CASE STUDY—STEAM SYSTEM

Dairy Plant Smart

U.S. Dairy Sustainability Commitment | INNOVATION CENTER FOR U.S. DAIRY

Cheese processor uses steam systems survey to identify energy and utility cost savings.

Best practices: Conduct a steam survey; check and repair steam traps and insulation.

Steam production makes the largest demands for fuel-fired energy, on average, at most milk processing plants. That's why Leprino Foods, the largest U.S. exporter of whey products, took a close look at its steam systems when looking for ways to save energy and utility costs throughout its manufacturing facilities.

It started with a steam assessment, which had three main objectives:

- Identify malfunctioning components and maintenance needs that cause energy waste
- Identify areas where current pipe installation or system design are not compatible with current steam system best practices
- Identify potential or existing safety hazards

Basic repairs make an enormous difference in energy use. The steam assessment at Leprino Foods revealed several issues common to large boiler systems: multiple leaks, a failed steam trap and missing pipe insulation. The list of suggested actions below show how much money can be saved through repairs and maintenance.

Area/recommended repairs	Estimated annual energy savings*
Pressure regulating valve (PRV)-10	
Repair leaks, estimated at 76 pounds/hour	$9,600
Install 2" insulation	$550
PRV-2	
Repair leaks, estimated at 53 pounds/hour	$6,700
Replace failed steam trap	$3,800
Condensate return piping	
Add insulation	$1,440
Floc heater	
Insulate steam and condensate lines	$3,400
Pick heater	
Insulate steam supply piping	$1,200
Fix steam leaks	$200
Clean-in-place (CIP) heat exchangers (HX)	
Fix steam leak from flange connection	$500
Total estimated annual energy savings:	$27,390

*Savings are based on estimated natural gas cost of $1.1615/therm. Calculations are based on a boiler system with a combustion conversion efficiency rate of 82.5 percent. Incremental steam cost is estimated to be approximately $14.44 per 1,000 pounds for the Leprino Foods system. Its steam is created through three Cleaver-Brooks firetube steam boilers using natural gas, operating 24 hours per day, seven days per week, virtually year-round.

Additional recommendations include increased usage of steam flow meters and regular trap surveys, for ongoing monitoring of steam usage and prompt repair of issues that cause energy loss. These updates also help to avoid burn and slip hazards for plant employees.

Quick Facts

- *Common steam-system energy-efficiency measures include steam trap repair programs and semiannual boiler efficiency checks.*
- *Steam system improvements help many facilities save 10 percent to 20 percent in fuel costs.*

  Source: Department of Energy, Industrial Technologies Program
- *One hundred feet of uninsulated 2" pipe, operating at 120 pounds per square inch (PSI) in a 50°F room, will waste 47 pounds of steam per hour; an insulated pipe will waste only one-tenth that amount.*
- *A hole measuring only 1/64" in diameter in a system operating at 125 PSI will leak 1/37 pound of steam per hour — just one leak can waste up to 12,000 therms of wasted energy in a year, costing about $5,940.*

Tools and Resources

- *The U.S. Department of Energy's Industrial Technologies Program (ITP) Steam System Best Practices website offers case studies, tip sheets, software tools, training courses and more to help you identify and evaluate steam system improvements. Visit www1.eere.energy.gov/industry/bestpractices/steam.html.*
- *The California Energy Commission offers a video highlighting the benefits of a whole-systems approach to steam-system efficiency, including common ways to capture energy and reduce costs. View the video at http://energy.ca.gov/process/videos/index.html.*

Key benefits

Natural gas savings — The combination of repairs and insulation would save approximately $27,000 in natural gas annually (23,600 therms per year), based on a natural gas cost of $1.1615/therm.* Additions of drip traps and condensate removal system upgrades would result in even greater savings over time.

Greenhouse gas (GHG) reduction — The savings in natural gas would represent 260,000 pounds of CO_2 per year, equivalent to the CO_2 emissions from 274 barrels of oil consumed. (Source: EPA Greenhouse Gas Equivalency Calculator (www.epa.gov/cleanenergy/energy-resources/calculator.html).)

Reduced burn and slip hazards — Steam system leaks dramatically increase the risk to employees for severe burns and falls. A properly maintained system helps avoid these problems, while helping maintain the high sanitation and housekeeping standards required for high-quality cheese production at Leprino Foods.

Payback — Estimated payback for the survey and related improvements is two years, based on estimated energy savings and natural gas costs for this location at the time of project completion.

Cut costs and increase safety with steam system optimization.

Challenge area: Eliminate energy loss in large steam system.

At a large plant like Leprino Foods, steam is used for CIP heat exchangers, pasteurizers, whey dryers, tank heating and many other processes. The three boilers at the plant represent the greatest fuel-fired energy expenditure at the plant. The steam system survey gave plant managers the information they needed to make essential repairs and upgrades that will continuously save energy, lower natural gas costs and increase plant safety.

Plant profile: Leprino Foods.

Leprino Foods is based in Denver, Colo., and is a world leader in premium-quality cheese manufacturing as well as the largest U.S. exporter of whey products.

The company has made considerable investments in advanced technology and is committed to applying available technology to reduce energy use.

Financial Information

Investment	Approximately $5,000 for steam system survey and $50,000 for repairs
System includes	Three Cleaver-Brooks firetube steam boilers rated at 800 hp, capable of producing 27,000 pounds/hour of saturated steam at 150 psig
System life expectancy	Indefinite
Offsetting incentives	N/A**
Payback period	Approximately 2 years

*Energy cost savings were calculated at the time of project completion, based upon the regional cost of energy for the plant's location. Energy costs may fluctuate over time and by geographic region.
**State and federal incentives will vary by plant.

The Dairy Plant Smart Project is designed to increase U.S. milk processor awareness of and confidence in the economic feasibility of energy efficiency best management practices. The Dairy Plant Smart is one of 12 projects identified by the Innovation Center for U.S. Dairy® sustainability initiative that aims to help reduce greenhouse gas emissions and increase business value across the dairy industry.

This is one of a series of validated case studies that has been proved to be economically viable in dairy processing plants. Together, these case studies help identify critical control points for energy efficiency and best management methods for improving efficiency and profit opportunities. For more information about Dairy Plant Smart, or to join our mailing list, email **innovationcenter@usdairy.com**.

The Innovation Center for U.S. Dairy aligns the collective resources of the dairy industry to offer consumers nutritious dairy products and ingredients, and promote the health of people, communities, the planet and the industry.

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