Fierce Whiskers

Fierce Whiskers Distillery & CarbonBetter

Nicole Sullivan
Director of Climate Services
nicole@carbonbetter.com

www.carbonbetter.com
hello@carbonbetter.com

Fierce Whiskers Distillery (FW) was founded by Asian Americans and native Texans, Tri Vo and Tim Penney. Longtime collaborators (their first business together was in high school), Tri and Tim started the distillery with a singular goal in mind—creating world-class whiskey that the city of Austin, Texas, could be proud of.

To remain true to the brand, each decision along the way has focused on the duo's goal of a well-made and uniquely Austin whiskey. While this began with using an Austin-based branding agency, The Butler Bros., to design the brand identity, it continued through the use of a regional architecture firm, Overland Partners, to collaborate on the design of the property and through each step of the distilling process from equipment selection to barreling, aging, sustainability, and beyond.

Fierce Whiskers is proud to be a local grain-to-glass Austin distillery among a small percentage of minority-owned distilleries in the United States.


Tim Penney, Co-Founder


Tri Vo, Co-Founder

FW is focused on making the best whiskey in Texas while considering sustainability at every step, from grain to glass.

The Story of Fierce Whiskers

While the story of FW began in 2015, the facility broke ground in 2018 and began barreling whiskey in 2020. Each step in the Fierce Whiskers process aims to make Austin a premier home for whiskey. This includes the decisions to select the most efficient distilling equipment, an American-made copper still, and using Texas grains to ensure the grain-to-glass quality of its whiskey.

FW is a unique American craft distillery and leans into the idea of greatness through stubbornness. Making world-class whiskey is not easy. Central to FW's production philosophy is the Texas Tight Cut, which means only using the absolute best part of the distillate for its whiskey. Adding to the uniqueness of FW is its five-story rickhouse, which was built on-site and employed louvers to harness the extreme atmospheric conditions of Central Texas.

FW aims to be a foundational building block in the craft spirits world of Austin while staying true to its roots in the local community and ensuring direct ties to the local economy.

What's New for 2022

Since breaking ground in 2018 and releasing its first sustainability report in September 2021, FW has continued to make progress on its journey to bring fantastic whiskey to Austin, Texas, while also furthering its commitment to environmental sustainability. This report has been updated for 2022 to reflect progress made since the initial sustainability report.

> **"I think we are in a really special position that many companies that we compete against are simply not: We didn't have to retrofit sustainability into our brand or our processes—we thought about it from day one, and it's been pretty impactful in terms of our approach and how things happen."**

-Tri Vo, on incorporating sustainability into operations

While much of the FW product is still aging in the rickhouse, in September of 2022, FW released the world's first carbon-negative bourbon. This limited-release carbon-negative bourbon, called Five O'Clock Shadow, was produced and barreled in Barrel #47 in 2020, then aged in the rickhouse before bottling in September 2022.

FW has also made an effort to share its sustainability journey with others by participating in panel discussions like Brands Shaking Up Alcohol's Carbon Footprint, which highlighted the value of getting started on a sustainability journey before releasing a product and showed other brands that taking action is doable and essential.

FW has also expanded its carbon footprint calculations for 2021 and 2022 to include Scope 3 emissions sources, inclusive of ingredient production and transport. Learn more in the Environmental Impacts section. While FW's operations and, in turn, its carbon footprint have increased from the early days of production starting in 2020, FW is pleased to report a decrease in emissions intensity from 2021 to 2022 as it continues to improve operational efficiencies.

Footprint

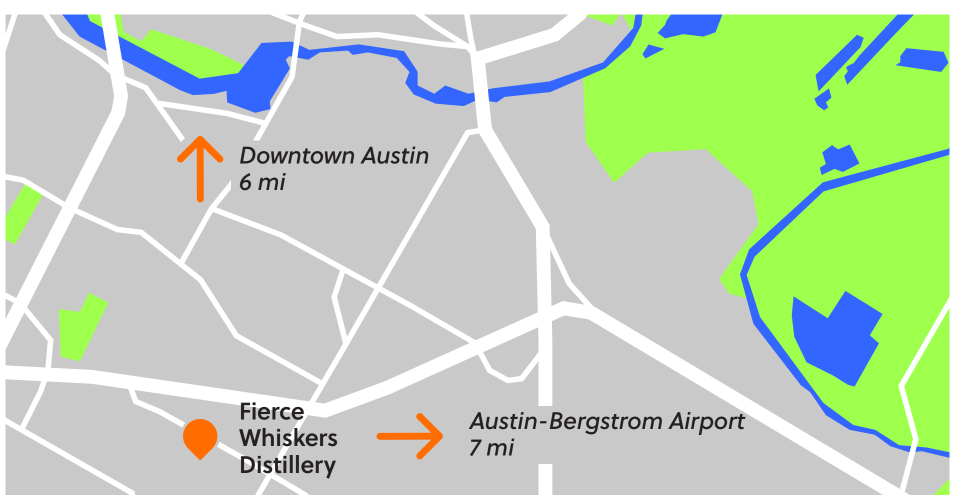
Grain to Glass

FW is focused on ensuring the highest quality of whiskey is produced, beginning with grain selection, barrel aging, and bottling. FW begins with milling regionally produced grains to create unique mash combinations for its whiskeys, including bourbon and rye. FW worked closely with a thirty-year Kentucky bourbon veteran to carefully select each piece of equipment, including a Kentucky-produced copper still and a custom rickhouse. Throughout the distillation and aging process, FW has introduced its own techniques to leverage the extreme atmospheric conditions in Austin, TX, to produce a distinctly Texan whiskey. This includes improved efficiency of equipment using sophisticated automation systems that optimize quality control, consistency, and safety.

From Grain to Glass

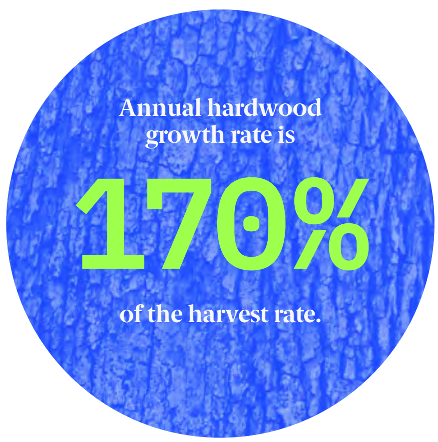
Distillery Location

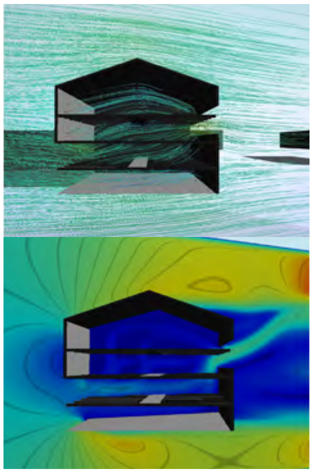
Finding a location to build a distillery with accessibility to the airport and the Austin community was difficult but essential to FW's plan of making Austin a new home for whiskey. The FW site was developed on six acres in Southeast Austin, roughly seven miles from downtown Austin and six miles from Austin-Bergstrom International Airport. The FW site includes a five-story rickhouse and distillery with a tasting room. The location provides ample space and an urban tasting room experience catering to the local customer base. Positioning the facility in Austin proper allows for shorter travel distances and reduced carbon emissions associated with customers traveling to the distillery to visit and tour its unique distilling operations. The proximity to the airport was an intentional choice from a logistics perspective, allowing distribution efficiencies down the road while simultaneously making it easier for tourists to incorporate a distillery tour into their Austin visit.



White Oak Barrels

FW's ethos of "greatness through stubbornness" continues in the selection of barrels for its whiskeys. As with traditional American Bourbon, FW ages bourbon and rye in new white oak barrels for years at a time, giving its whiskeys distinctive and rich flavors. FW selected Kelvin Cooperage white oak barrels as Kelvin Cooperage ensures 100% of every white oak log purchased gets processed and utilized, with soak scraps being utilized in the toasting process as this can yield different oak profiles, and has created a used barrel program for reselling once-filled barrels and minimizing waste.[1] Additionally, Kelvin Cooperage works with the White Oak Initiative[2] to ensure the long-term sustainability of America's white oak forests through research, technical assistance, program implementation, communication, and policy. These efforts have contributed to white oak being the second fastest-growing hardwood resource, including an annual growth rate exceeding harvest by 70%.[3] As part of FW's commitment to barrel sustainability, FW purchased previously used bourbon barrels for aging their non-whiskey spirits. Using these bourbon barrels not only reduces waste associated with white oak barrels in general, but it also provides a unique flavor profile to FW's non-whiskey spirits.





A natural ventilation analysis was conducted to optimize direct air flow and fast ventilation based on the main wind direction.

Rickhouse

The five-story bonded rickhouse, with four stories above ground and one below, is uniquely designed to allow FW more creative control over the flavor of its whiskey while harnessing the harsh summer climate conditions in Central Texas. FW selected the building location during the design phase based on the outcomes of a wind study, allowing the rickhouse to capture ideal prevailing winds. The louver system, with manual louvers on each side of the building, harnesses airflow to aid in temperature regulation. Typically, rickhouses have small windows rather than manual louvers. FW installed its own weather system to monitor temperature and humidity, allowing the distiller to make louver adjustments based on real-time weather data. The building is designed to maximize efficiency under harsh climate conditions while minimizing energy waste. The building is not HVAC-equipped; instead, there is a ridge vent and three fans in place in addition to the manual louvers system should ambient temperatures reach a level that might negatively impact the whiskey flavor, but to date, the fans have not been utilized.

Equipment

Co-Head Distiller Cole Miller transferring bourbon mash from the cooker to the fermenter.

American-made copper still from Vendome Copper & Brassworks, Louisville, KY.

Boiler

FW installed a Fulton Vertical Spiral Ribbed Tube (VSRT) boiler system with a brake-horsepower (bhp) of 40 bph to generate steam for use in the fermentation and distillation processes. VSRT boilers are optimized so that the spiral rib heat exchanger can transfer a high amount of heat in a compact space. The VSRT has an industry-leading operating efficiency of up to 86% (the industry standard is 82%), gross thermal efficiency of up to 82.5%, and 99.75% steam quality. Steam is applied to the fermentation batch tanks to maintain temperature and is also used for cleaning and sterilization of the tanks. Given the importance of steam to the distillation process and that the boiler is the largest consumer of natural gas at the facility, FW prioritized selecting an efficient boiler that was built to last to improve overall energy efficiency at the facility while minimizing life cycle impacts.

Reverse Osmosis Water

The distillery uses an economically efficient reverse osmosis system to produce high-purity water for use as feed water for the boiler and to adjust the alcohol proof prior to barreling and bottling. This system is capable of producing from 2.5 to 20 gallons of water per minute or up to 28,800 gallons per day, which can be produced as needed and stored on-site. Water is arguably the most important ingredient in the distillation process, and this machine aids in producing the highest quality of whiskey without impacting the flavor profile, ensuring flavor consistency over time.

HVAC

The FW distillery relies on an HVAC system consisting of a small split unit with a 4-ton capacity and 4 large split units with 7.5 tons of capacity each to heat and cool the distillery and tasting room. The large units utilize refrigerant R-410A for cooling, which is considered to be a high global warming potential (GWP) refrigerant and would yield higher greenhouse gas (GHG) emissions if vented to the atmosphere as compared to low GWP refrigerants. However, the system is a closed loop, meaning that any potential emissions associated with refrigerant leaking are limited. FW performs all necessary preventative maintenance to reduce the risk of leaking.

To reduce demand on the HVAC system, the FW team aims to keep a low-temperature differential between the outside and inside (e.g., thermostat in the distillery is set to 80° F in summer conditions rather than comfort cooling the process area). There are sensors on all doors to the outside that monitor when doors are open, even partially, to prevent HVAC usage when doors are open. The City of Austin required the installation of low-level vents in the distilling area to reduce fire and alcoholic vapor risks; the vents also take in cooled air. To increase HVAC efficiency and minimize the uptake of cooled air by the vents, FW is considering installing alcoholic vapor monitors to reduce run time of the vents.

Chiller

To maximize efficiency for temperature regulation in the distilling process, FW installed a closed-loop chiller system sized for efficiency in medium to high temperature applications. The chiller system leverages high efficiency scroll compressors uniquely suited to chilling in distillery operations. Keeping with FW's focus on a reduced supply chain impact and increased environmental standards for manufacturing, the G&D Chiller was manufactured in the United States.

Lighting

FW chose light-emitting diodes (LED) for the interior and exterior of the distillery, the tasting room, and the rickhouse. All exterior lighting is set with timers to only operate when it is dark outside. Interior lights in low-traffic areas, such as hallways and bathrooms, are equipped with motion sensors and only turn on when motion is detected. FW prioritized energy reduction in its selection and management of lighting.

Merchandise

FW's commitment to the highest quality goes beyond the production of its local Austin whiskey and carries through to its merchandise.

T-Shirts

The FW T-shirts are produced from SUPIMA® Cotton, which is grown in California under strict quality-controlled guidelines.[4] Due to challenges with recycling cotton and fibers and the risk of contamination with other fibers, such as spandex, recycled yarn cost is generally higher than virgin cotton yarn costs but is consistently of a lower quantity, making responsibly grown cotton the preferable choice for the FW shirts. While the cotton utilized for the shirts is 100% grown in the U.S., the garments are produced in a windmill-powered, Fair Trade Certified™ facility outside of the U.S. FW wants to sell high-quality merchandise that meets leading environmental standards. At this stage, FW has not found a shirt company that manufactures in the U.S. that meets its environmental criteria. To contribute to the local economy, FW has chosen to screen print shirts locally in Austin, TX; and in the future, they would like to identify a manufacturer that can produce the shirts in the U.S. to their standards.

Tasting Room Glasses

FW has selected lower-impact glassware for serving their craft whiskey. The glassware is sourced from a manufacturer that recycles 99.9% of their cullet and commits to responsible sourcing of glass components, including incorporation of recycled glass.[5] The manufacturer has retrofitted furnaces at their New Jersey facility with new filter systems and emissions controls to reduce the carbon emissions associated with the natural gas-fired furnaces.[6]

Environmental Impacts

UN Sustainable Development Goals

The United Nations (UN) has published 17 Sustainable Development Goals (SDGs) as part of a call to action to meet the UN's 2030 Agenda for Sustainable Development goals. Fierce Whiskers' environmental efforts directly support the following SDGs:

Baseline

FW barreled its first whiskey and moved it to the rickhouse for aging on September 30, 2020, with operations reaching a steady state in mid-November 2020. Depending on the product, the distillery currently operates 15-18 hours a day and could ramp up additional production hours in the future based on demand. While production is at a steady state, due to the aging times for the FW products, bottling and selling have been minimal, with a single barrel carbon-negative limited release in September 2022, with another limited release, the carbon-neutral Smoke + Mash, Volume 1, in April of 2023, and the first main product release, called Texas Straight Rye Whiskey, in June 2023.

To develop the environmental baseline, including water, energy, greenhouse gas emissions, and waste, an entire year of data at steady state operating conditions is needed. FW has now completed environmental impact calculations from startup through December 31, 2022, comprehensively reflecting current operations, which do not yet include bottling and distribution. FW values transparency and sees the importance of sharing data early on in its journey.

Methods and Boundaries

Methods

In preparation for this report, FW has referenced the Sustainability Accounting Standards Board (SASB) standard for the Food & Beverage Sector, Alcoholic Beverages, issued in October 2018. At this time, FW has focused on the Energy Management, Water Management, and Ingredient Sourcing sections of the SASB standard. Now that the facility has begun bottling and selling its products, additional accounting metrics and disclosure topics may be evaluated in accordance with the SASB standard (e.g., Packaging Lifecycle Management).

As a supplement to the accounting metrics and topics in the SASB standard, FW has also evaluated climate impacts by quantifying Scope 1 (direct) and Scope 2 (grid, indirect) GHG emissions. Scope 1 GHG emissions from direct combustion of natural gas on site were quantified utilizing International Energy Agency (IEA) reference data, natural gas consumption from Texas Gas Services billing data, and emission factors from Title 40 of the Code of Federal Regulations Part 98, Subpart C. Scope 2 emissions associated with purchased grid energy were quantified based on FW's Austin Energy bills, and emission factors from the U.S. Environmental Protection Agency's (EPA's) Emissions & Generation Resource Integrated Database (eGRID). Total GHG emissions are estimated in carbon dioxide equivalents (CO_2e).

As part of this report, FW has identified high water-stressed ingredients according to SASB standards in coordination with water stress levels based on the World Resources Institute's Water Risk Atlas tool, Aqueduct. The majority of FW's ingredients are grains produced near Amarillo, Texas, which falls under Aqueduct's high-risk category. It is important to note that the grains are not produced at FW's physical location, however, it is something FW is consciously aware of and considers when making purchasing decisions.

Water management on site follows SASB's definitions of total water

Scope 1 (Direct)

Emissions from natural gas used at the distillery.

Scope 2 (Indirect)

Emissions from generation of electricity used at the distillery.

Scope 3 (Indirect)

Emissions from production and transport of inputs.

withdrawn and total water consumed. However, water utility billing does not easily reflect total water consumption as the City of Austin's water utility billing system bills customers based on total water discharged. According to the billing statements for FW, the total water discharged equals the total water consumed. FW is working with the City of Austin to determine a better estimate of total water discharged and is tracking water consumption for their production process and whiskey barreling. FW will be installing a discharge meter to monitor actual water discharged from the facility and is tracking total water consumption in terms of total alcohol that is barreled.

Boundaries

All data reflected in the Water, Climate & Energy, and Waste sections below are the result of direct and indirect consumption within the boundaries of the operational footprint of FW. FW has estimated intensity of emissions, energy consumption and water use against produced alcohol, utilizing the proof gallon unit of measure for the production rates. Once bottling commences, FW will be able to calculate impacts against bottles of a certain proof but cannot do so until the **angel's share** is determined.

At this time, Scope 3 (indirect) emissions associated with the supply chain, distribution, and transit to and from the site by employees and customers have not yet been considered. Data herein are reflective of the calendar year 2022.

→ **Angel's Share**

(noun) | */ˈeɪndʒəlz ˈʃɛr/*

The amount of distilled spirits lost to evaporation from the barrel into the air as the whiskey ages.

Barrels & Proof Gallons

The produced quantity of alcohol in units of measure of proof gallon is calculated by the barrels produced and the proof of alcohol contained in each barrel. The proof gallon unit of measure is used for reporting to the federal Alcohol and Tobacco Tax and Trade Bureau (TTB).[7] FW has quantified the proof gallons for 2022 in order to map emissions, energy, and water consumption impacts against actual production rates of alcohol as barreled. In 2022, FW produced a total of 1,508 barrels, which totaled 95,251 proof gallons.

To relate environmental and energy impacts to a single 750 milliliter (mL) bottle of 90-proof whiskey as barreled, referred to as "bottle" henceforth, FW has assumed a value of 250 bottles per barrel. Note: The estimated bottles per barrel cannot accurately account for any impacts after barreling, including angel's share losses, as the product is still aging. Once bottling commences, FW plans to refine its rates per bottle to accurately reflect the actual number of bottles produced from each barrel.

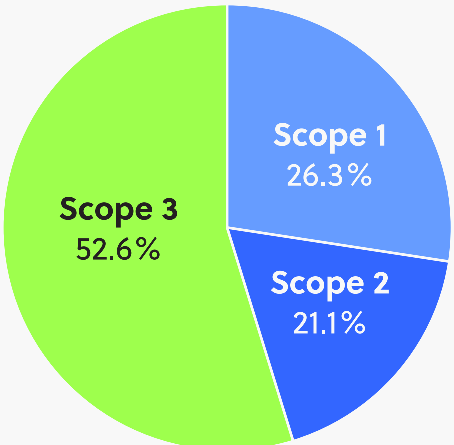
Water

FW has two water meters, one for irrigation and another for non-irrigation water use. However, as mentioned, FW is not calculating its exact water consumption aside from the total volume of alcohol that is barreled. In 2022, FW withdrew a total of 508,700 irrigation gallons and 2,585,096 non-irrigation gallons, with a **total of 79,683 gallons being barreled**.

Climate & Energy

FW has calculated its GHG emissions based on a combination of operational data and representative emission factors. For details on all estimated emissions and corresponding assumptions, please refer to Appendix A (2022 Supplemental Calculations for 2022) and Appendix B (2021 Supplemental Calculations for 2021). Figure 1 below summarizes FW's 2022 emissions results.

Figure 1: 2022 Emissions Summary



Scope 1 Emissions

FW quantifies the Scope 1 combustion emissions associated with natural gas, which is combusted by the high-efficiency VSRT boiler for steam generation. The fuel totals are based on utility bills from Texas Gas Services and assume all gas purchased is combusted. In 2022, FW consumed a total of 5,854 million British thermal units (MMBtus) of natural gas and emitted a total of 310.92 metric tons of CO_2e from natural gas combustion. These totals translate to an estimated emissions rate of 0.82kg CO_2e per bottle (3.26 kg CO_2e per proof gallon) from natural gas combustion and an estimated natural gas consumption rate of 0.02 MMBtus per bottle (0.06 MMBtus of natural gas per proof gallon produced).

Scope 2 Emissions

FW has quantified the indirect emissions associated with the consumption of electricity at the site using location-based emission factors from the EPA's eGRID database. The estimated emissions are more conservative than a market-based approach, which would take into account Austin Energy's residual grid mix of an estimated 40% renewables as compared to the Electric Reliability Council of Texas (ERCOT) regional mix, which includes an estimated 25.7% renewables. During the 2022 annual period, FW has emitted an estimated 249.88 metric tons of CO_2e from electricity usage and has purchased a total of 674,148 kilowatt hours (kWh) from Austin Energy. FW also generated 97,683 kWh from its solar array in 2022, accounting for 14.5% of its total electricity consumption for the year. FW's 2022 electricity consumption translates to an estimated emissions rate of 0.66 kg CO_2e per bottle produced (2.62 kg CO_2e per proof gallon) from indirect electricity emissions. FW utilized an average of 1.79 kWh of electricity per bottle produced (7.08 kWh of electricity per proof gallon).

Scope 3 Emissions

FW sources inputs, including raw ingredients, barrels, and bottles, globally for whiskey production at its Austin distillery, with a focus on ingredient sourcing as close to the distillery as possible. FW has estimated emissions associated with the manufacture and/or agricultural production of its inputs using representative Life Cycle Assessment (LCA) factors and purchase quantities. For the 2022 annual period, the emissions associated with input production are 490.41 metric tons of CO_2e. Emissions associated with the transport of ingredients to the distillery are estimated through the application of the EPA factor for maritime transport with the nautical miles in addition to trucking mileage of shipping routes. International and domestic ingredient transport for 2022 production generated approximately 132.57 metric tons of CO_2e. In total, the indirect emissions generated from FW's 2022 supply chain were 622.97 metric tons of CO_2e.

Energy Intensity for 2022 is 0.02 GJ per bottle (0.09 GJ per proof gallon of alcohol) produced. GHG Emissions Intensity for 2022 is 3.14 kg CO_2e per bottle (12.43 kg CO_2e per proof gallon of alcohol).

Energy:

0.02 GJ /

Emissions:

3.14 kg CO_2e /

Total Energy Usage and Emissions

In 2022, FW generated 1,183.77 total metric tons of CO_2e, inclusive of Scopes 1, 2, and 3. For electric and gas combined, FW consumed a total of 8,866 GJ in 2022.

Energy Intensity for production through 2022 is 0.02 GJ per bottle (0.14 GJ per proof gallon of alcohol) produced.GHG Emissions Intensity for the same period is 3.14 kg CO_2e per bottle (12.43 kg CO_2e per proof gallon of alcohol) produced.

To track progress over time, FW has compared its emissions results from startup through December 31, 2022, as summarized below in Table 2. Note that FW's initial reporting period, from June 2020 to March 2021, referred to herein as "Initial Report," as disclosed in September of 2021, was prior to a full year of operations and overlaps with 2021 annual results. The Initial Report was limited to Scope 1 and Scope 2 emissions. Scope 3 emissions were first quantified in the 2021 annual period. Going forward, FW intends to summarize emissions on an annual basis and will not include Initial Report results in future summaries.

The emissions increase from 2021 to 2022 was anticipated due to increased production rates and increased ingredient sourcing. FW is pleased to be tracking a decrease in emissions intensity and energy intensity from 2021 to 2022. Note that FW has updated its approach for estimating the number of bottles from the as-barreled alcohol utilizing 250 bottles per barrel estimated based on limited release data; in the Initial Report, bottles were estimated based on the proof gallon as barreled and converted to 90-proof bottles without accounting for any of the potential evaporative losses. As such, the emissions intensity values from Initial Report have been updated to reflect the assumption of 250 bottles per barrel.

Solar

FW made the conscious decision to invest in solar energy, which was installed in April 2021. While these panels only generate a portion of the electricity FW consumes, FW understands that each step in helping reduce its impact is meaningful. By installing on-site solar, FW is reducing its load from the local grid, which can assist Austin Energy in long-term energy management, water management, and GHG goals. Austin Energy's grid is a mix of fossil fuel-fired generation and renewable energy, produced locally and regionally. In most cases of fossil fuel fired generation, water must be considered for cooling purposes and steam generation.

Table 2: Results from Initial Report 2021 and 2022

Emissions Summary	Initial Report		2021		2022	
	metric tons CO_2e	kg CO_2e	metric tons CO_2e	kg CO_2e	metric tons CO_2e	kg CO_2e
Scope 1	83	83,446	225	225,382	311	310,917
Scope 2	94	94,180	192	192,155	250	249,883
Scope 3	Not quantified		388	387,630	623	622,974
Total	**178**	**177,626**	**805**	**805,167**	**1,184**	**1,183,775**

Emissions Intensity (All Scopes)	Initial Report	2021	2022
kg CO_2e/ proof gallon *as barreled*	10.4	13.4	12.4
kg CO_2e/ barrel	506.1	910.8	785.0
kg CO_2e/ 90 proof bottle*	2.0	3.6	3.1

Energy Intensity (Electricity & Natural Gas)	Initial Report	2021	2022
Total GJ consumed	2,585	6,523	8,866
GJ/ proof gallon (as barreled)	0.15	0.12	0.09
GJ/ barrel	7.36	7.38	5.88
GJ/ 90 proof bottle*	0.03	0.03	0.02

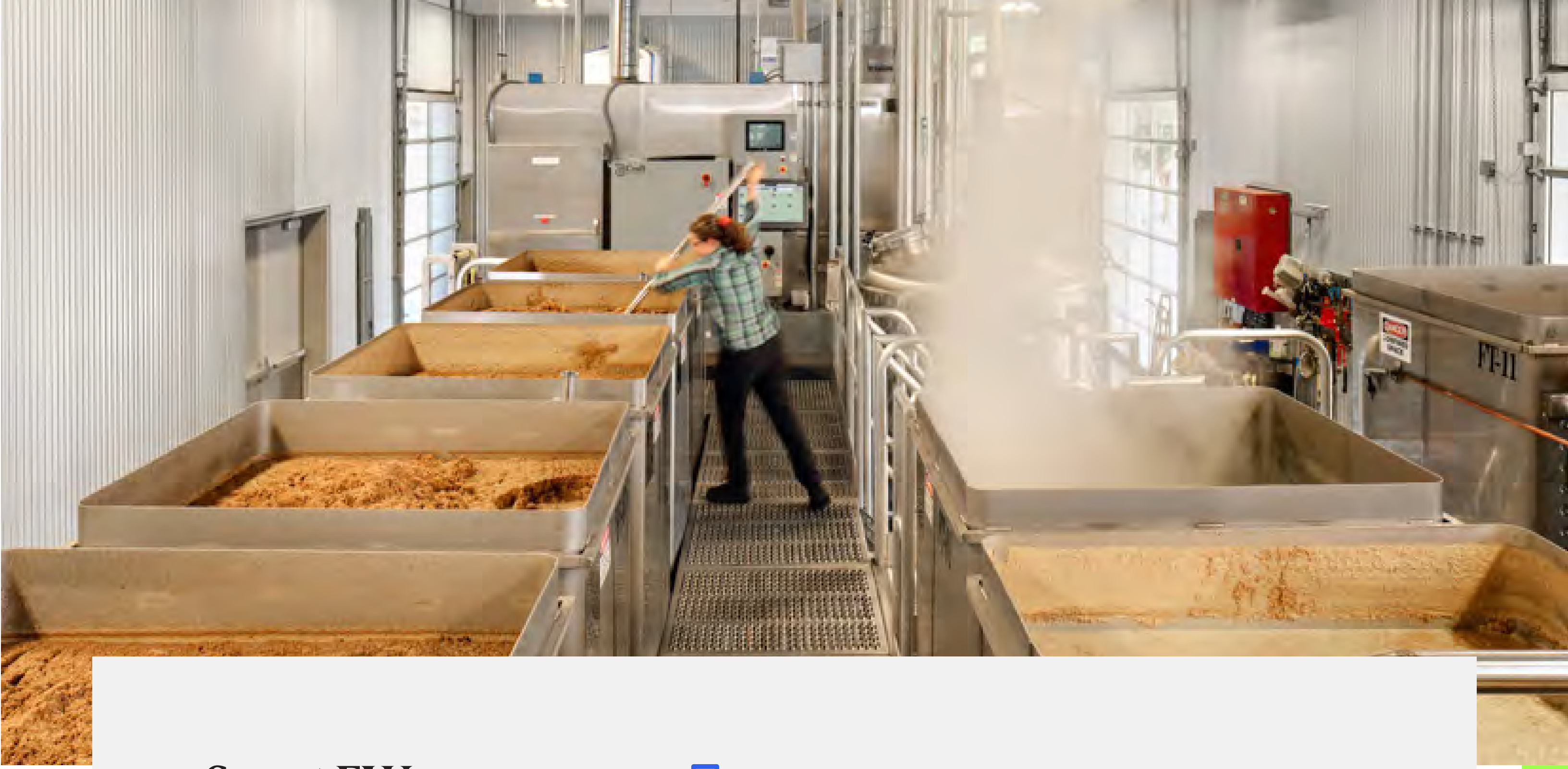
Production	Initial Report	2021	2022
Proof Gallons (as barreled)	17,038	54,692	95,251
Barrels	351	884	1,508
Estimated 90 Proof Bottles*	87,750	221,000	377,000

** assumes 250 bottles per barrel*

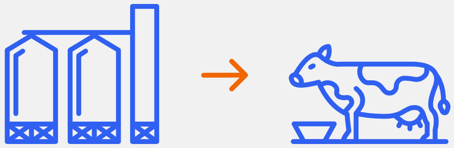
Energy Efficiency

A portion of FW's energy efficiency comes from its automation systems, which seek to produce high-quality whiskey as well as to ensure quality control over time. Facilities of this size do not typically have automation systems to this extent. FW specifically selected automation systems to ensure the quality and consistency of its products; additional benefits include reduced energy consumption and reduced water loss.

Fierce Whiskers tasting room in Austin, TX.



Spent FW Grains Feed Local Cattle



Spent Grains Donated to Farmers:

125,000

lb / month

→ **Circular Economy**

(noun) | */ˈsɜrkjələr ɪˈkɑnəmi/*

An economic system based on the principles of designing out waste and pollution, keeping products and materials in use, and regenerating natural systems.

Waste

FW is focused on reducing its waste, from energy and water to the supply chain. As part of its efforts toward making mindful decisions in energy efficiency, solar energy investment, water conservation, and its grain-to-glass initiative, FW is committed to reducing waste and participating in the **circular economy**. This includes finding off-takers for all of its spent grains. Ensuring the use of these grains is incredibly important to FW, which can be seen in its long-term commitments to local farmers who use the spent grains as animal feed to local competitions using the spent grains to create biodegradable products.

FW's spent grain from mash consists of roughly 125,000 pounds of grain mixed with 40,000 gallons of water on a monthly basis. FW is committed to finding consistent and sustainable solutions for this waste and currently donates all spent grain to local farmers.

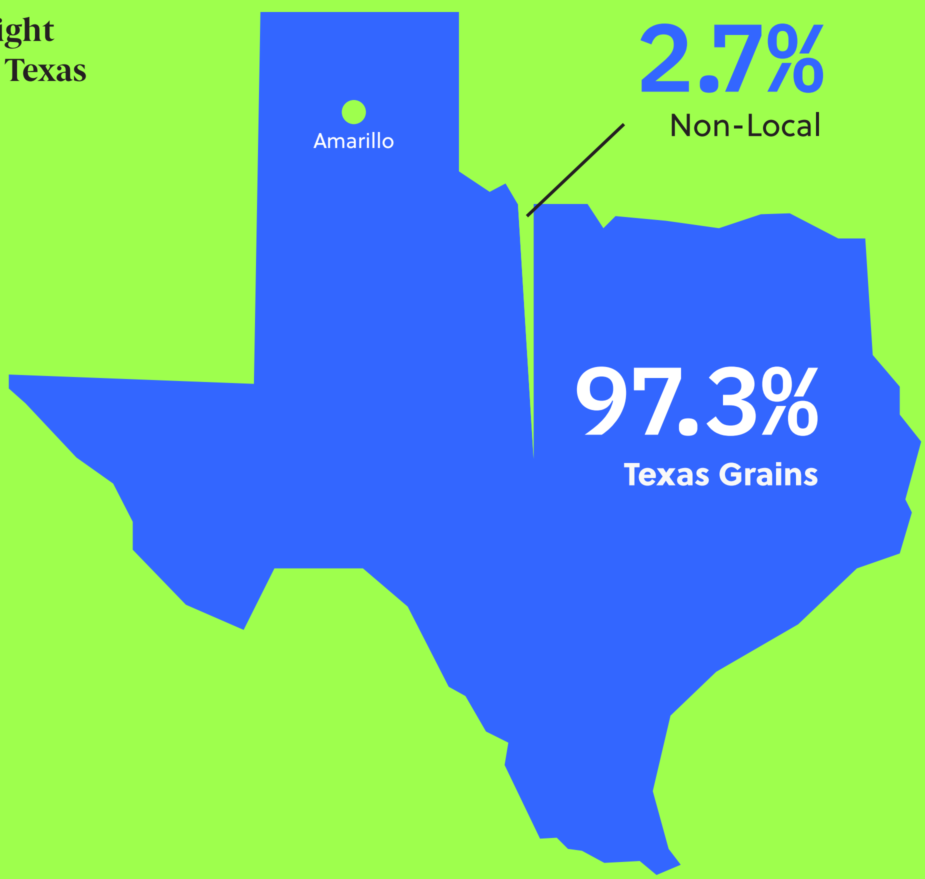
> **“ For me, having a way to dispose of our used grain mashes responsibly is hugely important, but using it to feed animals locally is an added bonus! ”**
>
> *-Cole, Co-Head Distiller*

Ingredient Sourcing

The Ingredient Sourcing within the SASB standard for the Food & Beverage Sector, Alcoholic Beverages, has been used to share FW's story. As part of this standard, identifying each ingredient, the percentage of beverage ingredients sourced from regions with high or extremely high baseline water stress, and the distance from the distillery has been taken into account. In all cases, FW's decisions in selecting its ingredients were as purposeful as possible. For most grains, a regional company from Texas was selected; however, the supplier was not able to provide high-quality options for all required grains, resulting in the selection of suppliers located farther than anticipated, including Canada and Germany. Meanwhile, 97.3% of the grains by weight and sourced by FW were produced near Amarillo, Texas. Amarillo lies within Texas' Region A water planning area, where the primary source of water comes from the Ogallala Aquifer, an aquifer that is used at a rate that exceeds recharge. According to the Texas Water Development Board's Draft 2022 State Water Plan, the state as a whole is still expected to have severe water shortages as demand far exceeds supply. According to the World Resources Institute's Aqueduct,[8] a Water Risk Atlas tool, the Amarillo region is considered high risk, with surrounding areas falling under a medium-high risk.

Based on SASB's standards, the percentage of ingredients used from a region with high risk to water resources is high as grains are the majority of FW's ingredients. While purchasing regionally produced grains is beneficial to the regional economy and FW's carbon footprint, FW will continue to balance its ingredient selections based on environmental and socioeconomic impacts.

Grains by weight sourced from Texas



Goals & Improvements

Data Transparency & Baseline

This report reflects FW's activities to date as production has ramped up over time. Based on existing data, the facility has reached an operational steady state, with production having scaled from launch in 2020 to present. The 2022 annual results, which now include Scope 3 emissions, will be utilized to evaluate optimization opportunities moving forward. While FW has incorporated sustainability and energy efficiency into every facet of the facility and distillation process, FW strives for continual improvement. FW is committed to data transparency in its sustainability. Despite not having a set baseline yet, FW sees the value and importance of sharing data from day one to present.

Solar

In April 2021, FW installed a solar project consisting of a rooftop solar array, a centralized inverter, and related electrical metering and safety equipment. FW selected high-efficiency inverters (98.5% California Energy Commission optimized) and power optimizers (99.5%). If production and energy demand increase from the current operational steady state, FW will evaluate the potential for additional energy generation and the potential for energy storage with the goal of taking steps to reduce the impact on load. For example, this may include coordinating with Austin Energy to shift production times to time periods of low grid demand.

Water Conservation

FW follows the City of Austin's conservation stage requirements for landscaping water use by only watering one day per week, between the hours of 7 p.m. to midnight and/or midnight to 10 a.m. Austin's climate is part of what makes FW's aging process unique, but the summer climate also creates significant landscaping water demand. FW is evaluating rainwater collection as a potential option moving forward to reduce water consumption.

While not directly related to FW's water consumption, FW is actively looking into the impacts of water on grain selection in relation to where its grains are produced. As with many sustainability choices, there is not a clear winner—selecting regionally produced grain from a water-stressed region adds to the complexity of FW's decisions and weighs heavily on decisions moving forward.

Currently, the facility is billed based on the total amount discharged for non-irrigation gallons. According to billing statements, the total amount discharged equals the total amount of water consumed. However, this does not properly reflect actual water consumption, as a portion of the water in the facility is used for whiskey production and is barreled. Moving forward, FW will continue to monitor the total non-irrigation water discharged and compare this to the total water billed by the City of Austin. The difference between water discharged and water barreled should indicate the consumed process water for the distillery.

Energy Efficiency

FW was required to install low-level vents in the distilling area to reduce fire and alcoholic vapor risks. While these are required to ensure safety for the distillery and its staff, the vents also increase the loss of temperature-controlled air to the environment. To increase HVAC efficiency and minimize the uptake of cooled air by the vents, FW is considering the installation of alcoholic vapor monitors to reduce the runtime of the vents. These monitors would allow FW to close vents when vapors are at levels considered safe or, if de minimis, increase energy efficiency of the HVAC system.

Future of the Brand[9]

FW focuses on utilizing the best ingredients combined with a data-driven approach to ensure the highest quality and most enjoyable taste from each barrel. This means transparency in production and its sustainability efforts. Every single decision revolves around uncompromising quality while keeping energy efficiency in mind. As FW ramps up production, it plans to grow its impact locally: FW is proud to serve Austinites, source grain as close as possible, and support local farmers with its spent grain. FW strives for continual improvement in all that it does and will continue to share data every step of the way.

→ Footnotes

1 https://kelvincooperage.com/

2 https://www.whiteoakinitiative.org/

3 https://www.iscbarrels.com/2016/06/16/white-oak-sustainability/

4 https://originalfavorites.com/pages/supima

5 https://www.arc-intl.com/en/commitments/

6 http://www.cardinalfoodservice.com/sustainability

7 https://www.ttb.gov/

8 https://www.wri.org/aqueduct

9 The FW tasting room follows all required TABC Code and Rules specific to the facility. https://www.tabc.texas.gov/texas-alcohol-laws-regulations/tabc-code-rules/

Appendices

A. 2022 Supplemental Calculations

1. 2022 Carbon Emissions, Scope 1, 2, 3

	Metric Tons CO_2e	kg CO_2e
Scope 1	310.92	310,917
Scope 2	249.88	249,883
Scope 3	622.97	622,974
Total	**1,183.77**	**1,183,775**

Emissions Intensity (All Scopes)	
kg CO_2e/proof gallon	12.43
kg CO_2e/90 proof bottle	3.14

Energy Intensity (Electricity and Natural Gas)	
Total GJ consumed	8,866
GJ/proof gallon	0.093
GJ/90 proof bottle	0.024

2. 2022 Production

Proof Gallons	95,251
Estimated Bottles based on 250 bottles per barrel	377,000
Number of Barrels	1,508

3. 2022 Natural Gas Calculations (Scope 1)

Billing Cycle Start Date	Billing Cycle End Date	Total NG Consumed (ccf-hundreds of cubic feet)	Total NG Consumed (cf)	HHV (BTU/cf)	Total Btus of Natural Gas	Total GJ	kg CO_2	kg CH_4	kg N_2O	kg CO_2e	Metric Tons of CO_2e	Total MMBtus of Natural Gas
12/14/21	01/17/22	2,306.09	230,609.45	1037	239,142,000	263	12,689	0.24	0.02	12,702	12.70	239
01/17/22	02/14/22	4,555.25	455,524.80	1037	472,379,218	520	25,064	0.47	0.05	25,090	25.09	472
02/14/22	03/16/22	4,788.31	478,830.70	1037	496,547,436	546	26,347	0.50	0.05	26,374	26.37	497
3/16/22	4/14/22	4,212.28	421,228.00	1037	436,813,436	480	23,177	0.44	0.04	23,201	23.20	437
4/14/22	5/16/22	4,552.60	455,260.00	1037	472,104,620	519	25,050	0.47	0.05	25,076	25.08	472
5/16/22	6/14/22	4,610.86	461,086.40	1037	478,146,597	526	25,370	0.48	0.05	25,397	25.40	478
6/14/22	7/15/22	4,884.97	488,497.40	1037	506,571,804	557	26,879	0.51	0.05	26,906	26.91	507
7/15/22	8/16/22	5,205.43	520,543.00	1037	539,803,091	594	28,642	0.54	0.05	28,672	28.67	540
8/16/22	9/15/22	4,561.87	456,186.90	1037	473,065,815	520	25,101	0.47	0.05	25,127	25.13	473
9/15/22	10/17/22	5,078.31	507,830.70	1037	526,620,436	579	27,942	0.53	0.05	27,971	27.97	527
10/17/22	11/14/22	4,265.25	426,524.80	1037	442,306,218	487	23,469	0.44	0.04	23,493	23.49	442
11/14/22	12/14/22	4,634.70	463,470.00	1037	480,618,390	529	25,502	0.48	0.05	25,528	25.53	481
12/14/22	1/16/23	2,792.38	279,237.65	1037	289,569,448	319	15,365	0.29	0.03	15,380	15.38	290
	Total	**56,448.30**	**5,644,829.80**		**5,853,688,507**	**6,439**	**310,597**	**5.85**	**0.59**	**310,917**	**310.92**	**5,854**

Summary of Scope 1 Emissions and Natural Gas Energy Consumption

	Total	per proof gallon produced	per 90 proof bottle
kg CO_2e	310,917	3.26	0.82
Metric Tons of CO_2e	311	3.26E-03	8.25E-04
GJ	6,439	0.068	0.017
MMBtu	5,854	0.061	0.016

1 FW uses Texas Gas Services natural gas. Since 2014, Texas Gas has achieved a 22.1% reduction in pipeline CO_2e emissions through pipeline replacement programs.

2 Utilizing the EIA average American HHV for end users. The HHV was the same for 2021 and 2022. https://www.eia.gov/totalenergy/data/monthly/pdf/sec12_5.pdf

3 For the unit conversion between BTU and GJ: 0.0000011 GJ/BTU

4 Per 40 CFR 98 Subpart C, table C-1, the emission factor for emissions of CO_2 from the combustion of Natural Gas is 53.06 kg CO_2/MMBtu

5 Per 40 CFR 98 Subpart C, Table C-2, the emission factor for emissions of CH_4 from the combustion of Natural Gas is 0.001 kg CH_4 /MMBtu

6 Per 40 CFR 98 Subpart C, Table C-2, the emission factor for emissions of N_2O from the combustion of Natural Gas is 0.0001 kg N_2O/MMBtu

7 To calculate the total CO_2 equivalency (CO_2e), the following global warming potentials (GWP) were used per 40 CFR 98 Subpart A.

25 CH4 298 N2O

8 There are 1,000 kilograms in a metric ton and 1,000 grams in a kilogram.

9 The primary consumer of natural gas is the VSRT boiler, which has a high thermal efficiency and long life cycle.

10 Proof gallon is a standard unit of measure for distilled spirits, relating volume and alcohol content: https://www.ttb.gov/distilled-spirits/conversion-tables

4. 2022 Electric Calculations (Scope 2)

							Location-Based Emissions				
Start Date	End Date	Total Consumption in 2022 (kWh)	Total Consumption (MWh)	Total Consumption GJ	Total Produced by On-Site Solar (kWh)	% of Total Energy Consumption Generated by On-site Solar	kg CO_2	kg CH_4	kg N_2O	kg of CO_2e	Metric Tons of CO_2e
12/15/0201	1/18/2022	27,739	27.74	99.86	3,518	12.68%	10,236	0.67	0.11	10,282	10.28
1/18/2022	2/15/2022	49,878	49.88	179.56	6,628	13.29%	18,406	1.20	0.20	18,488	18.49
2/15/2022	3/17/2022	52,391	52.39	188.61	7,641	14.58%	19,334	1.26	0.21	19,420	19.42
3/17/2022	4/15/2022	47,900	47.90	172.44	9,900	20.67%	17,676	1.15	0.19	17,755	17.75
4/15/2022	5/16/2022	56,190	56.19	202.28	8,190	14.58%	20,736	1.35	0.22	20,828	20.83
5/16/2022	6/15/2022	65,018	65.02	234.06	10,768	16.56%	23,993	1.56	0.26	24,100	24.10
6/15/2022	7/15/2022	70,303	70.30	253.09	10,553	15.01%	25,944	1.69	0.28	26,059	26.06
7/15/2022	8/16/2022	51,000	51.00	183.60	10,896	21.36%	18,820	1.22	0.20	18,904	18.90
8/16/2022	9/15/2022	65,161	65.16	234.58	8,411	12.91%	24,046	1.56	0.26	24,153	24.15
9/15/2022	10/17/2022	66,530	66.53	239.51	9,280	13.95%	24,551	1.60	0.27	24,660	24.66
10/17/2022	11/15/2022	48,333	48.33	174.00	5,833	12.07%	17,836	1.16	0.19	17,915	17.92
11/15/2022	12/14/2022	45,870	45.87	165.13	3,370	7.35%	16,927	1.10	0.18	17,002	17.00
12/14/2022	1/15/2023	27,835	27.84	100.21	2,695	9.68%	10,272	0.67	0.11	10,318	10.32
	Total	**674,148**	**674.15**	**2,426.93**	**97,683**		**248,778**	**16.18**	**2.70**	**249,883**	**249.88**

** January and December data adjusted by billing days for 2022 usage only*

Summary of Scope 2 Emissions and Electricity Consumption

	Total	per proof gallon produced	per 90 proof bottle
kg CO_2e	249,883	2.62	0.66
Metric Tons of CO_2e	250	2.62E-03	6.63E-04
GJ	2,427	0.025	0.006
MWh	674	0.007	0.002
kWh	674,148	7.08	1.79

1 FW's electric provider is Austin Energy, a City of Austin utility. As of May 2022, Austin Energy's generation mix was 40% renewable energy, including solar and wind. Austin Energy oversees a mix of >4,600 MW of total generation capacity and operates three natural gas powered plants in the Austin area. They are also part owners of two power plants outside of Austin (one coal and one nuclear fuel). Purchase Power Agreements (PPAs) are in place for the renewables in their portfolio.

https://austinenergy.com/ae/about/environment/renewable-power-generation

https://austinenergy.com/ae/about/company-profile/electric-system/power-plants

2 For the unit conversion between BTU and GJ: 0.0000011 GJ/BTU

3 The location-based emission factor for the regional ERCOT grid was determined from the EPA's eGRID database. The 2021 data was issued on 1/30/2023. Tab SRL21 was utilized for ERCOT subregion data. https://www.epa.gov/egrid/download-data

4 The annual eGRID sub-region total emission rate outputs for GHGs are as follows, in kg/MWh:

369.025	CO_2	0.004	N_2O
0.024	CH_4	370.665	CO_2E

The grid mix accounted for in the eGRID emission factors for ERCOT includes:

74.30% Non-renewables
25.70% Renewables

5 There are 1,000 kWh in a MWh.

6 There are 1,000 kg in a metric ton.

5. 2022 Ingredient Production (Scope 3)

Name of Ingredient/Source	Amount Purchased	Unit of Measure	LCA Factor	Unit of Measure	LCA Factor Converted	Unit of Measure	Emissions (Metric Tons CO_2e)	Emissions (kg CO_2e)	Data Source
Corn	848,672	lbs	390	g CO_2e/kg corn	0.18	kg CO_2e/lb	150.13	150,131	
Wheat (Hard Red Winter)	299,750	lbs	540	g CO_2e/kg wheat	0.24	kg CO_2e/lb	73.42	73,421	
Barley, base malt	150,535	lbs	570	g CO_2e/kg barley	0.26	kg CO_2e/lb	38.92	38,921	
Rye	233,038	lbs	870	g CO_2e/kg rye	0.39	kg CO_2e/lb	91.96	91,963	
Agave Syrup Concentrate	3,020	lbs	0.1	kg CO_2e/kg agave syrup	0.22	kg CO_2e/lb	0.67	666	
Yeast	358	kilos	3,204	g CO_2e/kg yeast	3.20	kg CO_2e/lb	1.15	1,148	
Yeast Nutrient	39	kilos	460	g CO_2e/kg yeast nutrient	0.46	kg CO_2e/lb	0.02	18	
Barrels	1,508	each	85.4	kg CO_2e/barrel	85.4	kg CO_2e/barrel	128.78	128,783	
Enzymes	2,100	kilos	1.3	kg CO_2e/kg amylase	1.3	kg CO_2e/kg	2.73	2,730	
Baking Soda	19,000	lbs	0.138	ton CO_2e/ton baking soda	0.06	kg CO_2 /lb	1.19	1,189	
Citric Acid	250	lbs	0.41	kg CO_2e/kg citric acid	0.90	kg CO_2 /lb	0.23	226	
Cleaning Chemicals	598	lbs	0.92	kg CO_2e/kg bleach	2.03	kg CO_2 /lb	1.21	1,212	
Bottles	2,846	each	0.656	kg CO_2e/kg glass	0.328	kg CO_2e/bottle	0.93	933	
						Total	**490.41**	**490,407**	

1 The LCA Factor for Agave Syrup Concentrate was taken from an approximate factor from agave nectar.

2 The LCA Factor for Yeast Nutrient was taken from an approximate factor from diammonium phosphate.

3 The LCA Factor for cleaning chemicals was taken from an approximate factor from bleach.

4 For the unit conversion between kilograms to pounds: 2.20462 lb/kg

5 For the unit conversion between kilograms to grams: 1000 g/kg

6 For the unit conversion between metric tons to kilograms: 1000 kg/metric ton

7 Weight of a bottle: 500 g

6. 2022 Ingredient Transportation (Scope 3)

Name of Ingredient/Source	Location / Region	Port to Port Nautical Miles	Distance by Truck (mi)	Amount Purchased (lbs)	Ship Ton-Miles	Truck Ton-Miles
Corn	Amarillo, Texas		668	848,672		283,456
Wheat (Hard Red Winter)	Amarillo, Texas to Ft Worth		668	299,750		100,116
Barley, base malt	Amarillo, Texas to Ft Worth		668	150,535		50,279
Rye	Amarillo, Texas		668	233,038		77,835
Rye, malted	Vernon, BC, Canada		2,265	16,885		19,122
Agave Syrup Concentrate	Maple Plain, MN		1,043	3,020		1,575
Yeast	Louisville, Kentucky		1,412	162		115
Yeast Nutrient	Louisville, Kentucky		1,412	18		12
Barrels	Lebanon, KY		1,014	150,800		76,456
Enzymes	Louisville, Kentucky		1,036	952		493
Baking Soda	Ewing, NJ		1,460	19,000		13,870
Citric Acid	Markolshreim, France	6,479	180	250	932	22
Cleaning Chemicals	Denver, CO		933	598		279
Bottles	Germany / Quebec, Canada	3,670	1,972	645		
				Total	**932**	**623,630**

Ingredient Emissions

Pollutant	Ship	Truck	Total
CO_2 (kg)	38	131,586	131,624
CH_4 (kg)	0.017	1	1
N_2O (kg)	0.001	3	3
CO_2e (kg)	39	132,528	132,567
CO_2e (Metric tons)	0.039	133	132.57

1 Distances are estimated based on representative ingredient sourcing locations.

2 For the unit conversion between lb and kg: 0.453592 kg/lb

3 For the unit conversion between miles and km: 0.621371 miles/km

4 For the unit conversion between miles and nautical miles: 1.15078 miles/nautical mile

5 For the unit conversion between kg and tons: 907.185 kg/ton

6 Distance by sea between ports determined using with the port of Houston as the destination: http://ports.com/

7 Distribution emission factors published by the EPA in April 2022 in Table 8: https://www.epa.gov/system/files/documents/2022-04/ghg_emission_factors_hub.pdf

Ship	Truck	Emission Factors
0.041	0.211	kg CO_2/ton-mile
0.0116	0.002	g CH_4/ton-mile
0.0116	0.0049	g NO_2/ton-mile
0.0183	0.002	g CH_4/ton-mile
0.0008	0.0049	g NO_2/ton-mile

8 There are 1,000 kilograms in a metric ton and 1,000 grams in a kilogram.

9 To calculate the total CO_2 equivalency (CO_2e), the following global warming potentials (GWP) were used per 40 CFR 98 Subpart A.
25 CH4 298 N2O

10 Weight of a single bottle: 0.5 kg

11 Weight of an empty whiskey barrel: 100 lb

7. 2022 City of Austin Water

Billing Cycle Start Date	Billing Cycle End Date	Non-Irrigation Gallons*	Irrigation Gallons	Total Water (Irrigation & Non-Irrigation)	Non-Irrigation Discharge	Total water (liquor) barreled (gal)	Non-irrigation use (gal) per bottle
12/15/2021	1/17/2022	95,509	200	95,709	95,509	4,293	0.302
1/17/2022	2/15/2022	183,000	6,500	189,500	183,000	7,112	0.261
2/15/2022	3/17/2022	195,800	46,300	242,100	195,800	6,047	0.207
3/17/2022	4/15/2022	191,900	55,700	247,600	191,900	4,823	0.166
4/15/2022	5/16/2022	202,700	61,500	264,200	202,700	6,105	0.202
5/16/2022	6/16/2022	201,100	60,200	261,300	201,100	8,002	0.267
6/16/2022	7/15/2022	209,300	62,700	272,000	209,300	6,572	0.211
7/15/2022	8/16/2022	240,400	67,300	307,700	240,400	8,533	0.239
8/16/2022	9/15/2022	219,900	39,700	259,600	219,900	7,261	0.222
9/15/2022	10/17/2022	256,800	64,000	320,800	256,800	7,049	0.184
10/17/2022	11/15/2022	226,200	30,900	257,100	226,200	4,717	0.138
11/15/2022	12/14/2022	228,900	13,700	242,600	228,900	6,095	0.178
12/14/2022	1/14/2023	133,587	0	133,587	133,587	3,074	0.155
	Total	**2,585,096**	**508,700**	**3,093,796**	**2,585,096**	**79,683**	

** January and December data adjusted by billing days for 2022 usage only*

B. 2021 Supplemental Calculations

1. 2021 Carbon Emissions, Scope 1, 2, 3

	Metric Tons CO_2e	kg CO_2e
Scope 1	225	225,382
Scope 2	192	192,155
Scope 3	388	387,630
Total	**805**	**805,167**

Emissions Intensity (All Scopes)	
kg CO_2e/proof gallon	14.7
kg CO_2e/90 proof bottle	3.6

Energy Intensity (Electricity and Natural Gas)	
Total GJ consumed	6,523
GJ/proof gallon	0.119
GJ/90 proof bottle	0.030

2. 2021 Production

Proof Gallons	54,692
Estimated 90 Proof Bottles	221,000
Number of Barrels	884

3. 2021 Natural Gas Calculations (Scope 1)

Billing Cycle Start Date	Billing Cycle End Date	Total NG Consumed (ccf-hundreds of cubic feet)	Total NG Consumed (cf)	HHV (Btu/cf)	Total Btus of Natural Gas	Total GJ	kg CO_2	kg CH_4	kg N_2O	kg CO_2e	Metric Tons of CO_2e
12/16/20	01/19/21	2,072.30	207,229.50	1037	214,896,992	236	11,402	0.21	0.02	11,414	11.41
01/19/21	02/13/21	2,878.81	287,881.10	1037	298,532,701	328	15,840	0.30	0.03	15,857	15.86
02/13/21	03/17/21	1,638.04	163,803.50	1037	169,864,230	187	9,013	0.17	0.02	9,022	9.02
3/17/21	4/17/21	2,829.82	282,981.50	1037	293,451,816	323	15,571	0.29	0.03	15,587	15.59
4/17/21	5/17/21	2,723.88	272,387.90	1037	282,466,252	311	14,988	0.28	0.03	15,003	15.00
5/17/21	6/16/21	2,461.69	246,168.80	1037	255,277,046	281	13,545	0.26	0.03	13,559	13.56
6/16/21	7/17/21	3,915.66	391,565.90	1037	406,053,838	447	21,545	0.41	0.04	21,567	21.57
7/17/21	8/16/21	3,568.72	356,871.90	1037	370,076,160	407	19,636	0.37	0.04	19,657	19.66
8/16/21	9/15/21	4,225.52	422,552.20	1037	438,186,631	482	23,250	0.44	0.04	23,274	23.27
9/15/21	10/15/21	4,066.62	406,661.80	1037	421,708,287	464	22,376	0.42	0.04	22,399	22.40
10/15/21	11/15/21	3,903.74	390,374.20	1037	404,818,045	445	21,480	0.40	0.04	21,502	21.50
11/15/21	12/14/21	4,192.42	419,241.70	1037	434,753,643	478	23,068	0.43	0.04	23,092	23.09
12/14/21	1/17/22	2,441.75	244,174.71	1037	253,209,176	279	13,435	0.25	0.03	13,449	13.45
	Total	**40,918.95**	**4,091,894.71**		**4,243,294,816**	**4,668**	**225,149**	**4.24**	**0.42**	**225,382**	**225.38**

1 FW uses Texas Gas Services natural gas. Since 2014, Texas Gas has achieved a 22.1% reduction in pipeline CO_2e emissions through pipeline replacement programs.

2 Utilizing the EIA average American HHV for end users. The HHV was the same for 2021 and 2022. https://www.eia.gov/totalenergy/data/monthly/pdf/sec12_5.pdf

3 For the unit conversion between BTU and GJ: 0.0000011 GJ/BTU

4 Per 40 CFR 98 Subpart C, table C-1, the emission factor for emissions of CO_2 from the combustion of Natural Gas is 53.06 kg CO_2 /MMBtu

5 Per 40 CFR 98 Subpart C, Table C-2, the emission factor for emissions of CH_4 from the combustion of Natural Gas is 0.001 kg CH_4 /MMBtu

6 Per 40 CFR 98 Subpart C, Table C-2, the emission factor for emissions of N_2O from the combustion of Natural Gas is 0.0001 kg N_2O/MMBtu

7 To calculate the total CO_2 equivalency (CO_2e), the following global warming potentials (GWP) were used per 40 CFR 98 Subpart A.

25 CH4 298 N2O

8 There are 1,000 kilograms in a metric ton and 1,000 grams in a kilogram.

9 The primary consumer of natural gas is the VSRT boiler, which has a high thermal efficiency and long life cycle.

10 Proof gallon is a standard unit of measure for distilled spirits, relating volume and alcohol content: https://www.ttb.gov/distilled-spirits/conversion-tables

4. 2021 Electric Calculations (Scope 2)

					Location-Based Emissions				
Start Date	**End Date**	**Total Consumption (kWh)**	**Total Consumption (MWh)**	**Total Consumption (GJ)**	**kg CO_2**	**kg CH_4**	**kg N_2O**	**kg of CO_2e**	**Metric Tons of CO_2e**
12/15/2020	1/16/2021	17,419	17.42	62.71	6,468	0.42	0.05	6,495	6.50
1/16/2021	2/13/2021	28,750	28.75	103.50	10,675	0.69	0.09	10,720	10.72
2/13/2021	3/16/2021	40,000	40.00	144.00	14,853	0.96	0.12	14,915	14.91
3/16/2021	4/16/2021	31,000	31.00	111.60	11,511	0.74	0.09	11,559	11.56
4/16/2021	5/17/2021	30,500	30.50	109.80	11,325	0.73	0.09	11,373	11.37
5/17/2021	6/16/2021	32,500	32.50	117.00	12,068	0.78	0.10	12,118	12.12
6/16/2021	7/16/2021	50,250	50.25	180.90	18,659	1.21	0.15	18,737	18.74
7/16/2021	8/16/2021	51,000	51.00	183.60	18,937	1.22	0.15	19,017	19.02
8/16/2021	9/17/2021	62,500	62.50	225.00	23,207	1.50	0.19	23,305	23.30
9/17/2021	10/15/2021	49,817	49.82	179.34	18,498	1.20	0.15	18,575	18.58
10/15/2021	11/13/2021	44,830	44.83	161.39	16,646	1.08	0.13	16,716	16.72
11/13/2021	12/15/2021	49,778	49.78	179.20	18,483	1.19	0.15	18,561	18.56
12/15/2021	1/18/2022	26,992	26.99	97.17	10,022	0.65	0.08	10,065	10.06
	Total	**515,336**	**515.34**	**1855.21**	**191,352**	**12.37**	**1.55**	**192,155**	**192.16**

** January and December data adjusted by billing days for 2021 usage only*

1 FW's electric provider is Austin Energy, a City of Austin utility. As of June 2019, Austin Energy's generation mix was renewable energy, including solar and wind. Austin Energy oversees a mix of >5,000 MW of total generation capacity and operates three natural gas powered plants in the Austin area. They are also part owners of 2 power plants outside of Austin (one coal and one nuclear fuel). Purchase Power Agreements (PPAs) are in place for the renewables in their portfolio.

https://austinenergy.com/ae/about/environment/renewable-power-generation

https://austinenergy.com/ae/about/company-profile/electric-system/power-plants

2 For the unit conversion between BTU and GJ: 0.0036 GJ/kWh

3 The location-based emission factor for the regional ERCOT grid was determined from the EPA's eGRID database. The 2019 data was issued on 2/23/2021. Tab SRL19 was utilized for ERCOT subregion data.

https://www.epa.gov/egrid/download-data

4 The annual eGRID sub-region total emission rate outputs for GHGs are as follows, in kg/MWh:

371.315 CO_2 0.003 N_2O
0.024 CH_4 372.874 CO_2E

The grid mix accounted for in the eGRID emission factors for ERCOT includes:

77.20% Non-renewables
22.80% Renewables

5 There are 1,000 kWh in a MWh.

6 There are 1,000 kg in a metric ton.

5. 2021 Ingredient Production (Scope 3)

Name of Ingredient/Source	Amount Purchased	Unit of Measure	LCA Factor	Unit of Measure	LCA Factor Converted	Unit of Measure	Emissions (Metric Tons CO_2e)	Data Source
Corn	500,720	lbs	390	g CO_2e/kg corn	0.18	kg CO_2e/lb	88.58	
Wheat (Hard Red Winter)	190,070	lbs	540	g CO_2e/kg wheat	0.24	kg CO_2e/lb	46.56	
Barley	165,429	lbs	570	g CO_2e/kg barley	0.26	kg CO_2e/lb	42.77	
Rye	125,470	lbs	870	g CO_2e/kg rye	0.39	kg CO_2e/lb	49.51	
Agave Syrup Concentrate	6,040	lbs	0.1	kg CO_2e/kg agave syrup	0.22	kg CO_2e/lb	1.33	
Panela	3,020	lbs	0.57	kg CO_2e/kg panela	1.26	kg CO_2e/lb	3.80	
Yeast	510	kilos	3204	g CO_2e/kg yeast	3.20	kg CO_2e/lb	1.63	
Yeast Nutrient	40	kilos	460	g CO_2e/kg yeast nutrient	0.46	kg CO_2e/lb	0.02	
Barrels	886	each	85.4	kg CO_2e/ barrel	85.4	kg CO_2e/ barrel	75.66	
Enzymes	1660	kilos	1.3	kg CO_2e/kg amylase	1.3	kg CO_2e/kg	2.16	
Baking Soda	2000	lbs	0.138	ton CO_2e/ton baking soda	0.06	kg CO_2 /lb	0.13	
Citric Acid	100	lbs	0.41	kg CO_2e/kg citric acid	0.90	kg CO_2 /lb	0.09	
Cleaning Chemicals	200	lbs	0.92	kg CO_2e/kg bleach	2.03	kg CO_2 /lb	0.41	
						Total	**490.41**	

1 The LCA Factor for Agave Syrup Concentrate was taken from an approximate factor from agave nectar.

2 The LCA Factor for Yeast Nutrient was taken from an approximate factor from diammonium phosphate.

3 The LCA Factor for cleaning chemicals was taken from an approximate factor from bleach.

4 For the unit conversion between kilograms to pounds: 2.20462 lb/kg

5 For the unit conversion between kilograms to grams: 1,000 g/kg

5 For the unit conversion between metric tons to kilograms: 1,000 kg/metric ton

6. 2021 Ingredient Transportation (Scope 3)

Name of Ingredient/Source	Location / Region	Port to Port Nautical Miles	Distance by Truck (mi)	Amount Purchased (lbs)	Ship Ton-Miles	Truck Ton-Miles
Corn	Amarillo, Texas		668	500,720		167,240
Wheat (Hard Red Winter)	Amarillo, Texas to Ft Worth		668	190,070		63,483
Barley, Base Malt	Amarillo, Texas to Ft Worth		668	145,314		48,535
Barley, Vienna Malt	Bamberg, Germany	6,429	499	935	3,459	233
Barley, Biscuit Malt	UK	6,089	169	3,190	11,176	270
Barley, Caramunich Malt	Bamberg, Germany	6,429	499	6,820	25,228	1,702
Barley, Brown Malt	Bamberg, Germany	6,429	499	1,650	6,104	412
Barley, Golden Promise Malt	UK	6,089	169	6,325	22,160	534
Barley, Melanoiden Malt	Bamberg, Germany	6,429	499	275	1,017	69
Barley, Peachwood Smoked Malt	Bamberg, Germany	6,429	499	700	2,589	175
Barley, Pilsner Malt	Amarillo, Texas to Ft Worth		668	220		73
Rye	Amarillo, Texas		668	118,870		39,703
Rye, Malted	Vernon, BC, Canada		2,265	6,600		7,474
Agave Syrup Concentrate	Maple Plain, MN		1,043	6,040		3,150
Panela Sugar - Rum Sugar	Orlando, Florida		1,596	3,020		2,410
Yeast	Louisville, Kentucky		1,412	510		360
Yeast Nutrient	Louisville, Kentucky		1,412	40		28
Barrels	Lebanon, KY		1,014	886		449
Enzymes	Louisville, Kentucky		1,036	1660		860
Baking Soda	Ewing, NJ		1,460	2000		1,460
Citric Acid	Markolshreim, France	6,479	180	100	373	9
Cleaning Chemicals	Denver, CO		933	200		93
				Total	**72,107**	**338,722**

Ingredient Emissions

Pollutant	Ship	Truck	Total
CO_2 (kg)	2,956	71,470	74,427
CH_4 (kg)	1	1	2
N_2O (kg)	0.1	2	2
CO_2e (kg)	3,007	71,982	74,988
CO_2e (Metric tons)	3	72	75

1 Distances are estimated based on representative ingredient sourcing locations.

2 For the unit conversion between lb and kg: 0.453592 kg/lb

3 For the unit conversion between miles and km: 0.621371 miles/km

4 For the unit conversion between miles and nautical miles: 1.15078 miles/nautical mile

5 For the unit conversion between kg and tons: 907.185 kg/ton

6 Distance by sea between ports determined using with the port of Houston as the destination: http://ports.com/

7 To calculate the total CO_2 equivalency (CO_2e), the following global warming potentials (GWP) were used per 40 CFR 98 Subpart A.

25 CH4 298 N2O

8 There are 1,000 kilograms in a metric ton and 1,000 grams in a kilogram.

9 Distribution emission factors published by the EPA in April 2022 in Table 8: https://www.epa.gov/system/files/documents/2022-04/ghg_emission_factors_hub.pdf

Ship	Truck	Emission Factors
0.041	0.211	kg CO_2/ton-mile
0.0183	0.002	g CH_4/ton-mile
0.0008	0.0049	g NO_2/ton-mile

7. 2021 City of Austin Water

Billing Cycle Start Date	Billing Cycle End Date	Non-Irrigation Gallons*	Irrigation Gallons	Total Water (Irrigation & Non-Irrigation)	Non-Irrigation Discharge	Total water (liquor) barreled (gal)	Non-irrigation use (gal) per bottle
12/15/2020	1/16/2021	71,766	390,234	462,000	71,766	2,014	0.181
1/16/2021	2/13/2021	134,000	728,400	862,400	134,000	2,491	0.120
2/13/2021	3/16/2021	113,000	413,500	526,500	113,000	2,226	0.129
3/16/2021	4/16/2021	136,200	109,700	245,900	136,200	2,799	0.136
4/16/2021	5/17/2021	143,500	56,600	200,100	143,500	2,226	0.103
5/17/2021	6/16/2021	141,700	800	142,500	141,700	3,126	0.143
6/16/2021	7/16/2021	156,900	40,700	197,600	156,900	4,399	0.181
7/16/2021	8/16/2021	164,000	108,900	272,900	164,000	3,763	0.150
8/16/2021	9/16/2021	180,200	106,200	286,400	180,200	4,770	0.177
9/16/2021	10/15/2021	160,400	68,400	228,800	160,400	6,089	0.251
10/15/2021	11/12/2021	150,400	200	150,600	150,400	4,027	0.180
11/12/2021	12/15/2022	192,000	400	192,400	192,000	5,936	0.207
12/15/2021	1/17/2022	95,509	103	95,612	95,509	2,597	0.184
	Total	**1,839,575**	**2,024,137**	**3,863,712**	**1,839,575**	**46,463**	