Taos Mesa Brewing Environmental Footprint Reduction

EPA Region 6; NAICS Code 312120

NM STATE College of Engineering

Taos Mesa Brewing

Taos Mesa Brewing Has been in operation since 2012. Since opening, they have expanded to two locations: The Mothership and The Tap Room. Combined, Taos Mesa Brewing employs a total of 56 people. The Mothership is where the brewing of Taos Mesa beers takes place. With a facility of 5,000 ft^2 and a crew of 6 workers, The Mothership is located on the Hondo Mesa. It boasts a concert venue, restaurant, and stunning mountain views. Currently, due to both the novel Coronavirus and an unfortunate fire, The Mothership remains closed but operational for brewing purposes only. The Tap Room is still operational and has recently re-opened for dine-in experiences. The Tap Room is open 5 days a week and is set in the historical downtown area. This location features fresh brews and artisan cuisine.

Case Study Point of Interest

On November 2021, a team from NMSU's Engineering New Mexico Resource Network (ENMRN) visited Taos Mesa Brewing Co to conduct a Pollution Prevention (P2) assessment. The goals of this activity were to assess the brewery's efficiencies in production, materials handling and storage, environmental and energy performance, and to provide recommendations for improvement.

Contact Information

Taos Mesa Brewing
20 ABC Mesa Rd.
El Prado, NM 87529
(575) 758-1900 – The Mothership

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Challenge – Why P2?

Taos Mesa Brewing wanted to better understand and decrease the environmental impact of the brewery as part of its commitment to environmental stewardship. As an established brewery, Taos Mesa has exemplified a commitment to sustainability and has implemented several methodologies and techniques to continue the trend.

Energy Efficient Recommendations

Solid waste

The brewery generates approximately 34.15 tons of solid waste annually. This waste is composed of cardboard, plastic, and aluminum which makes it suitable for recycling. The impact of recycling these materials will result in an overall reduction in Carbon dioxide emissions of 2,210 tons per year. At the time of assessment, the City of Taos was not collecting any recycling materials, therefore everything was ending up in the landfill. With the effort by the NMSU team and suggestion from New Mexico Recycling Coalition a private company was found to collect all the recycling materials from the Taos Mesa Brewing.

Other Implementations

- LED bulbs installed
- Installation of heat recovery system
- Donating all organic waste to local farmers
- Reducing harmful chemicals for CIP process.

Wastewater

Taos Mesa Brewing Company is an 1,800 BBL per year brewery and onsite restaurant/event facility. Currently brewery and restaurant wastewater discharges are stored in holding tanks and hauled offsite for disposal.

Wastewater Details

Current Wastewater Data		
Brewing Process Wastewater		**units**
Gal/Day	775	g
BOD	5000-6000	mg/L
TSS		
Restaurant Wastewater		
Gal/Day	915	g
BOD	1000-1500	mg/L
TSS		
Daily Total Wastewater		
Gal/Day	1690	g
BOD	4500	mg/L

Wastewater Treatment Best Practices

Some practices that will protect the amount of solid waste going into the sewer have been listed as follows:

- Install a monitoring point
- Install screen or filters to capture solids.
- Control pH
- Minimize the volume of unused and off-spec product discharge.
- Prevent chemical solutions from entering the sewer by implementing a secondary containment.
- Keeping records of waste generated.
- Use dry clean-up procedures prior to wet clean-up.

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The Taos Mesa Brewing has a private well at the brewery location and uses the well water for their brewing and restaurant.

Currently brewery and restaurant wastewater discharges are stored in holding tanks and hauled offsite for disposal. Sanitary wastewater is discharged to an onsite sewage disposal system, but they have capacity limitations for holding the wastewater since the City will not take the waste water due to high organic content. A wastewater treatment to reduce BOD and TSS to <300 mg/ L is recommended to allow discharge to an onsite leach field and save money on heavy wastewater disposal charges. Below, 2 anerobic wastewater treatment systems are described.

BioGill Proposed System

BioGIll is a highly effective biological wastewater treatment system ideal for high BOD waste streams. This bioreactor system has in its core a cartridge containing nanoceramic-coated media known as gills. A pump delivers wastewater to the top of these gills, this creates an air side and a water side. As liquid flows down, microbes consume dissolved nutrients. The gills structure allows enzymes to pass from the water to the air side, this allows the break down of organic compounds. All these steps are done without a aerators or blowers, oxygen is delivered to the system by natural convective airflow.

BioGill System Criteria

Wastewater type	Combined brewery and restaurant wastewater
Equalized, continuous feed flow into the BioGill System	1690 gpd (1.2 gpm)
Wastewater temperature	76 F
Influent sBOD	4500 mg/L
Effluent sBOD	<300 mg/L
Influent TSS	<300 mg/L
Influent FOG	<100 mg/L
Influent pH	6.5-8.5
Influent nutrient ratio	100:10:1 to 100:5:0.5
Influent Screening	1 mm

ClearBlu Proposed System

The proposed system will consist of two equipment: pre-treatment and primary system. The wastewater from the brewery will flow into the existing 6,000-gallon collection tank. The wastewater will then be pumped to a wedge wire waterfall screen to eliminate solids down to .5 mm. Water will then gravity flow to an automatic pH adjusting system. The pH tank is integrated into the Primary Treatment system. The metered water from the screen will be collected in an epoxy lined 4,000-gallon tank equipped with nano-bubble aeration, fixed film media and dosed with high strength bacteria.

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Cost

Implementing either of the treatment systems proposed will require a high amount of initial investment. These systems will cost more than $80,000 USD just for the system components. Other costs associated with these systems include pH balancing system, filtration, monitoring systems, etc. Fortunately, the rate of investment could be in 5 years or less due to disposal costs savings. The savings in such a case have been tabulated below.

Wastewater Cost Analysis	
6000-gal Tank	**BioGill**
Weekly removal Cost:	**Installation Cost:**
425 $	80,000 $
Monthly Removal Frequency:	**Other Cost:**
4	10,000 $
Monthly Cost:	**Total Cost:**
1700 $	90,000 $
Yearly Disposal Cost:	**Yearly Savings:**
20400 $	20,400 $
Payback Period	**4.4 Years**

System Process Flow

1. Wastewater flows into a wedge sire waterfall screen where large, fibrous material will be removed. Filtered water will fall into a pH balancing system.
2. Screened water will flow into a tank with a rigid media stack for microbe adhesion which improves digestion rates.
3. The tank will be aerated with a nanobubble aerator generating non-buoyant bubbles that will stay resident until all air and oxygen are consumed. The system recirculates the aerated water through a media stack.
4. Metering pumps will dose liquid microbes essential to BOD digestion process.

Wastewater for Irrigation

Both the brewing industry and agriculture are high water consumers, but both could benefit from the other. With a wastewater flow of approximately 1700 gallons per day from the restaurant and brewery, Taos Mesa Brewing could use some if not all of this water for irrigation. This practice will not only reduce water consumption for irrigation, but it will decrease the wastewater removal.

Although monitoring of this irrigation source will be necessary, studies have shown that using food processing and domestic wastewater are safer than coming from an industrial source.

The effectiveness of this wastewater on the soil will depend on its composition and ecology of the soil. This irrigation method could increase the levels of macronutrients, phosphorus, and potassium in the soil.

Another brewery in Santa Fe, NM is planning on planting Christmas trees and using this practice for irrigation. Trees in general absorb 5,900 grams of CO_2 per year, and one acre is able to absorb up to 2.5 tons of this greenhouse gas while reducing temperature by 30%.

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Water Consumption

Taos Mesa has a great opportunity for making a positive impact by planting trees. They have the space available, and could reuse brewery wastewater for irrigation. One acre of land can fit an average of one thousand trees, plus or minus 100 depending on the space left between each one. The average water consumption of the trees is 1 gallon per day per tree. The wastewater flow of 1,690 gallons per day from the brewery is more than enough to support tree growth. The water consumption for the trees will be higher during the first years of development, but there will be plenty of water to account for this.

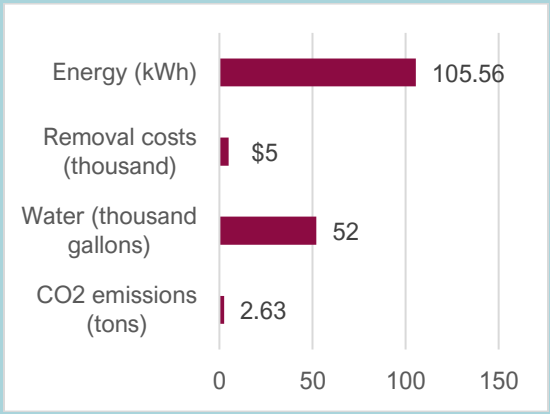
Environmental Benefits from Tree Farming

- Reduce temperature by 30%
- Absorb up to 2.5 tons of CO2
- Christmas trees are a renewable, recyclable, and biodegradable resource.
- They are grown on soil that does not support other crops 1 acre produces half a ton of new biomass each year helping remove more than 500 pounds of CO2.

Cost of Implementation

The initial cost of investment will depend on how much equipment needs to be purchased, type of irrigation system desired, amount of seeds purchased, supplier, storage tank (if needed), and any extra labor on the land (if required). On average, seeds are sold at $0.39 while trees can be sold up to 76 dollars. This implementation is a long-term investment since these trees will take approximately 6 years to grow and be sold. However, the profitable margin for tree farming is of 25% to 30% (8-10 dollars per tree).

Annual Savings from Tree Farming



Summary of Total Savings from Suggested Implementations