Case Study:

A collaborative project to improve cooling system performance at La Crema Winery.

By: MICHAEL LONG, President, Heritage Systems Inc.

The wine industry has considerable opportunity to improve cooling system performance from a number of perspectives. Although much progress has been made to conserve water in the areas of cleaning and sanitation, barrel washing, irrigation and wastewater reduction, cooling systems have generally been over-looked.

As an industry we are always striving to reduce water and energy usage. We need to also look for ways to improve health and safety, minimize our environmental impacts and reduce our carbon footprint.

That is why in January 2011, Heritage Systems and Jackson Family Wines initiated a study of the La Crema Winery cooling water system. The objectives of the study were:

- Reduce water usage in the cooling systems.
- Reduce energy consumed in the cooling process.
- Reduce cooling system maintenance costs.
- Improve environmental/human health and safety related to cooling water operations.
- Minimize the environmental impact from cooling system operations.

When left unattended and improperly conditioned, water will support biological growth, corrosion and scaling. Proper treatment and management is important to process optimization and efficiencies.

COOLING WATER BASICS

In simple terms, a cooling tower is a device designed to reject unwanted heat into the atmosphere. Water is a highly effective heat transfer medium and as such is used extensively in the wine industry for rejecting heat generated in the cooling process.

Water evaporation in the cooling tower accounts for the majority of the heat rejected. The remainder of the heat is removed through windage (drift) and by transfer into the air flow passing through the tower.

Blowdown (BD) is the intentional removal of water from the cooling tower and is important to prevent over-concentration of dissolved minerals and air-borne debris.

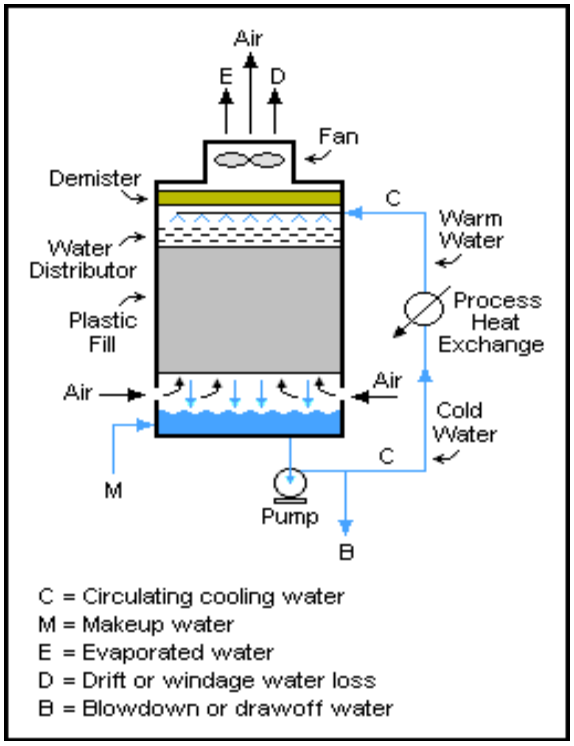
Makeup (MU) is the fresh water that is added to the cooling system to replenish the evaporative and blowdown losses.

The number of times the makeup water is increased in concentration is commonly referred to as cycles of concentration (C).

Low cycles of concentration leads to increased water usage.

Effects of tube bundle scaling

Environmental requirements, dwindling water resources and LEED program requirements are driving factors for increasing cooling tower cycles of concentration.



Project Matrix

Before initiating the study we investigated several parameters to establish baseline operating conditions and implemented new control measures:

- The cooling towers were opened and inspected to determine their condition with respect to scale and corrosion.

- Past water use numbers were agreed on.
- Electrical demand, based on past operational procedures, were established.
- Water meters were installed on the tower make-up and blow-down water lines.
- Cooling towers were cleaned to remove scale and corrosion.
- New chemical feed and conductivity controllers were installed to further automate the process.

Adjustments to the cooling towers were made to increase the cycles of concentration, a new chemical program was implemented to condition the water to accommodate the increased cycles and regular measurements were implemented.

Monitoring consisted of measuring and adjusting scale/corrosion inhibitors in the cooling water; adjustments to the blow down rate in order to minimize water usage; regular inspections of the cooling water mechanical surfaces along with tracking water and electrical usage.

These activities were conducted throughout 2011.

Project Results

Water Savings

A key component of the study was to operate the systems efficiently while minimizing water use. The following spreadsheet shows that we were able to conserve over 260,000 gallons of water by implementing a correct treatment and service program which allowed us to double the cycles of concentration. This resulted in a cost savings of $5,800.00 (water acquisition, pumping and disposal costs).

Target Cycles of Concentration	5.00	
Make up Conductivity	689	
Tower Conductivity	1,200	(Current Supplier)
Recirc Rate, gpm	1,354	
Delta T	10	
System Volume, gal	2,647	
Operating Days, per year	168	
Make-up Water Cost, $/1000 gal	$ 17.79	
Blowdown Cost, $/1000 gal	$ 4.01	
MU & BD Cost, $/1000 gal	$ 21.80	Typically - $2.50 to $8.00
		High Arsenic Removal System on Potable Water

La Crema Current Program Results

		GPM	GPD	GPY	$/yr	
Cycles of Concentration	2.50					
Holding Time Index, minutes	690					
Make up		6.660	6,394	1,074,125	$ 23,415.92	$/yr
Blowdown		2.660	2,554	429,005		
Evaporation		4.000	3,840	645,120		

La Crema Heritage Systems Results

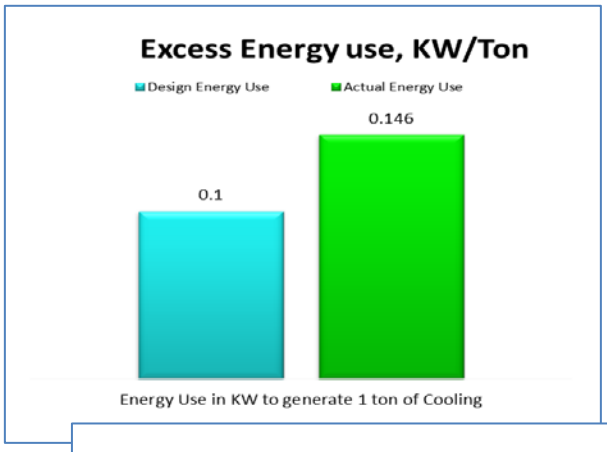
		GPM	GPD	GPY	$/yr	
Cycles of Concentration	5.00					
Holding Time Index, minutes	1834 minutes					
Make up		5.000	4,800	806,400	$ 17,579.52	$/yr
Blowdown		1.000	960	161,280		
Evaporation		4.000	3,840	645,120		

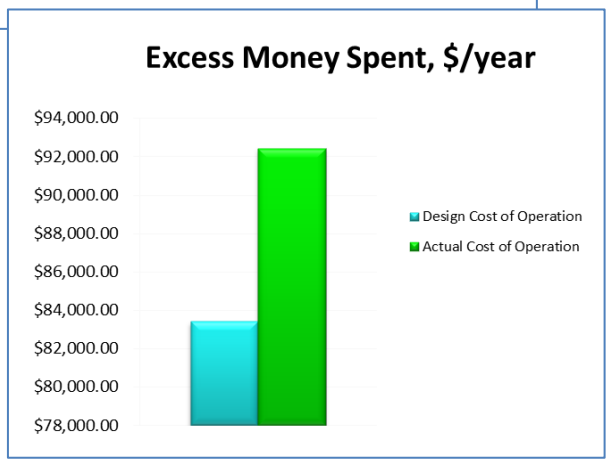
La Crema Annual Water Savings with Heritage Systems program	$ 5,836.40
Gallons per year saved with Heritage Systems program	267,725

Reduced Energy Usage

Consistent with many systems in the wine industry, these towers were prone to scaling and corrosion due to improper management. After initially cleaning the towers in late 2010 we implemented a service program to eliminate the necessity for this moving forward. Based on inspections of the system and comparing the degree of scale on the heat transfer

surfaces prior to the new service program compared to inspections of the heat transfer surfaces at the end of 2011 we were able to calculate a net energy savings of over $9,000.00 per year.





Maintenance Costs

Inefficient cooling system management leads to additional maintenance activities and costs associated with those activities.

This study showed that we were able to reduce out-sourced HVAC maintenance costs by $5,000.00 per year along with $1,600.00 per year in La Crema maintenance costs associated with tower cleaning and de-scaling. Chemicals used for regular de-scaling were eliminated resulting in an additional $6,500.00 annually.

Improved Health & Safety

When looking at overall improvements to the cooling system, the study partners placed an emphasis on reducing human exposure and environmental impact from cooling tower operations.

A “drum-less” (chemical tanks are refilled in place) storage and delivery system was put in service that safely double-contained the cooling water chemicals, eliminated winery exposure and eliminated the use and disposal of 276 pounds of plastic chemical containers resulting in a CO2 savings of 1,656 pounds per year.

Automatic control system with double contained chemical Storage

In addition, all chemicals used in the cooling system are fully bio-degradable and compatible with the wineries wastewater treatment processes.

Summary of Study Results

In summary, the study was successful in meeting and exceeding all of the original objectives. We were able to achieve water and energy savings, reduce maintenance activities and cost, reduce the environmental footprint by reducing CO2 emissions, improve personal/environmental health and safety and reduce overall costs at the winery.

The following table is a summary of the program results:

Category	Annual Savings in Dollars	Annual Gallons Saved	Annual LBS of CO2 Saved
CO2			1,656
Water	$5,836.40	267,725	
Energy	$9,008.88		
Out-MNT	$5,000.00		
In-MNT	$1,600.00		
De-Scale	$6,500.00		
New Program Cost	($15,540.00)		
Totals	$12,405.28	267,725	1,656

In conclusion, cooling water maintenance is essential to efficient operation of your winery's cooling system. Water treatment is a complex undertaking with many things to consider. Properly managed, we have the opportunity to conserve resources, improve efficiencies and save money.

Acknowledgements:

Robert Boller, Vice President of Sustainability, Jackson Family Wines

Justin Lee, Sustainability Program Manager, Jackson Family Wines

Michael Mendenhall, Production Manager, La Crema Winery

Rick Bonitati, Vice President of California Wineries, Jackson Family Wines

Tony Aiello, Director of Business Development, Heritage Systems Inc.

Chip Garner, Technical Services Representative, Heritage Systems Inc.