



P2: Pollution Prevention

Brewing Success with P2 Grantees

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Brewery Industry Profile

Beer production yields significant quantities of waste byproducts, wastewater effluents, and air emissions that can be costly—both financially and environmentally—to the brewer and its community. Breweries regularly discharge large volumes of waste beer, wort (unfermented beer), yeast, and grains into a wastewater system, incurring expensive permitting fees and straining public treatment capacity. In fact, 1 gallon of wastewater per gallon of beer produced and about 70 percent of the water withdrawals from breweries end up as wastewater effluent. This effluent is high in biological oxygen demand, with rates that far exceed post-treatment limits—often resulting in significant treatment costs to the brewery and community based treatment facilities. Suspended solids, such as yeast and hop wastes, can also end up as sludge in the wastewater treatment plan and result in additional disposal fees. During the fermentation process, each barrel of wort produced emits nearly 10 pounds of carbon dioxide. Breweries' water and energy consumption can also add up. Refrigeration, packaging, lighting, and compressed air use typically account for much of a brewery's electricity use; natural gas is used in the brewhouse, as well as for packaging and space heating. Breweries often rely on harsh cleaners, which can raise wastewater pH and end up down the drain, thus affecting a facility's ability to meet local or state water permits.

Even during challenging economic times, the brewing industry is a bright spot in American beverage manufacturing, with continued growth and an ingrained culture of sustainability. According to the National Beer Wholesalers Association, California, New York, Washington, Pennsylvania, and Colorado now each have more breweries than the entire country had in 1990. More than 70,000 Americans work for breweries and importers, and each job in the brewing industry generates about 30 more full-time jobs. However, along with the brewing industry's benefit to the economy can come sizeable environmental impacts. Implementing pollution prevention (P2) technologies and practices can help breweries reduce costs and lessen their effects on the environment, while differentiating their brands in the eyes of an environmentally conscious consumer base.

The EPA P2 Program chose the American food and beverage manufacturing industry—which includes the brewing industry—as a National Emphasis Area (NEA) because of its potential to benefit the economy and achieve measurable environmental results. EPA is providing P2 grants to provide technical assistance to businesses within the NEAs to help them develop and adopt source reduction practices.

[For more information on EPA's P2 Grants Program, visit www.epa.gov/p2.](http://www.epa.gov/p2)

Brewery Operations Run Over with Clean Opportunities

Investigate alternative cleaners. Breweries commonly use caustic cleaners to sterilize their lines and remove scale from stainless steel brew kettles. [Merrimack Ales](#) demonstrated that brewers can use less powdered brewers wash (a cleaning agent popular with brewers) by substituting safer, less hazardous technology. This minor change saved \$3,000 annually and did not affect product quality.

Evaluate brewing process byproducts. The largest source of waste for most breweries is spent grains, accumulated from the brewing and lautering process. Many breweries, such as [Breckenridge Brewery](#) and [Left Hand Brewing](#) in Colorado, successfully repurpose spent grains and yeast as animal feed supplement for local dairy farms or as compost, and reuse yeast instead of buying new for each brew.

Reduce wastewater treatment costs at the source. Brewing is a water-intensive process. Implementing water conservation strategies can save money, use less water, and result in less wastewater to manage or treat. [Wild Wolf Brewing Company](#) in Nellysford, Virginia, removed the filtration step from its brewing process, reducing water use by 15,000 gallons per year as well as the number of times it would pay to pump out its brewery tank. [Blasty Bough Brewing Company](#) of Epsom, New Hampshire, used geothermal



technology in its wort cooling process to prevent groundwater from ending up in the septic system. This action saves the brewery \$13,000 per year and greatly reduces its wastewater output. Small and large breweries alike should consider upgrading to efficient canning rinse nozzles, efficient water treatment, and water-efficient refrigeration equipment to reduce water use intensity.

Investigate wastewater chemistry and implement pre-treatment. Brewery wastewater can contain slugs of materials that can be very low or very high in pH. Adjusting the pH in a waste stream can be one of the most difficult processes in wastewater treatment and effluent compliance. Good pH neutralization and adjustment includes proper mixing, tank configuration, and instrument control. Breweries should also review sewer bills for volumes of wastewater and overage fees for biological oxygen demand (BOD), total suspended solids (TSS), or other constituents. They should sample and analyze different wastewater streams to determine which have high BOD, high TSS, low pH, or other contaminants of concern. Pre-treatment of brewery wastewater will reduce the effluent strength as an end-of-pipe solution.

Reduce air emissions. Both large and small breweries emit considerable quantities of carbon dioxide (CO₂) during the fermentation process, causing both ambient air pollution and indoor air quality concerns. Even small breweries emit a large amount of CO₂ during fermentation—about 10 pounds of CO₂ per barrel of wort produced. But there's room for change: for example, [Abita Brewing Company](#) upgraded to a high-efficiency recirculating wort heater and boiler system, reducing its CO₂ emissions by 70 percent. Breweries can address leaks and losses in CO₂ lines and

Widmer Brothers Brewing Wins Most Valuable Pollution Prevention (MVP2) Award

One of Oregon's top craft beer producers, Widmer Brothers Brewing, wanted to tackle a challenge many American breweries face: wastewater effluent with high biological oxygen demand (BOD) and total suspended solids (TSS). Waste beer, wort, yeast, and grains increase the concentrations of BOD and TSS, which in turn increases the cost of the brewery's discharge permitting fees.

Supported by EPA P2 grant funding, Oregon's Department of Environmental Quality (DEQ) worked with Oregon Sea Grant and Oregon State University (OSU) to develop the Oregon Applied Sustainability Experience, a statewide internship program that connects students with businesses to research waste prevention. Widmer Brothers Brewing, part of the Craft Brew Alliance, was the first Oregon business to volunteer to host a P2 intern project to develop a solution that would prevent waste and reduce wastewater at the brewery. By installing a TSS meter and in-house chemical oxygen demand testing, and repurposing used yeast as feed for local dairy farms, Widmer slashed its TSS output by 60 percent and BOD by 11 percent and is now saving \$150,000 per year. For these accomplishments, the National Pollution Prevention Roundtable awarded Widmer and OSU with the Most Valuable Pollution Prevention Award.

storage by changing to hard lines instead of flexible tubing and clamps, which are more subject to leaks and friction loss. A larger brewery might also consider installing an onsite CO₂ recovery system, or an onsite nitrogen extractor to replace CO₂ use altogether. Breweries can further reduce air emissions by installing low-NO_x burners on boilers and fabric filters to control particulate matter emissions from grain handling and drying.

Increase energy efficiency. Refrigeration, temperature and pressure control, and automated equipment use a lot of energy during brewing. P2 strategies can increase the efficiency of an entire brewery, which help reduce energy use and utility costs. For example, [Yards Brewing](#) of Philadelphia, Pennsylvania, upgraded its bottle labeling technology to a more efficient air-drying system, thus saving time and energy by streamlining the labeling process.

P2 Resources for the Brewery Sector

- [Brewers Association's COVID-19 Resource Center](#):
Important industry-specific information to help breweries weather the COVID-19 pandemic.
- [ENERGY STAR's "Treasure Map for Microbreweries"](#):
Guidance on self-auditing to discover opportunities for becoming more efficient.
- [Pacific Northwest Pollution Prevention Resource Center's \(PPRC\) Topic Hub: Craft Brewing](#):
An overview on the waste effluents and emissions from the brewing industry, along with P2 implementations that will reduce waste and expenditure.
- [The World Bank Group's "Environmental, Health, and Safety Guidelines for Breweries"](#):
Guidance on general and industry-specific Good International Industry Practice (GIIP) for brewing.
- [Colorado Department of Public Health and Environment's "Sustainable Breweries"](#):
Fact sheet on P2 strategies at breweries.
- [Multilateral Investment Guarantee Agency's "Environmental Guidelines for Breweries"](#):
Guidance on P2 technologies, emissions and wastewater treatment research, and ambient noise pollution.
- [EPA's "Compilation of Air Pollutant Emissions Factors," malt beverages section](#):
In-depth analysis of the brewing process and fermentation factors.
- [Brewers Association's "Water and Wastewater: Treatment/Volume Reduction Manual"](#):
Compilation of brewing best practices, wastewater treatment research, and case studies.
- [Rhode Island Department of Environmental Management's "Wastewater Disposal Guidance for Breweries, Wineries & Distilleries"](#):
Wastewater disposal resources and guidance based on research on Rhode Island breweries, wineries, and distilleries.
- [Craft Brewery Alliance's "Brewing a Better Planet"](#):
Report quantifying and highlighting American breweries' actions to reduce their pollution impact each year.
- [Vermont Green Brewery Partnership's "Striving to Make Great Beer and a Difference for the Environment"](#):
Short video on the Vermont Green Brewery Partnership initiative, a P2 business strategy developed by the Vermont Department of Environmental Conservation.
- [The Beer Institute](#):
An authoritative source of information on aspects of the brewing industry that provides technical information and service to brewers.

