

Refrigeration Heat Recovery

Introduction

Hot water for washing of milk lines, milk tanks and other equipment can account for as much as one-quarter of the electrical energy that is used on a dairy farm. The use of waste heat recovery from the milk refrigeration system can significantly reduce the amount of energy that needs to be purchased.

What is heat recovery?

A cow produces milk at about 39°C (102°F) which needs to be cooled to 4°C (39°F) for storage in the bulk tank. A refrigeration unit is used to cool the milk which often discards the heat directly into the air. A heat recovery system which consists of a small heat exchanger and an insulated water storage tank can capture this heat to be later used to heat water for line and tank washes. The heat exchange unit has hot refrigerant from the refrigeration system of the bulk tank on one side which is cooled as its heat is transferred through the plates to the water being heated on the other side.

Types of refrigeration heat recovery systems

There are two basic types of heat recovery systems.

Water-cooled condensing units consist of a heat exchanger jacket inside a water storage tank. This type of unit can pre-heat water to about 55°C which will then need to be heated to the required wash temperature.

Desuperheaters consist of a small heat exchanger with refrigerant on one side and water from the water storage tank on the other. They are located external to the hot water storage tank.



Source: [DeLaval](#)

Energy Savings

A refrigeration heat recovery unit can increase water temperature from 13°C to as high as 55°C using only the heat removed from the milk. This means that as much as 2/3 of the energy required to heat the water can be supplied by this free heat. A rule of thumb, to help recover as much heat as possible, says the refrigeration heat recovery storage tank should be large enough to provide all of the hot water needed for one milking.

\$\$ Savings

Annual cost to heat 100 litres of water, from 13°C to 75°C for two milkings each day using only electricity would be about \$600. The energy available in the milk could heat the water from 13°C to 55°C which could save about \$400 annually per 100L heated.

Heat recovery system maintenance

Maintenance of a heat recovery system is mainly prevention of buildup of sediment in the tank. An easy way to help prevent this is to use water for washing cow's udders from this tank each milking. A valve would be

required near the bottom of the tank to allow this to happen.

Benefits of heat recovery

- Reduced energy needed for heating water
- Warm water for equipment washing
- Reduced compressor use
- Increased refrigeration system efficiency

Plate Coolers

Installing a plate cooler and a refrigeration heat recovery unit may reduce the overall total energy savings. This is because it requires more energy to heat water than it does to cool milk. If the amount of heat energy available in the milk is reduced there may not be enough heat left to pre-heat the volume of hot water needed.

Available Funding

Programs and Business Risk Management Division, NS Department of Agriculture administers federal and provincial funding under the Farm Investment Fund for energy-efficiency implementation. There is funding of up to 50% of the cost of a heat recovery system, with a cap of up to \$20,000/yr (\$40,000 max), depending on farm income level.

What Next?

After deciding to install a refrigeration heat recovery system you should speak with your dairy equipment supplier for a cost estimate. Apply for funding the Farm Investment Fund.