CASE STUDY: BOZEMAN SPIRITS DISTILLERY

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Company Background:

Bozeman Spirits Distillery is a small craft award-winning distillery in downtown Bozeman, Montana. It was founded in 2014 by Jim Harris and his wife, MaryPat. It is committed to producing high-quality spirits using only the finest ingredients, most of which are sourced locally. Their products include Bourbon, Whiskey, Vodka, Huckleberry Vodka, Lemon Vodka, Gin, Agave Spirit, and Rum. All of these spirits are distilled and bottled on-site.

Project Background:

Bozeman Spirits Distillery has many processes in place to achieve the production of high-quality vodkas. Just like most distilleries, the principal production processes include Mashing, Fermentation, Distillation, and Bottling. Most water usage in the distillery goes into heating and cooling operations. The processes that have the greatest water usage are mashing and distillation. The steam boiler utilizes water to provide steam to heat the mash cooker for cooking grains and to the still to separate the alcohol from the wash (the fermented mash). Additionally, cool water is used to reduce the temperature of the cooked mash to the fermentation temperature, for condensation of the alcohol vapor to liquid which will then be bottled, and for cooling the spent wash. All the water used for cooling is discarded into the drain.

Being a small craft distillery, Bozeman Spirits Distillery experiences high Waiting waste. The distillery employs batch production. To produce one batch of vodka, it takes two weeks. It involves four (4) mashing in four days, 5-6 days of fermentation, six (6) wash distillations in six days, and one (1) spirit distillation. The equipment used includes a 500-gallon mash tun, three 300-gallon fermentation vessels, and a 300-gallon pot still. In addition, most of the bottling process is carried out manually: labeling, rinsing, and capping. This also contributes to Waiting waste.

The mash (cooked grains) is converted into spent wash after distillation. This spent wash is in a liquid form, containing approximately 70% water. After distillation, the spent wash is discarded into the drain while being cooled to avoid damaging the drain pipes. The spent wash contains high levels of nutrients, such as potassium, nitrogen, and phosphorus, this can lead to eutrophication if it gets into contact with a water body.

The Fermentation Vessels and the Pot Still

Bottle Rinsing

Spent Wash being discarded into the drain while being cooled

Proposed Solutions:

Glycol Chiller Purchase: Introducing a closed-loop system by installing a glycol chiller can go a long way toward reducing cooling water waste. The water from cooling the mash and from the distillation enters the chiller hot where the glycol cools it and then sends it back to cool the mash and for the distillation process. The cycle continues until the mash is at the right temperature for fermentation and the distillation is completed. The water can then be stored in a holding tank for the next batch. After several uses, the water can then be treated and used for other purposes in the distillery like in the restroom or cleaning the facility. The installation of a glycol chiller will save approximately 404,592 gallons of water annually.

Higher Capacity Equipment Purchase: To simplify the production process, increase production and improve efficiency, new distillery equipment with higher capacity than the current equipment should be purchased. Also, a continuous system should be put in place instead of the current batch system. Using a continuous system will increase production, improve consistency, and reduce Waiting waste.

Installation of Automated Bottling Line: Using an automated bottling line in the distillery has lots of benefits. This will minimize Waiting waste and improve efficiency. The bottling line can be fully automated or partially automated, depending on available funds.

Spent Wash Repurposing: The spent wash can be repurposed in two ways: aerobic/anaerobic digestion and dewatering. When the spent wash undergoes either aerobic or anaerobic digestion, it produces biogas. Biogas can be used as a renewable energy source, and it can also be used to generate heat and electricity for use in the distillery. The treated effluent from the biological digestion can be used for irrigation. Alternatively, a centrifuge can be used to dewater the spent wash. The solid spent wash can be used as animal feed while the expelled water will be used for irrigation or treated and then reused in the distillery for other purposes.

Recommended P2 Actions	If Implemented:				If Not Implemented:	
	$		Annual Reductions			
	One-time Cost to Implement ($)	Annual Savings from P2 Actions ($)	Water Pollution (lbs)	Water Use (gal.)	Barrier to Implementation	Plans to Implement within 5 years? (Pick Y/N)
Glycol Chiller Installation	TBD	2,444		404,592	Funds	Y
Fully/Semi-Automated Bottling Line	TBD	-	-	-	Funds	Y
Higher Capacity Distillery Equipment Purchase	483,602	-	-	-	Funds	Y
Spent Wash Repurposing	-	-	301,838	-	Lack of Technical Know-How for the Digesters	Y