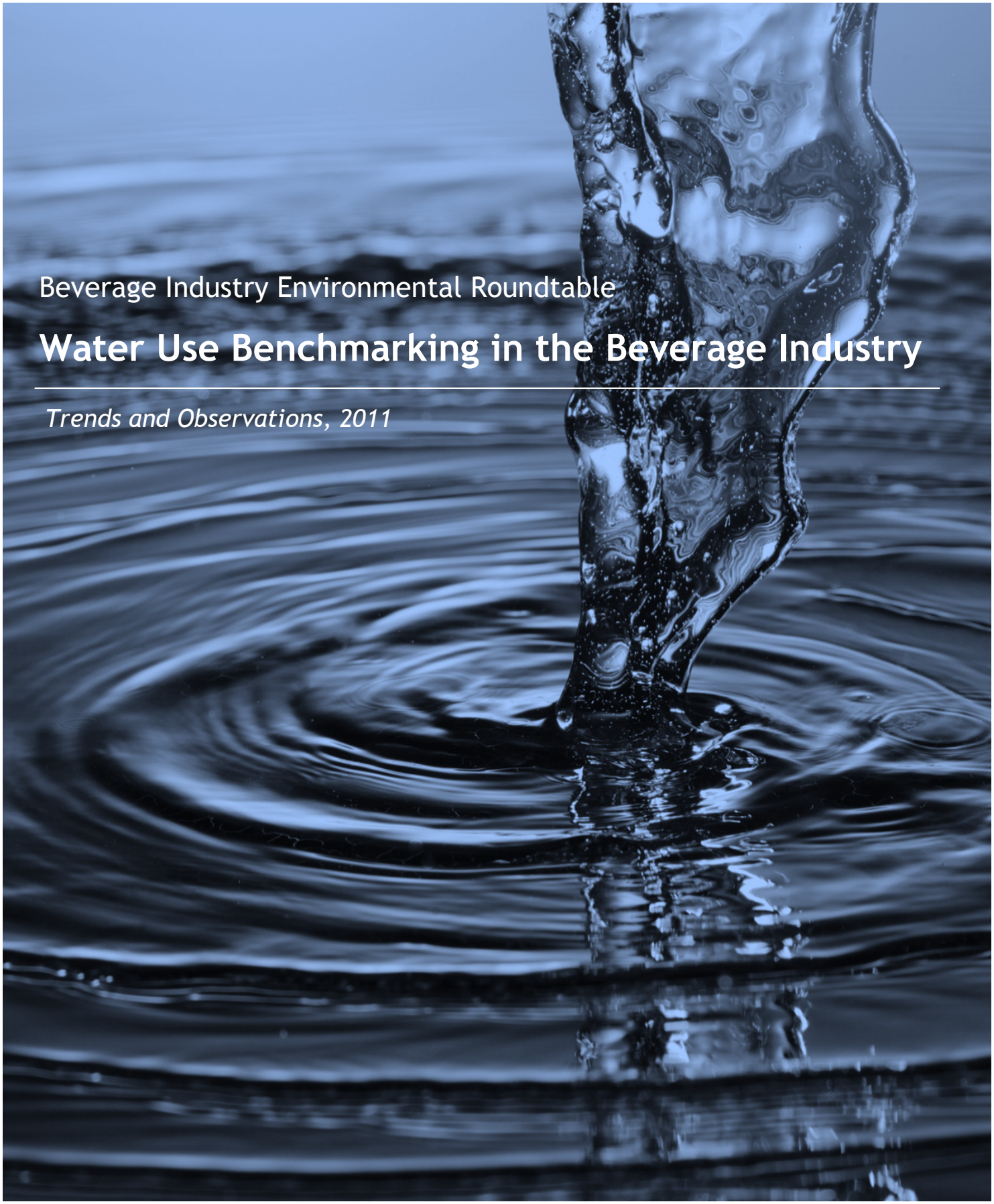


Beverage Industry Environmental Roundtable

Water Use Benchmarking in the Beverage Industry

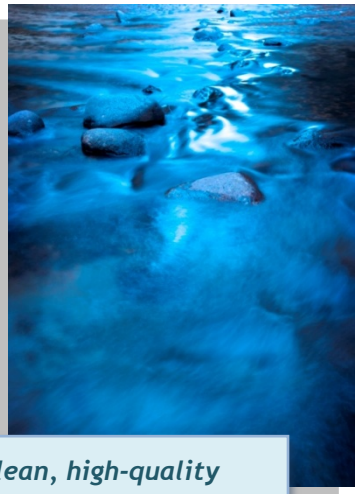
Trends and Observations, 2011

Beverage Industry
Environmental Roundtable

anteagroup

Water Use Benchmarking in the Beverage Industry
Trends and Observations, 2011

Clean, high-quality water is the essential ingredient for all products of the beverage industry. For years, beverage companies have focused on water use avoidance and conservation to demonstrate one aspect of environmental stewardship. Since 2007, the Beverage Industry Environmental Roundtable (BIER) has completed an annual quantitative benchmark to evaluate water use in the beverage industry. This article shares some of the key water use and performance information collected as part of this study, including an evaluation of facility performance in water scarce regions. Further, the article presents important steps BIER members are taking to expand water stewardship studies beyond the four walls of the facility, by accounting for water use in the supply chain and assessing water risks and opportunities.



Clean, high-quality water is the essential ingredient for all products of the beverage industry.

Benchmarking Process

In 2011, BIER successfully completed its fifth annual water benchmarking study. The study evaluated the performance of more than 1,600 beverage manufacturing locations representing 16 different beverage companies. As in previous years, BIER members continued to fine-tune the benchmarking process by refining the benchmarking metrics (ref. Table 1), determining the most critical data to collect, and adjusting the data analysis process for an ever-expanding data set. For the second year in a row, BIER membership elected to share select results of this annual study with external stakeholders, in support of the Transparency Principle espoused in *World Class Water Stewardship in the Beverage Industry 2010: Water Efficiency and Beyond*.[1]

To establish the data set, each of the 16 member companies submitted three years (2008, 2009, 2010) of facility-specific data, as described in Table 1. For consistent comparison purposes, all companies provided facility-specific data for total water use, total beverage production, facility type and location. The basis for analysis, then, is the water use ratio, which describes how efficiently a facility uses water for beverage production. The annual study, including data collection, analysis, verification, and reporting, has been managed by the Global Corporate Consultancy of Antea™Group, a third-party consultant, since the study's inception.

[1] *World Class Water Stewardship in the Beverage Industry 2010: Water Efficiency and Beyond*, Beverage Industry Environmental Roundtable, November 2010.

For the purposes of this study, four types of beverage production facilities were identified: bottling, brewery, distillery and winery. While all water uses at these facility types (including water used for employee services, on-site landscaping, etc.) were included, non-manufacturing facilities, such as office buildings and warehouses, were excluded from the study. Facility type was then determined by the primary process conducted at each facility. Further, bottling facilities were broken down into additional sub-categories based on product mix, to account for the various product types processed at bottling facilities. All facilities reported a beverage product mix, or a percentage breakdown of the different beverage types produced at each facility (ref. Table 1).

Particular characteristics of each facility and beverage type are further explained in the following sections.

Table 1: Quantitative Facility-Level Data Set

- **Total Water Usage (kL):** all water used by the facility (including bottling and industrial water) from all sources used for activities as identified below:

  Includes water used for:
  - Facility-level beverage production and packaging (accounts for water contained in product)
  - Cleaning/sanitizing processes
  - Cooling waters
  - Heating waters
  - Sanitation
  - Landscaping
  - Stormwater captured for aforementioned activities

  Excludes water used for:
  - Return water (underground water returned to the aquifer, recharge area, or natural drainage basin without significant modification).[2]
  - Concentrate, syrup or flavor production
  - Agriculture
  - Production of raw materials (plastic, glass, etc.)
  - Shipment of raw materials
  - Distribution of finished product
  - User consumption purposes (e.g. addition of ice cubes, spirits dilution, etc.)

- **Total Beverage Production (kL):** the volume of finished product generated at a facility or by a company. For facilities that produced alcoholic beverages, the actual volume of product (not scaled for alcohol content) was represented in the beverage production total.

- **Water Use Ratio (L/L)**: a calculated ratio of the total water usage to total beverage production at each facility.

- **Facility Type:** designated as brewery, distillery, winery, or bottling based on primary process enacted at each facility.

- **Beverage Product Mix (%):** percentage breakdown of the different beverage types produced at each facility. For purposes of this study, nine beverage types were identified: beer, bottled water, carbonated soft drinks, distilled spirits (high-proof), distilled spirits (low proof), 100% juice, non-carbonated beverages, wine and other.

- **Facility location:** continent, nation, latitude and longitude.

[2] Return water use is most frequently associated with the bottled water industry. A constant flow is maintained for microbiological purposes; displaced water which does not enter the facility is returned to the watershed as defined above. Other industries with a similar arrangement for private water resources may also exclude return water from their total water use.

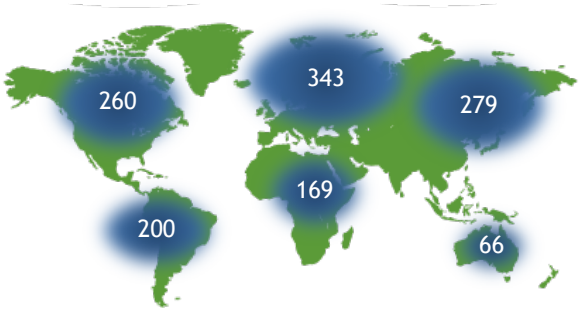
As noted in Table 1, water used in upstream processes, such as agriculture, flavor production, and production of raw materials, was not included in water use totals. Similarly, water used in downstream processes, such as distribution of finished product, was not included in water use totals. Upstream and downstream processes are addressed under Principle VI of *World Class Water Stewardship in the Beverage Industry*. It should also be noted that water contained in the final beverage product was included in water use totals and beverage production totals; however, any water added to finished product by users as ice or to dilute product was excluded. Further information on the processes included in water use may be found within each facility type's definition.

The member companies also submitted supplemental process information for their facilities; process-specific information such as package type, pasteurization type, and alcohol content was collected to evaluate trends observed during data analysis.

2011 Water Stewardship Benchmarking Results

Each year, the industry dataset continues to grow in size, with 2011 representing the most robust report to date, including over 1,600 facilities distributed across six continents. To maintain consistency in data evaluation, however, only facilities which reported data in each of the three study years were included in the subsequent analyses. Due to acquisitions, divestitures, site openings and closures, gaps in data reporting for specific facilities exist. The net result is a three-year data set for 1,317 facilities included in our analysis (Figure 1).

Figure 1: Continent Facility Representation (# of Facilities)

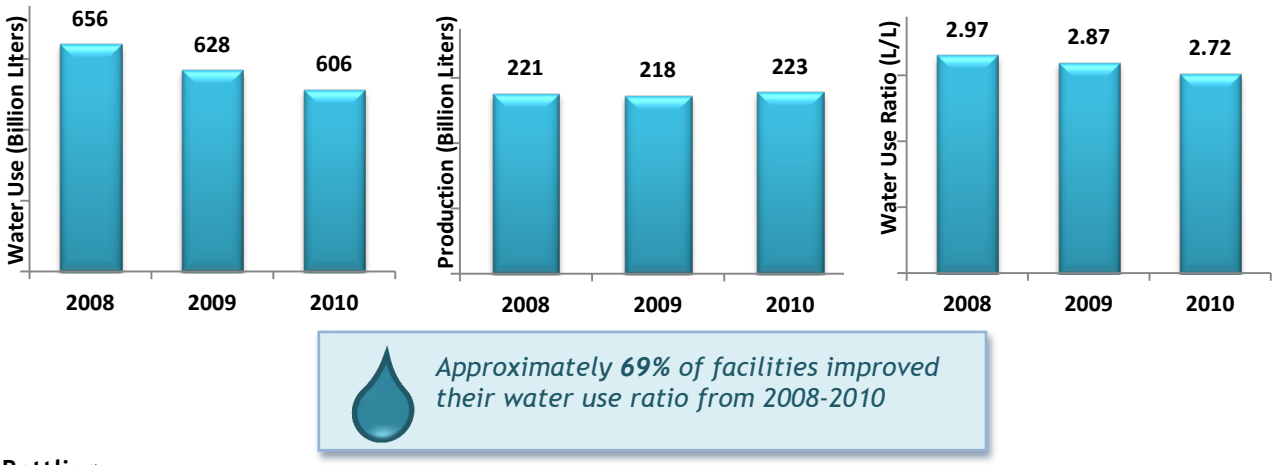


Analyses were conducted to determine industry water use, production, and water use ratio over the three year period (from 2008-2010). As seen in Figure 2 on the following page, the industry aggregate water use ratio improved by 9 percent from 2008 to 2010. Approximately 69 percent of facilities improved their water use ratio from 2008 to 2010. Aggregate beverage production remained relatively stable, increasing 1 percent from 2008 to 2010. Industry aggregate water use decreased approximately 8 percent from 2008 to 2010. By improving water use efficiency, the industry avoided the use of approximately 39 billion liters of water in 2010 - enough water to supply the entire population of New York City for eight days.

By improving water use efficiency, the industry avoided the use of approximately 39 billion liters

Further analysis was performed on each of the four facility types to identify specific trends in water use. Facility types, general process steps, and associated water use ratio trends are described in the next section. Notably, annual water use benchmarking has revealed the unique processes that use water at each facility type and the many variances between facility processes within the same facility types. BIER recognizes that, because of these unique processes, it is impossible to compare water use ratios across different facility types or with other consumer goods industries. Similarly, BIER abstains from "ranking" facility efficiency within beverage types, in consideration of the many unique characteristics and process variances within individual facilities.

Figure 2: Industry Trends in Water Use, Production, and Water Use Ratio



Bottling

For the purposes of the benchmarking study, bottling facilities were defined as:

> *Locations where concentrate, syrup, flavors/infusions, and/or bulk alcohol are blended with water and packaged into various container types. Bottling facilities also encompass facilities which receive finished bulk product (such as completely brewed beer or matured whiskey). No fermenting or distilling processes are conducted at bottling facilities.*

All nine beverage categories were represented in this facility type (see Table 1).

Bottling represented the largest data set of the study, with bottling facilities accounting for 74 percent (by volume) of the overall industry data set. Bottling facilities generally use the least amount of water to make a liter of product, since there are fewer water-intensive processes as compared to other beverage types (e.g. cooking, fermenting and distilling). Bottling facilities, however, typically package a mix of several different products and beverage types; 48 percent of these facilities had a beverage product mix of more than one type of beverage.

The bottling facility data set included a range of beverage types, processes, and production volume. For the purposes of this article, we will focus on the two largest sub-groups within the bottling data set: Carbonated Soft Drinks and Bottled Water.

Carbonated Soft Drinks

Carbonated soft drinks are defined as:

> *Non-alcoholic, flavored carbonated beverages; this category includes colas, ginger ales, and seltzers, but excludes non-carbonated beverages such as ready to drink teas, coffees, fitness drinks, energy drinks, and juice drinks.*

Facilities included in this sub-group reported a beverage production mix (percentage of each type of beverage produced at the facility, totaling to 100) of 50 percent or more carbonated soft drinks. Figure 3 shows the boundaries of the operations where water use was included in the benchmarking report.

In 2011, 705 carbonated soft drink bottling facilities comprised this beverage category study set. Carbonated soft drinks were the most well represented sub-group with facilities located on six continents. This sub-group also contained some of the largest facilities by production volume in the entire study.

Of the 705 carbonated soft drink bottling sites, 74 percent showed an improvement in water use ratio from 2008 to 2010. As seen in Figure 4, the overall carbonated soft drink subset water use ratio showed a 7 percent improvement from 2008 to 2010.[3] Facilities with a beverage product mix of 100 percent carbonated soft drinks (544 facilities) showed a similar improvement of 8 percent from 2008 to 2010.

*Of 705 carbonated soft drink bottling sites, **74%** showed an improvement in water use ratio*

Figure 3: Process Map, Carbonated Soft Drinks

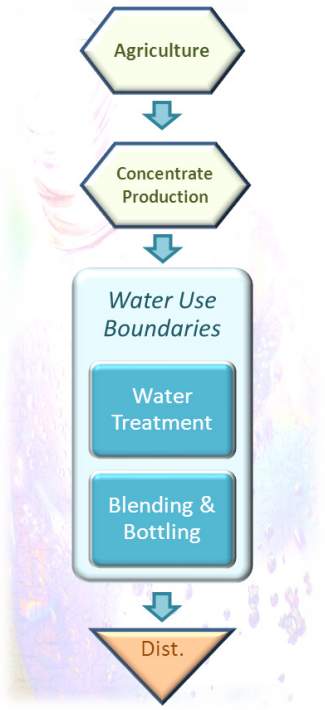
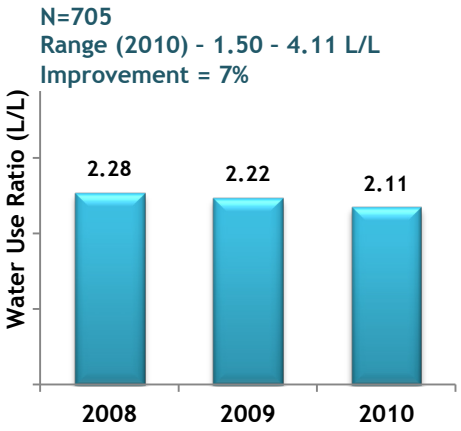


Figure 4: Carbonated Soft Drink Performance



[3] For all subsequent graphs, the following criteria apply: "water use ratio" represents a volume-weighted mean; "range" refers to the middle 80 percent of the 2010 data set; and "improvement" refers to the percent change in water use ratio from 2008 to 2010.

Bottled Water

Bottled water is defined as:

> *All unflavored bottled waters including spring water, purified water (produced by distillation, deionization, reverse osmosis or other processes), mineral water, sparkling bottled water, or well water.*

The study process data sheets offered three choices for specifying bottled water mix: spring water, natural water or mineral water. For the purposes of this article, data is presented for facilities that had a beverage product mix of 50 percent or more of any bottled water type. As seen in Figure 5, benchmarking accounts for water treatment (as applicable) and bottling processes.

In 2010, 112 bottled water facilities comprised this beverage category study set, representing 14 percent (by volume) of the bottling facility data set. As seen in Figure 6, the water use ratio range reported in this sub-group had the smallest range of all sub-groups.

Of these 112 sites, 64 percent showed an improvement in water use ratio from 2008 to 2010. The overall bottled water sub-group water use ratio remained relatively stable from 2008 to 2010. Facilities with a beverage product mix of 100 percent bottled water (47 facilities) showed similar stability in water use ratio from 2008 to 2010.

*Of 112 bottled water sites, **64%** showed an improvement in water use ratio*

Figure 5: Process Map, Bottled Water

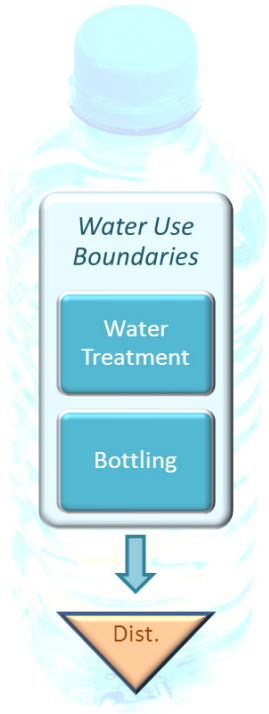
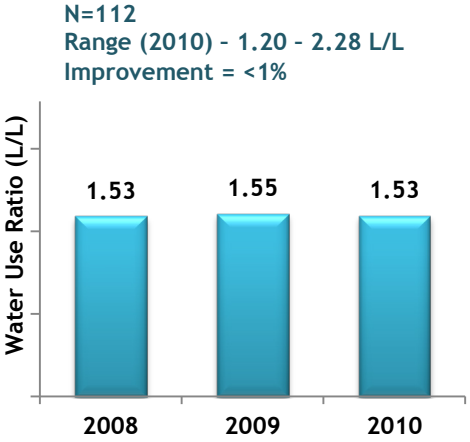


Figure 6: Bottled Water Performance



Brewery

For the purposes of the benchmarking study, a brewery was defined as:

> *A facility conducting all processes after the malting process to produce beer (mashing/lautering, boiling, fermenting, aging, and packaging).*

All breweries in this study conducted bottling operations on site; a small number also shipped product off site in bulk containers to a separate bottling facility. Breweries may have also produced other beverages (carbonated soft drinks, bottled water) in addition to beer, but in all cases, the majority of beverage product mix was beer.

Brewery (beer only) facilities accounted for 24 percent (by volume) of the industry data set, the second largest facility type of the study. As seen in Figure 7, benchmarking accounted for all process steps except for upstream agricultural growth, malting and distribution of finished product.

In 2011, 244 breweries were included in this beverage category study set. Of these breweries, 211 manufactured beer only, while 33 facilities produced other beverages in addition to beer. Figure 8 presents the water use ratios of the 211 facilities that produced beer only. The range in water use ratios observed in the brewery data set can be attributed to several factors, including:

- package type (e.g. smaller packages - 12 oz. bottles - tend to require more water use than larger packages, like kegs) and
- facility size (e.g. facilities with larger production volumes report lower water use ratios).

Of these 211 breweries, 72 percent showed an improvement in water use ratio from 2008 to 2010. The water use ratio for breweries that produce only beer improved 10 percent from 2008 to 2010, the greatest improvement in the study.

Figure 7: Process Map, Brewery

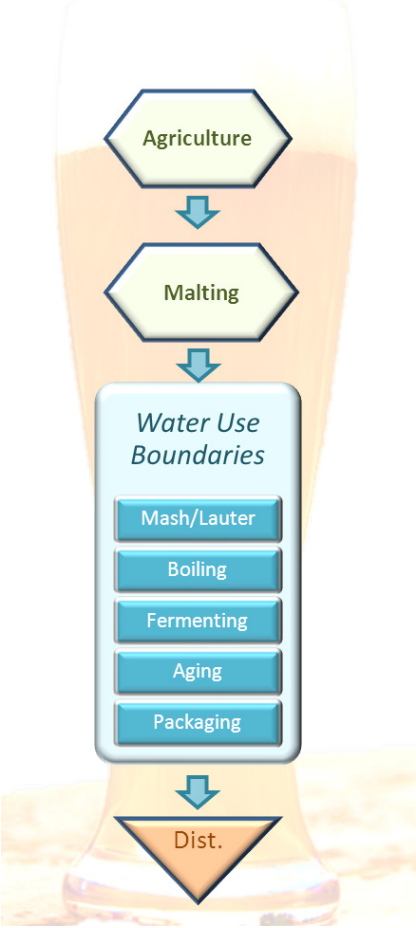
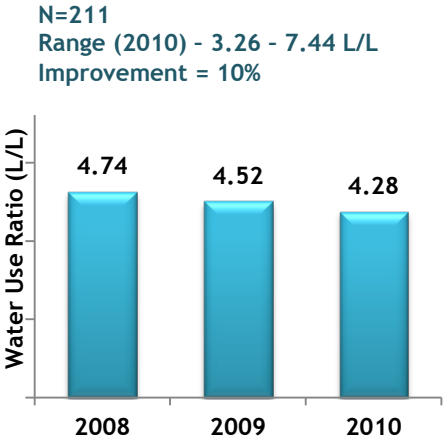


Figure 8: Brewery (Beer Only) Performance



Breweries also demonstrated a statistically significant improvement in water use ratio tied to increase in production: facilities that improved production more than 1 percent from 2009 to 2010 also experienced water use ratio decreases from 6 to 11 percent.

*The water use ratio for breweries (beer only) improved **10%** - the greatest improvement in the study.*

Distillery

For the purposes of the benchmarking study, a distillery was defined as:

> *Any facility that receives agricultural inputs (grains, agave, molasses, etc.) and conducts processes (cooking, fermenting, distilling and storage/maturation) to make bulk alcohol.*

Production volume at distilleries is reported as "wine liters," or the bulk volume of alcohol produced at the facility independent of alcohol content. As seen in Figure 9, benchmarking did not account for upstream agricultural processes or distribution of finished product.

Figure 9: Process Map, Distillery

Similar to bottling facilities, distilleries produce a wide variety of products, each of which can require a different number of manufacturing processes that can impact the total water use at the facility, including differences in the distillation process itself. Facilities that produce a single product or product-type, however, experience lower water use ratios than those facilities that produce more than one type of spirit, due to reduced cleaning requirements.

Alcohol content is also a driver for water use ratio in distilleries. The spirits that result from the distilling process have a range of alcohol content; thus, a lower proof spirit has more water in the final beverage product than a high proof spirit. Additionally, due to transportation regulations and proximity to the bottling facility, some products are partially blended to a lower proof at the distillery.

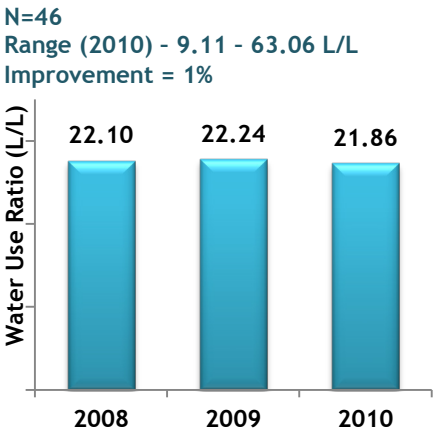
Forty-six (46) distilleries providing three years of data are included in the analyses. As seen in Figure 10, distilleries had the greatest water use ratio range in the industry data set. One of the main drivers for this range was the extensive

***Cooling water use** is one of the main drivers for the range of water use ratios for distilleries.*

cooling water requirements of distilleries, coupled with the different types of cooling water processes. For example, a once-through cooling water system which draws from a surface water body typically uses more water than either an open recirculating or a closed loop cooling system.

Of these 46 facilities, 52 percent improved their water use ratio from 2008 to 2010. The distillery data set as a whole showed a slight improvement of 1 percent from 2008 to 2010.

Figure 10: Distillery Performance



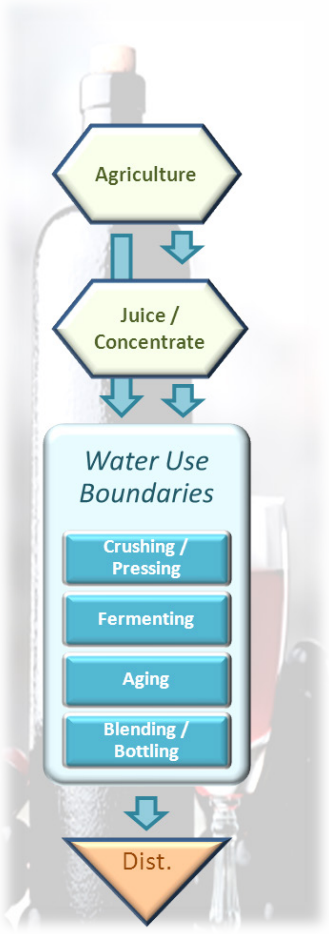
Winery

For the purposes of the benchmarking study, the scope of winery processes included:

> *The crushing and pressing of grapes, fermentation, storage/aging and bottling of product.*

As seen in Figure 11, water used for agriculture, including crop irrigation, was not included in total water use data. Water used for concentrate production and distribution also was not included in benchmarking.

Figure 11: Process Map, Winery



Wineries represented the smallest data set in the study, with 35 facilities reporting three years of data in 2010, accounting for less than 1 percent (by volume) of the industry data set. Like distilleries, wineries also had a large range of water use ratios among facilities, which was the result of: various facility sizes; type of inputs used (concentrated juice, grapes or both); and the type/blend of product (red, white or sparkling wine).

As seen in Figure 12, the winery dataset was the only major beverage category to demonstrate an increase in water use ratio from 2008 to 2010. The dataset also reported the greatest decrease in production (28 percent) from 2008 to 2010.

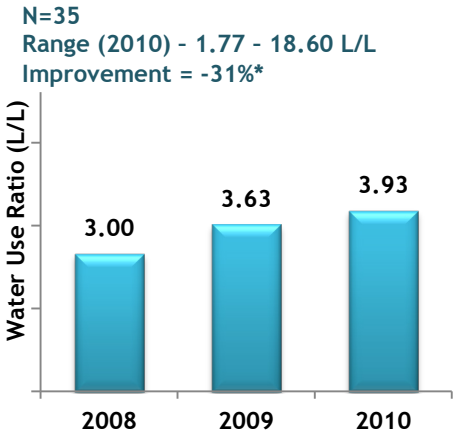
Production volume change at individual facilities showed a statistically significant correlation to water use ratio from 2009 to 2010. Similar to other facility types, most wineries that increased production from 2009 to 2010 also decreased water use ratio; however, facilities reporting production decreases of 3 percent or more also reported average water

use ratio increases of up to 40 percent. This indicated that the size (or production volume) of a winery is a primary factor in determining its water use ratio.

***Production volume** of a winery is a key factor in determining water use ratio*

***Note:** Wineries were the only major beverage category that did not improve water use ratio from 2008 - 2010*

Figure 12: Winery Performance



Water Scarcity Evaluation

In addition to the water use ratio evaluation, the 2011 report also included an evaluation of water use relative to water scarce geographies, using the World Business Council for Sustainable Development (WBCSD) Global Water Tool.[4] WBCSD roughly defines water scarcity on the basis of annual renewable water supply per person, denoting five levels of availability as defined in Figure 13.

Precise facility location data was available and used for water scarcity mapping for 1,195 of the 1,317 facilities reporting three full years of data to the study. Figure 13 presents an analysis of where efficiency improvements are being realized relative to general water scarcity indicator definitions of WBCSD. As seen in the figure, 151 facilities operate under extreme water scarcity and 164 facilities operate under water scarce conditions. These facilities comprise approximately 28 percent of the production volume represented by the 1,195 facilities.

Figure 13: Facility WUR Improvement vs. Water Availability

Annual Renewable Water Supply per Person (m3/person/year)	Number of Facilities	% Reporting WUR Improvement, 2008 - 2010
< 500	151	72%
500 - 1,000	164	69%
1,000 - 1,700	168	70%
1,700 - 4,000	287	72%
> 4,000	425	68%

In each water scarcity category, the majority of facilities reported an improvement in water use ratio from 2008 to 2010.

*The industry is making **significant improvement** in areas where water is scarce or extremely scarce*

[4] World Business Council for Sustainable Development Global Water Tool (2011): http://www.wbcsd.org/web/watertool.htm

"Closing the Loop" on Water Use Efficiency

Five years of water stewardship benchmarking has provided BIER members with great insight into industry trends and performance for water used within the "four walls" of the facility. In recent years, though, the industry has also turned its attention to water use beyond the facility – quantifying water used for agriculture, package production and other aspects of the value chain, as well as examining the impact of production water use on regional resources, community partnerships, and local regulations.

Through these studies and best practice sharing, BIER members have begun to formulate a pathway of full circle water use quantification – a way to "close the loop" on water use by recognizing water use, consumption, risks and opportunities that reside along the complete value chain. BIER's sector leading initiatives include:

Figure 14:
Full Circle Water Use Quantification

- **Benchmarking:** Water stewardship benchmarking is an important primary step in water use quantification. BIER members have conducted the study for five years and the intent is to continue to benchmark and identify new areas of facility-level information that could lead to new opportunities for improvement within production and bottling operations. Sharing of water reduction and conservation best practices will also continue into the foreseeable future.

- **Accounting for Water Use**: In December 2011, BIER released *A Practical Perspective on Water Accounting in the Beverage Sector,*[5] a guidance document designed to assist industry leaders in establishing consistency when conducting water footprint studies on their product(s). The document presents suggested approaches to water footprinting, guidance on how to set water inventory boundaries (indirect and direct water consumption), and data reporting requirements (transparency, alignment, data limitations and verification).

- **Water Risks and Opportunities:** BIER members have moved beyond mere quantification of water use and consumption along the value chain to instead assessing the physical, social and regulatory risks and impacts. To aid in these efforts, a BIER working group is currently preparing a water risk guidance document for member use. The document will evaluate existing assessment tools in detail, provide insight on what can be done to capitalize on opportunities or mitigate risks, and highlight case studies on risk management and opportunity development. The guidance document will be applicable both to companies who have not

[5] *"A Practical Perspective on Water Accounting in the Beverage Sector." Beverage Industry Environmental Roundtable, December 2011.*

completed risk and opportunity assessments, as well as to those who have already begun the process. BIER aims to have this document available in late 2012.

Next Steps

Five years of water stewardship benchmarking has provided BIER with exceptional insight into trends and figures that are now shared with external stakeholders. The 2011 study identified an overall improvement in industry-wide water use ratio, as well as within three of the four main facility types. BIER members also demonstrated significant water use improvements in water scarce operations. BIER members continue to improve upon the benchmarking study, identifying new process trends to analyze and new opportunities for best practice sharing to drive improved water stewardship practices across the complete value chain.

BIER plans to work with member companies to continue the annual water use benchmarking and to improve the quality and depth of data collected, adding an energy benchmarking component to the study in 2012. Acknowledging the importance of transparency, BIER plans to continue publishing select results of the benchmarking study to external stakeholders on an annual basis.

About the Beverage Industry Environmental Roundtable

The Beverage Industry Environmental Roundtable (BIER) is a technical coalition of leading global beverage companies working together to advance environmental sustainability within the beverage sector. Formed in 2006, BIER aims to accelerate sector change and create meaningful impact on environmental sustainability matters. Through development and sharing of industry-specific analytical methods, best practice sharing, and direct stakeholder engagement, BIER accelerates the process of analysis to sustainable solution development. BIER membership is listed in Figure 15.

Figure 15: BIER Member Companies, 2011

BIER developed six principles of *World Class Water Stewardship in the Beverage Industry* (Figure 16) to help guide the beverage sector in pursuit of excellence in water stewardship. [6] Annual water use benchmarking supports Principle II and is designed to allow for the measurement of water use-reduction efforts.

Additional, recent BIER accomplishments include: the development of "Beverage Industry Sector Guidance for Greenhouse Gas Reporting", "A Practical Perspective on Water Accounting in the Beverage Sector", "Impacts and Dependencies of the Beverage Sector on Biodiversity and Ecosystem

[6] *World Class Water Stewardship in the Beverage Industry 2010: Water Efficiency and Beyond*, Beverage Industry Environmental Roundtable, November 2010.

Services: An Introduction", Beverage Category Greenhouse Gas Modeling, 5th Annual Water Stewardship Benchmarking Study, and dialogue initiatives with several trade, NGO and customer organizations to name a few. For more information, visit http://www.bieroundtable.com.

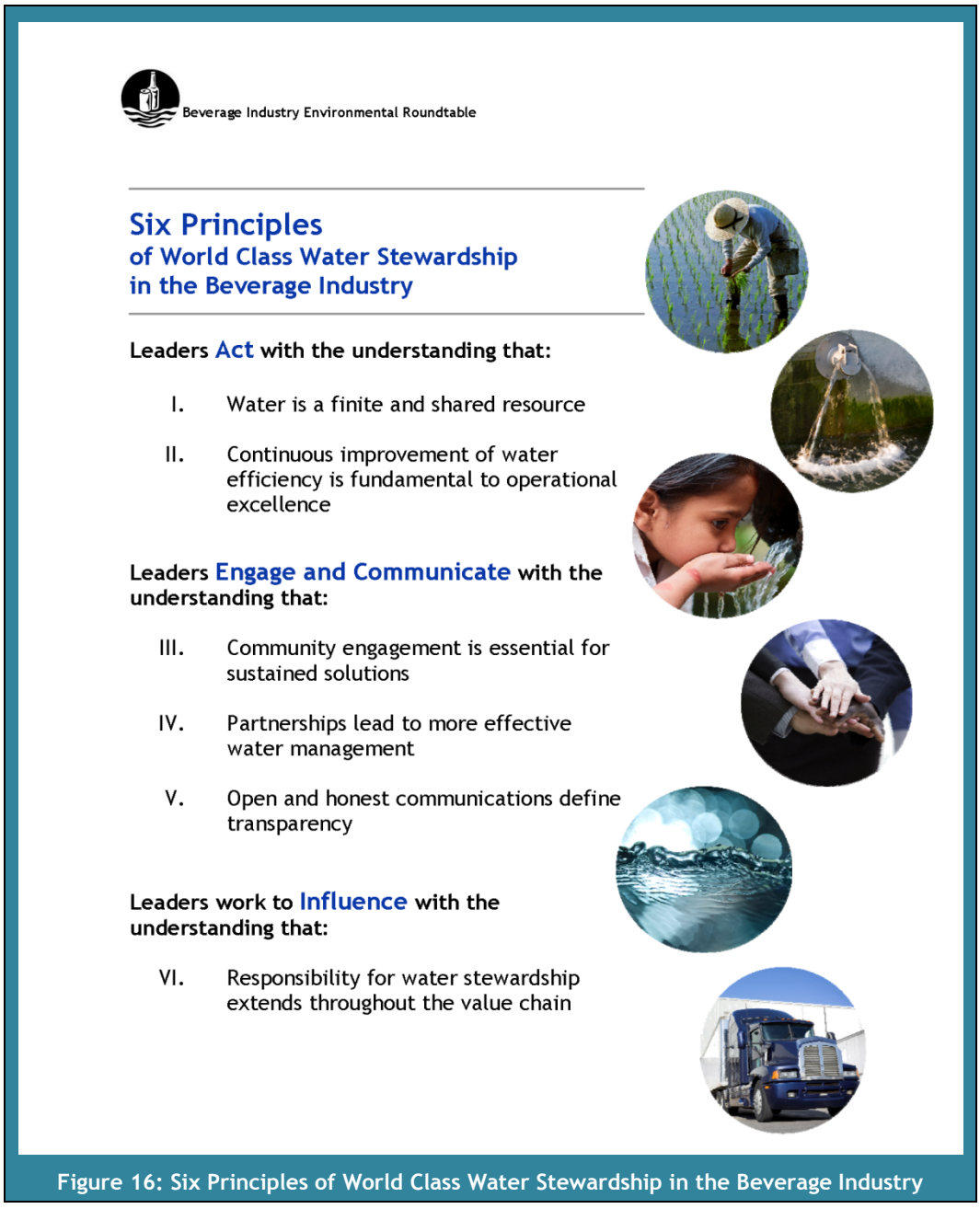


Figure 16: Six Principles of World Class Water Stewardship in the Beverage Industry