



ASSESSING OPPORTUNITIES
TO REDUCE THE
**ENVIRONMENTAL IMPACT
OF BREWERY WASTE
IN ALBANIA**

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INTRODUCTION

Volumetrically, beer is the third most consumed alcoholic beverage in Albania behind wine and raki, and the beer market is only growing. Brewing beer consumes large amounts of water and produces waste streams that have the potential to significantly harm the environment. As the Albanian brewing industry grows, beer breweries will become a more significant contributor to waste streams, but the extent of which is unknown. The brewing process produces both wastewater and solid waste in the form of spent grains, spent hops, yeast, and trub. Brewery wastewater by itself has a high organic load and negatively impacts receiving water bodies and ecosystems. Solid waste contains nutrient-rich organic materials that disrupt aquatic ecosystems when they decompose.



Three of the ten urban wastewater treatment plants (WWTPs) in Albania are not in operation due to a lack of technical and financial support— the remaining treatment plants have the capacity to treat approximately 25% of the country's wastewater (United Nations Economic Commission for Europe, 2018). The Albanian government has not implemented any industrial wastewater treatment infrastructure. Due to the lack of framework, breweries and other industries do not treat their wastewater before discharging it directly to the environment. The Water Supply and Sewerage Association of Albania (SHUKALB) has developed initiatives to assess the environmental impact of Albania's current wastewater management practices. This project on assessing the impacts of brewing beer is a part of these initiatives.

PROJECT OBJECTIVES



Due to the lack of industrial wastewater treatment in Albania, breweries have a greater responsibility to find alternative methods to treat their waste in a manner that protects the natural resources around them. The goal of this project was to assess the waste management practices of Albanian breweries and to identify options to reduce the breweries' impact on the environment. By becoming more sustainable, breweries may also be able to reduce operating costs, increase profits, and increase employee and consumer engagement. To achieve this, the team developed four main research objectives:



1 Assess wastewater systems near breweries to characterize the collection, treatment and disposal of brewery effluent.



2 Assess how sustainable production processes can reduce operational costs for breweries.



3 Evaluate current brewery waste management practices and their impact on the surrounding environment.



4 Characterize beer consumer purchasing preferences to determine if consumers value a more sustainably brewed beer.

To evaluate brewery waste management practices, the team toured seven breweries of varying scales and interviewed brewers in Albania. During the brewery tours, the team requested to photograph the brewery’s processes and used these photos to compare Albanian brewery processes to U.S. breweries. The combination of brewery tours, interviews, and photo documentation helped us characterize current Albanian brewery practices and identify where breweries can most significantly improve their practices to reduce their environmental impact. Our interviews with breweries also illuminated what factors, such as operation costs and market competition, limit or drive Albanian breweries to invest in process improvements.

BREWERY TOURS

Bräuhaus	Pub	Nov. 11, 2019
Birra Stela	Large	Nov. 12, 2019
Birra Korça	Large	Nov. 15, 2019
Birra Tirana	Large	Nov. 19, 2019
Birra Kaon	Large	Nov. 19, 2019
Birra Puka	Micro	Nov. 21, 2019
Birraria e Gjyshit	Micro	Nov. 25, 2019



Circle the age range that best describes you: 18-20 21-30 31-40 41-50 51-60 60+

Circle the gender that you identify with: Male Female Prefer not to answer

Circle the number of beers per week you consume on average: 0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15+

Based on the statements below, check one box to rank the level of which you agree or disagree with each statement. Only one ranking per statement. If you prefer not to answer a question, check the box that says "Not Relevant/Prefer Not to Answer" and move to the next statement.

Statement	Strongly Disagree	Somewhat Disagree	Neutral	Somewhat Agree	Strongly Agree	Not Relevant/Prefer Not to Answer
I purchase a brand of beer because it costs less than other brands.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
I purchase a brand of beer because I know it has a lower environmental impact than other brands.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
I drink Albanian beer more than foreign beer because it was brewed in Albania.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
I drink Albanian beer more than foreign beer because it is cheaper.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
The design of the beer packaging influences what beer I buy.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
I am more likely to drink beer that I see in advertisements on TV or around town.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
I am more likely to buy a beer that uses local ingredients.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
I am more likely to drink beer that my friends and family drink.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

BEER CONSUMER SURVEYS AND INTERVIEWS WITH BAR OWNERS

In the United States, breweries advertise their sustainable practices to market their beer. We wanted to know what factors influence how Albanians purchase beer and if a brewery’s environmental impact had any role in it. To determine this, we employed a five-point Likert scale survey, shown above. We asked consumers how much they agreed or disagreed with different factors of purchasing beer (i.e. price, packaging, sustainability), where zero indicates strongly disagree, two

indicates neutral, and four indicates strongly agree. SHUKALB distributed an online version of the survey to its general mailing list and the team distributed a paper version to customers at four bars in Tirana. We chose bars through convenience sampling as we could only distribute surveys with the owner’s permission. We also interviewed management from the establishments to gauge their attitudes towards serving more sustainably brewed beer.



REGULATIONS AND PERMITTING PROCESS

Through the interviews with wastewater treatment professionals, the team found that breweries must maintain an environmental permit from the Ministry of Tourism and Environment to obtain a license to operate. This permit specifies how the brewery must treat, reuse, or dispose of its waste, and details the brewery's plans to manage materials and equipment. In the section of the document that requires breweries to communicate how they plan to handle waste

streams, they often list “no further treatment” as an acceptable response for wastewater discharges. The brewery must then coordinate with local authorities to properly dispose of its wastewater. Given the lack of industrial wastewater treatment infrastructure in Albania, breweries generally discharge their wastewater directly to the environment (Personal Communication, Ministry of Tourism and Environment, Nov. 26, 2019).



To maintain their environmental permits, Albanian breweries must self-monitor their operations and report to the National Environmental Agency every six months. Each brewery must contract a certified lab to test the water, air, and solid emissions from its processes. The brewery sends the results from these tests to the NEA to show it is in compliance with its environmental permit. If the brewery is not in compliance with the permit, the Environmental Inspectorate monitors the brewery's operations on site. The Ministry of Tourism and Environment can issue fines to the brewery and possibly revoke its operating license if it does not comply (Personal Communication, Ministry of Tourism and Environment, Nov. 26, 2019).



WASTEWATER INFRASTRUCTURE IN ALBANIA

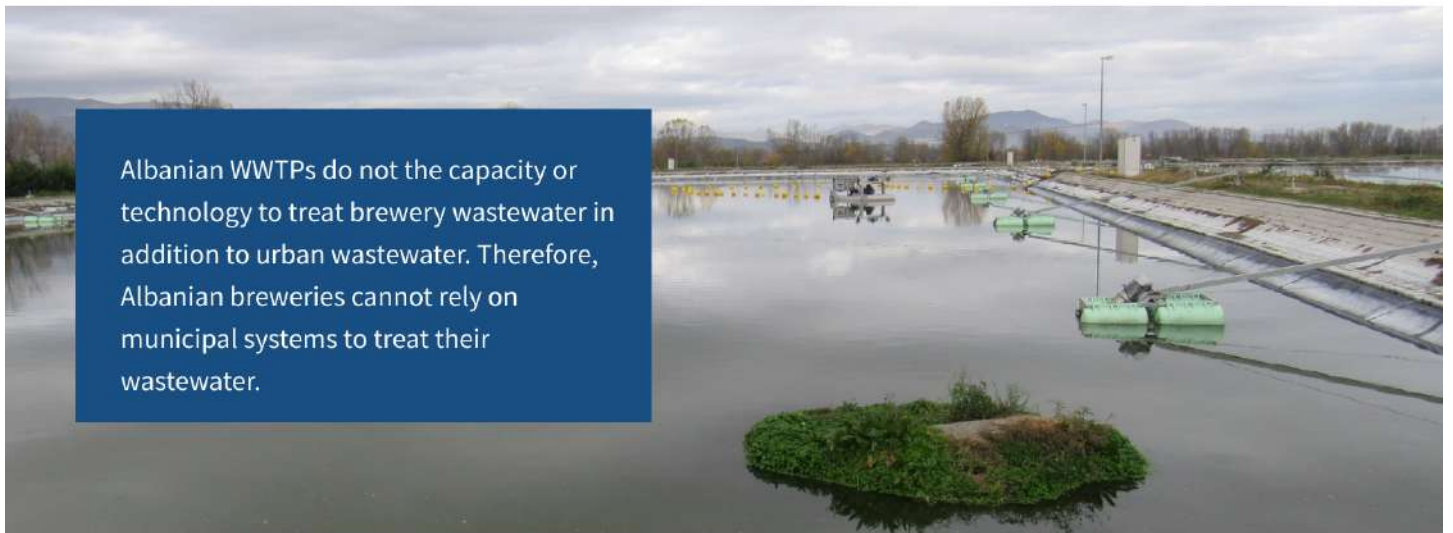


The team toured Vlorë WWTP and the Korçë WWTP to assess the current state of wastewater infrastructure in Albania. Vlorë WWTP is the newest facility in Albania and only pretreats the wastewater it receives before diverting it to a neighboring canal. It treats urban wastewater from the city of Vlorë but not industrial wastewater.

Korçë WWTP is Albania's most developed treatment facility. It treats effluent from the city of Korçë and also receives wastewater from Birra Korça. According to Korçë WWTP employees, the facility's effluent meets Albanian discharge standards. The status of the remaining Albanian WWTPs, according to regulatory officials, fall closer to Vlorë WWTP than Korçë WWTP. Five of the seven breweries the team interviewed are located in Tirana, where there is no municipal wastewater treatment.



Albanian WWTPs do not have the capacity or technology to treat brewery wastewater in addition to urban wastewater. Therefore, Albanian breweries cannot rely on municipal systems to treat their wastewater.



ALBANIAN BREWERY PRACTICES

WASTEWATER



From the brewery tours, the team found that none of the seven Albanian breweries fully treat their wastewater before discharge. Three of the breweries (Birra Korça, Birra Tirana, and Birra Stela) neutralize the pH value of their wastewater before discharge using mixing and balancing tanks. None of the breweries remove organics or suspended solids from their wastewater. Birra Korça sends its wastewater to the Korçë WWTP for further treatment.



SPENT GRAINS

Nearly all Albanian breweries, except for Birraria e Gjyshit, reuse their spent grains by distributing them to farmers for animal feed. Larger breweries, such as Birra Tirana, Birra Stela, Birra Kaon, and Birra Korça, profit from selling their spent grains to farmers, which is something the team had not observed before during its U.S. brewery tours. Five of the seven Albanian breweries reuse their yeast for multiple generations. All of the breweries mix their spent yeast, spent hops, and trub with their wastewater and send it down the drain.





WATER REDUCTION AND REUSE

Five of the seven Albanian breweries have implemented CIP systems to clean their equipment. CIPs reuse caustic and acid cleaning chemicals and reduces the amount of water needed in the cleaning process. All Albanian breweries have also implemented low water consumption spray nozzles to clean their tanks. These nozzles increase water pressure and spray the cleaning solution in all directions to reduce the number of rinses

necessary to clean the tank. Almost all Albanian breweries, except for Birra Puka and Birraria e Gjyshit, have closed loop heat exchangers. The breweries reuse hot water produced from cooling hot wort in the mashing step for the following batch. Lastly, Birra Kaon, Birra Tirana, and Birra Stela all recycle water within their pasteurization sections.

OTHER WASTE REUSE

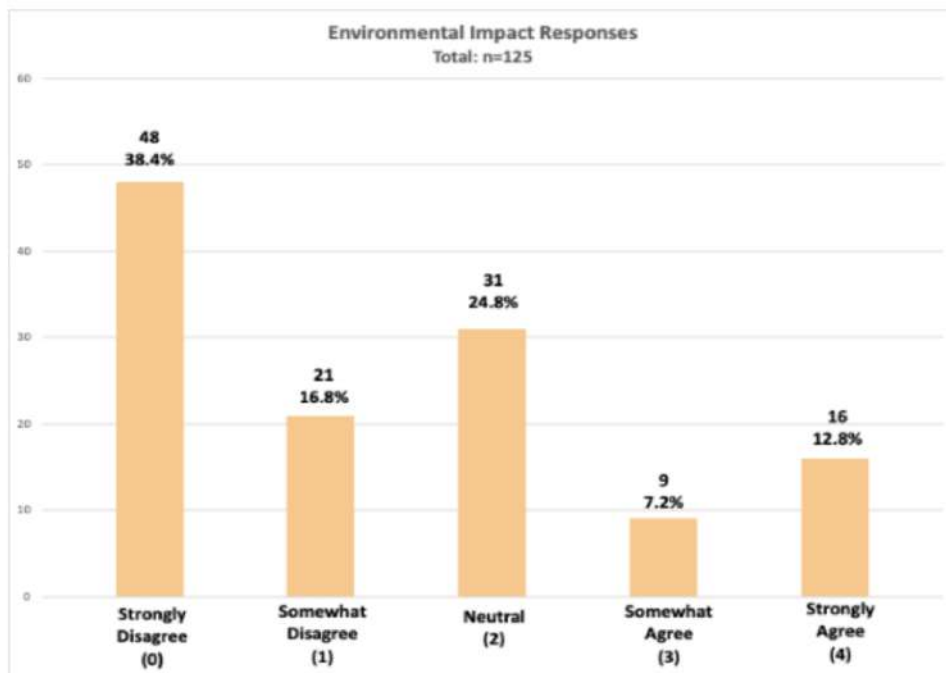
All Albanian brewers collect and recycle their glass bottles, kegs, or both. While the group had not anticipated it, we found that several Albanian breweries recover CO₂ yeast produce during the fermentation stage and reuse it in the packaging stage to adjust the levels of CO₂ in matured beer for quality and standardization purposes. This eliminates the discharge of CO₂ into the atmosphere, reducing the brewery's carbon footprint. Birra Stela also recycled its plastic waste to produce new packaging and shipping materials. These reuse processes were not the team's original focus, but we found that these procedures saved materials and reduced the overall waste from the breweries.



CONSUMER TRENDS

Through interviewing bar owners and brewers, the team learned that foreign beers are becoming increasingly popular in the Albanian beer market and many domestic brands declining. Additionally, Albanians tend to favor products that are new to the market or favor German and Belgian brewed beers because they perceive them to have a higher quality and different flavor profiles than Albanian beers. Some foreign beers, such as Birra Peja from Kosovo, have become increasingly cheaper to sell in Albania from a lack of import tariff enforcement at Albanian borders and possibly lower production costs in other countries. Declining sales may discourage Albanian breweries from investing in new treatment processes.

In our paper and online survey results, only 20% of consumers indicated that they considered the environmental impact in their decisions to buy a particular brand of beer before they purchased it. Of the rest of the respondents, 49% strongly indicated that they did not consider this an important factor. This indicates that from our sample, while a percentage do consider the environmental impact of a beer, the vast majority do not prioritize it.



CONSUMER SURVEYS

BAR	LOCATION	DISTRIBUTION DATE	# SURVEY	OWNER INTERVIEW
Duff Sports Bar	Blloku	Nov. 12, 2019	19	Yes
Radio Bar	Blloku	Nov. 22, 2019	10	No
Cheers	Blloku	Nov. 23, 2019	16	Yes
Illyrian Saloon	Blloku	Dec. 2-6, 2019	28	Yes

THE TEAM PROVIDED BOTH SHUKALB AND ALBANIAN BREWERIES WITH A SET OF RECOMMENDATIONS AND AREAS OF FUTURE RESEARCH CONCERNING BREWERY WASTE MANAGEMENT PRACTICES.

SHUKALB

A public education campaign would alert consumers of the environmental impacts of brewing beer Albania and influence consumer purchasing preferences to support more sustainable companies. The team also recommended SHUKALB to assist breweries in implementing wastewater treatment systems and perform a cost benefit analysis for waste reuse processes.

DEVELOP A PUBLIC EDUCATION CAMPAIGN

ASSIST BREWERIES IN IMPLEMENTING WASTEWATER TREATMENT SYSTEMS AND PERFORM A COST BENEFIT ANALYSIS



Multiple Albanian breweries expressed interest in developing their own wastewater treatment systems, so with the help of SHUKALB, breweries may be able to fully research and choose which treatment option would be financially worthwhile to invest in. It may even be more feasible for breweries to partner with neighboring industries and work together to construct their own wastewater treatment processes. Birra Stela expressed interest in this during our interview, and it may be more practical for breweries to implement if they could split the cost with other industries.

ALBANIAN BREWERIES



The team recommends that Albanian brewers who are planning to expand or renovate, such as Birra Tirana and Birra Korça, integrate environmentally friendly practices and equipment in their plans. Albanian breweries should install water efficient equipment wherever possible and consider reusing water within the brewing process. Reusing water can reduce the brewery's operating costs, the volume of wastewater, and ultimately the brewery's environmental impact. Breweries may face high initial costs when installing or changing equipment to reduce or reuse water, but these costs may be offset by lower water consumption costs.

Albanian breweries should also recycle their spent yeast, hops and trub as animal feed or fertilizer for local farmers. Larger breweries that are already charging farmers to pick up their spent grains could make additional profits from selling their other solid wastes. Reusing these wastes would decrease the organic matter that is discharged with the breweries' wastewater. The team recommends that breweries begin packaging their beer in reusable containers as well, to cut down on the amount of plastic that makes its way into the environment.

Lastly, Albanian breweries could possibly attract more customers advertising their sustainability processes. Even though the consumer surveys indicated that the majority of our sample did not prioritize the environmental impact of a beer when purchasing it, twenty percent of respondents did consider it an important factor. Bars such as Illyrian Saloon and Duff Sports Bar indicated that this market has the potential to grow in the coming years, so this may be an easy way for Albanian breweries to engage consumers and gain a competitive advantage.





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We are four engineering students at Worcester Polytechnic Institute (WPI) in Worcester, MA. We completed this project to fulfill our junior year Interactive Qualifying Project (IQP) requirement at WPI.

Learn more at <https://www.wpi.edu/academics/undergraduate/interactive-qualifying-project>