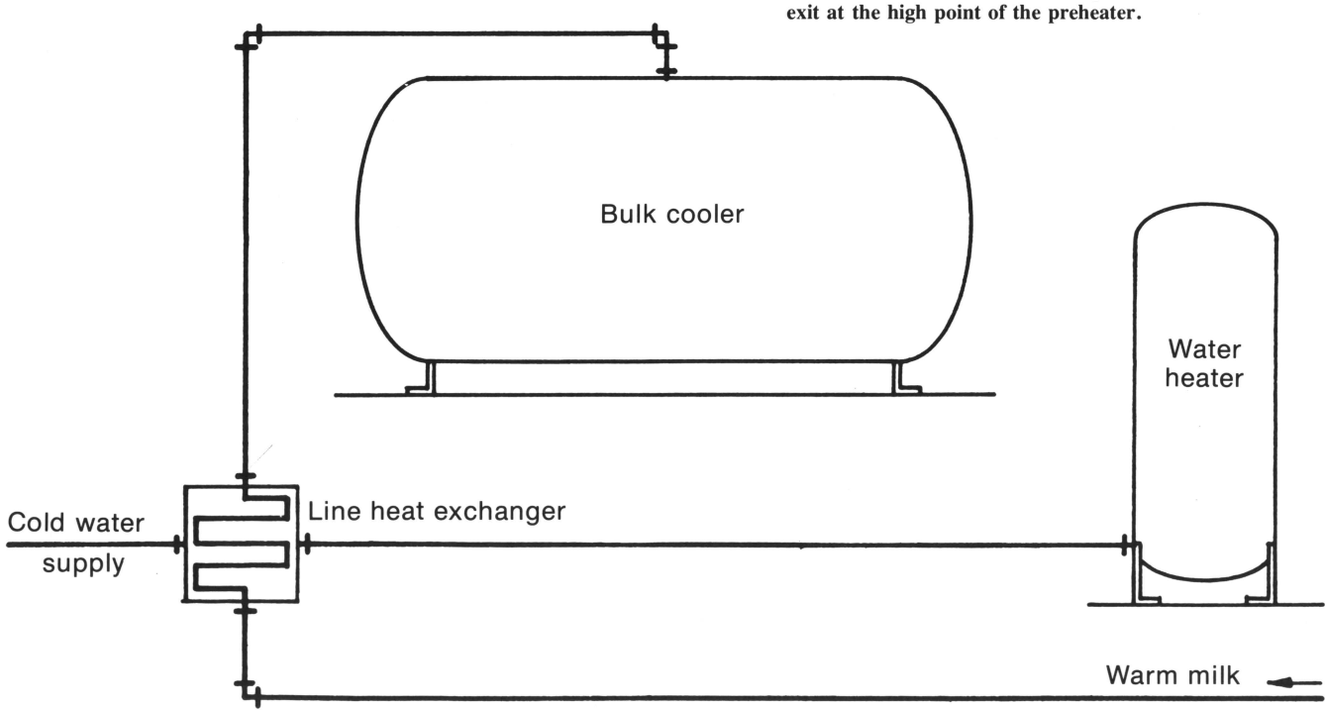


Figure 5. Line heat exchanger for cooling milk and warming water.

and proper service and maintenance of bulk cooler motor, wiring and controls.

Check refrigerant regularly to be sure lines are free of air. Three percent air in your ammonia refrigerant decreases efficiency 17 percent and can cost more than $40 per year for a 50-cow herd.

Ventilation

Running fans costs money, but proper ventilation is necessary. However, overventilating during the winter costs much more because you are heating excessive amounts of incoming cold air.

Generally, large diameter fans are considerably more efficient than smaller fans. For instance, a 36-inch good quality fan has been shown to be twice as efficient as a 20-inch fan. Use a large diameter fan for summer when you need more milk house and milking parlor ventilation and a small diameter fan in winter. Dual volume and variable speed fans, properly selected, also can be used with energy saving efficiency.

The milk house should be ventilated at a rate of about 600 cubic feet per minute. Use a pressurized system to keep air from being pulled from the milking parlor to the milk house.

Milking parlor ventilation should be the exhaust type. Install fan(s) which provide 100 cfm per stall for use during winter and 400 cfm per stall for summer. Air inlets should be sized at the rate of one square foot per 600 cfm.

Fan Selection

Fan performance varies greatly with design. While high quality fans cost more, they provide the best energy-conserving and maintenance-free investment. Select fans on the basis of cubic feet of air per minute delivered per kwh at 1/8 inch static water pressure. Most reputable manufacturers can provide this detailed information, if it isn't available in their regular literature. If they can't, check with other manufacturers.

The use of a low-cost static pressure gauge can also be an energy saver. It will indicate when air inlets are restricted and clogged, which makes the fan work harder to move air. Clean inlets, clean fans, and clean, well-lubricated motors help reduce energy use.

Water Usage

Use water (cold or hot) only when necessary; pumping that water costs money.

Every gallon of water that evaporates from the floor in winter uses 2½ kwh of electricity. Save energy by removing the excess water on the milk house floor after cleaning. A squeegee and sponge mop move water quickly and easily, if the floor has proper drainage.

Locate water lines in the warm parts of buildings to minimize heat required to prevent freezing. Where freezing is a danger, as in the milking parlor, put thermostatically controlled heat tape on pipes. Cover with pipe insulation. Never embed water lines in concrete. Always insulate hot water lines when the difference in water temperature and room temperature is 20°F or greater.

Lighting

Fluorescent lighting gives more light per unit energy, and the lamps last several times longer than incandescent bulbs. Savings in operating costs result.

Two rows of 40-watt fluorescent bulbs running the length of the milking parlor provide good lighting. Install them where they will not be bumped and where equipment will not shade the light. The operator should not have to work in dark shadows. (See UMC Guide 1403 for more specific information on planning farm lighting.)

In the milk house you need about 40 watts of fluorescent lighting for each 100 square feet of floor. To put light where it is most needed, locate a fixture above each cleaning area. Use incandescent flood lights for illuminating bulk tank interiors. Do not place a fixture *directly* above the bulk tank opening. Broken glass or dust could fall into the milk.

Use weather proof lighting fixtures because of the high moisture conditions. As ceilings should always be light colored, lamp reflectors are not always required.

Livestock Waterers

Livestock drinking water should be kept above freezing temperature. Many automatic waterers use efficient, thermostatically controlled electric heaters mounted under the drinking bowl. When purchasing, be sure to select a well-insulated one that handles the correct kind and number of animals and one carefully designed for safety. Install and maintain a grounded wiring system to serve each waterer. Use an approved ground rod installation at each unit.

Thermostats occasionally stick or malfunction. Use a thermometer to check water temperatures periodically. Make sure water temperatures do not rise above 50°F. Temperatures above that needed to prevent freezing are energy expensive and do not add to production.

Electric Demand

Power suppliers must install generating and transmission equipment capable of supplying your maximum rate of equipment capable of supplying your maximum rate of electricity use (demand). To cover this cost, they sometimes charge according to your peak monthly demand—in addition to total energy use. This soon may become a more common practice on farms. Thus, you'll need to become more concerned with alternating the use of large electrical equipment. By staggering use, you limit demand. You'll also make the best use of your wiring and service equipment, as well as that of your power supplier.

Reduce your electrical demand by not oversizing space heaters, water heaters, bulk coolers and other equipment. When selecting equipment, look for the small automatic electric units if you can extend the operation over a long period of time. Techniques are available to lock out some non-essential (but normally automatic) equipment during times of peak usage.

Talk to your local power supplier; he will be glad to help you plan an electrical system that will allow you to conserve, properly manage and prudently substitute electrical energy wherever feasible. He is interested in helping you manage your electricity and in reaping the resulting mutual benefits.

References:
1. Dairy Housing and Equipment Handbook, Midwest Plan Service, Iowa State University, Ames, Iowa 50011.
2. Conservation of Electricity in Dairy Barns, ASAE Paper No. 76-3539, Paul Shea, Minnesota Power and Light Company, Long Prairie, Minnesota 56347.

Issued in furtherance of Cooperative Extension Work Acts of May 8 and June 30, 1914 in cooperation with the United States Department of Agriculture. Carl N. Scheneman, Vice President for Extension, Cooperative Extension Service, University of Missouri and Lincoln University, Columbia, Missouri 65201.