



Beverage Industry Environmental Roundtable

# Water Use Benchmarking in the Beverage Industry

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*Trends and Observations 2012*



**Beverage Industry**  
Environmental Roundtable





## Water Use Benchmarking in the Beverage Industry Trends and Observations

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. The article also elaborates on BIER's plans to incorporate efficiency studies outside the "four walls" of the facility.



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

### Benchmarking Process

In 2012, BIER successfully completed its sixth annual water benchmarking study. The study evaluated the performance of more than 1,600 beverage manufacturing locations representing 17 different beverage companies. As in previous years, BIER members continued to fine-tune the benchmarking process by refining the metrics (ref. Table 1), determining the most critical data to collect, and adjusting the data analysis process for an ever-expanding data set. This is the third year BIER membership has 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*.<sup>1</sup>

To establish the data set, each of the 17 member companies submitted three years (2009, 2010, 2011) 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.

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

<sup>1</sup> *World Class Water Stewardship in the Beverage Industry 2010: Water Efficiency and Beyond*, Beverage Industry Environmental Roundtable, November 2010.



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).<sup>2</sup>
- 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, ten beverage types were identified: beer, bottled water, carbonated soft drinks, distilled spirits (high-proof), distilled spirits (low proof), juice - not from concentrate, juice from concentrate, non-carbonated beverages, wine and other.

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

<sup>2</sup> 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.

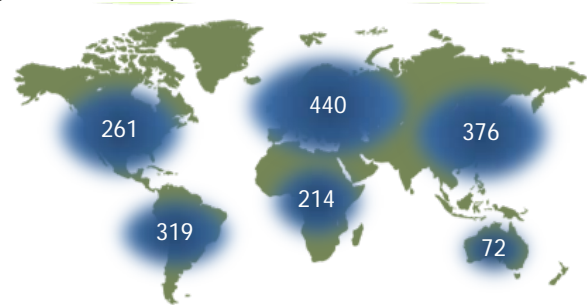
The member companies also submitted supplemental process information for their facilities; process-specific information such as package type, pasteurization type, and alcohol content was collected to evaluate trends observed during data analysis.

### 2012 Water Stewardship Benchmarking Results

Each year, the industry dataset continues to grow in size, with 2012 representing the most robust data set 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 1,481 facilities included in our analysis (Figure 1).

Analyses were conducted to determine industry water use, production, and water use ratio over the three year period (from 2009 to 2011). As seen in Figure 2 on the following page, the industry aggregate water use ratio improved by 10 percent from 2009 to 2011. Approximately 73 percent of facilities improved their water use ratio from 2009 to 2011, and those with greater production volumes had a statistically significant lower water use ratio than facilities with lesser production. Aggregate beverage production increased 6 percent from 2009 to 2011. Industry aggregate water use decreased approximately 5 percent from 2009 to 2011. By improving water use efficiency, the industry avoided the use of approximately 35 billion liters of water in 2011 - enough water to fill London's O2 Arena over 16 times.

Figure 1: Continent Facility Representation (# of Facilities)

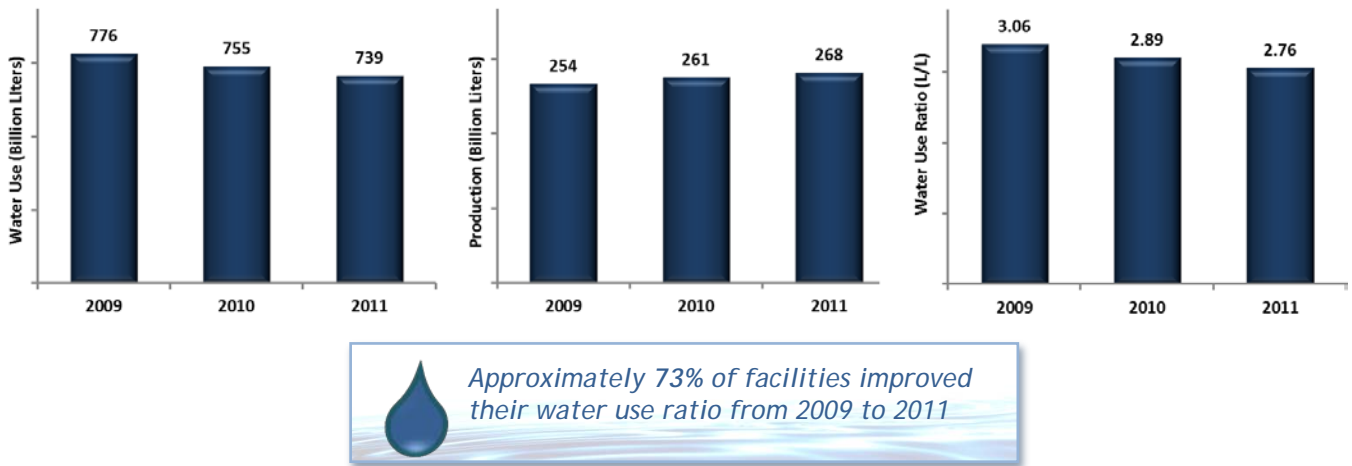


*By improving water use efficiency, the industry avoided the use of approximately 35 billion liters of water in 2011 - enough water to fill London's O2 Arena over 16 times.*



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:

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*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.*

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All ten 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 69 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 facility types (e.g. brewery, distillery, and winery).

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 2012, 725 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 725 carbonated soft drink bottling sites, 74 percent showed an improvement in water use ratio from 2009 to 2011. As seen in Figure 4, the overall carbonated soft drink subset water use ratio showed a 9 percent improvement from 2009 to 2011.<sup>3</sup> Facilities with a beverage product mix of 100 percent carbonated soft drinks (534 facilities) showed a similar improvement of 9 percent from 2009 to 2011. Facilities with refillable containers exhibit a statistically significant higher water use ratio than those that do not.

*Of 725 carbonated soft drink bottling sites, 74% showed an improvement in water use ratio*

Figure 3: Process Map, Carbonated Soft Drinks

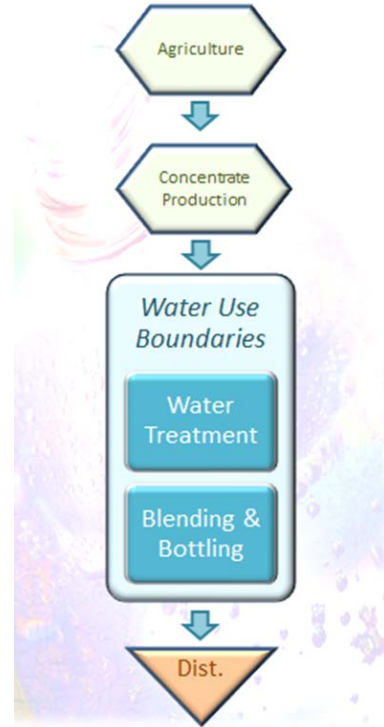
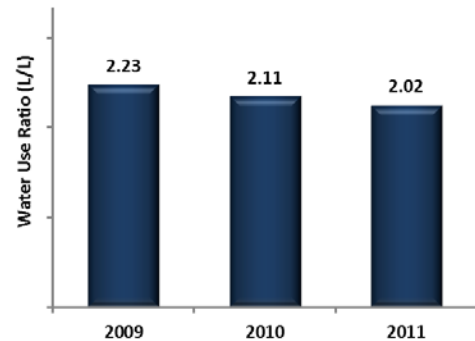


Figure 4: Carbonated Soft Drink Performance

N=725  
Range (2011) - 1.48 - 3.95 L/L  
Improvement = 9%



<sup>3</sup> 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 2011 data set; and "improvement" refers to the percent change in water use ratio from 2009 to 2011.



### 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 2012, 131 bottled water facilities comprised this beverage category study 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 131 sites, 75 percent showed an improvement in water use ratio from 2009 to 2011. The overall bottled water sub-group water use ratio showed a 5 percent improvement from 2009 to 2011. Facilities with a beverage product mix of 100 percent bottled water (118 facilities) also demonstrated a 5 percent improvement in water use ratio from 2009 to 2011.

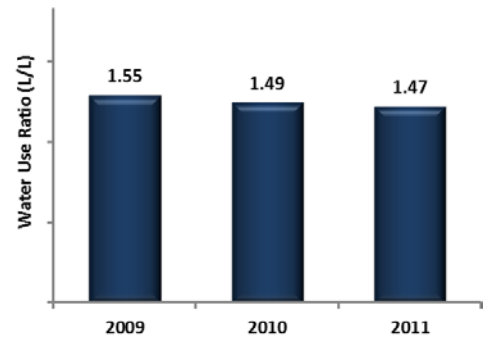
*Of 131 bottled water sites, 75% showed an improvement in water use ratio*

Figure 5: Process Map, Bottled Water



Figure 6: Bottled Water Performance

N=131  
Range (2011) - 1.17 - 2.22 L/L  
Improvement = 5%





### 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/lauter, 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 26 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 2012, 296 breweries were included the brewery (beer only) beverage category study set. The range in water use ratios observed in Figure 8 can be attributed to several factors, including:

- Package type: water use differs for small packaging (12 oz. bottles or cans) vs. larger or bulk packaging (kegs or tanks);
- Facility size: facilities with larger production volumes report lower water use ratios).

Of these 296 breweries, 83 percent showed an improvement in water use ratio from 2009 to 2011. The water use ratio for breweries that produce only beer improved 12 percent from 2009 to 2011, the greatest improvement in the study.

*The water use ratio for breweries (beer only) improved 12% - the greatest improvement in the study.*

Figure 7: Process Map, Brewery

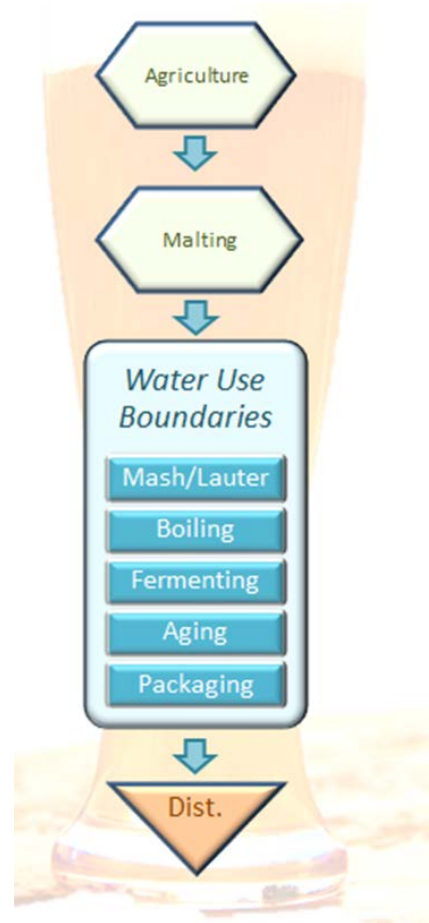
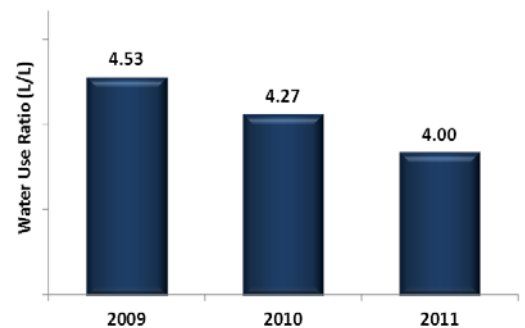


Figure 8: Brewery (Beer Only) Performance

N=296  
Range (2011) - 3.17 - 6.62 L/L  
Improvement = 12%







### 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.

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, since there are more stringent requirements for multiple product types.

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.

In 2012, 80 facilities<sup>4</sup> were included in the distillery data set. 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 requirements of distilleries, coupled with the different types of cooling water processes. For example, a once-through cooling water

<sup>4</sup> The distillery data set includes facilities that included cooling water as part of total use and those who are unable to meter cooling water at this time.

Figure 9: Process Map, Distillery

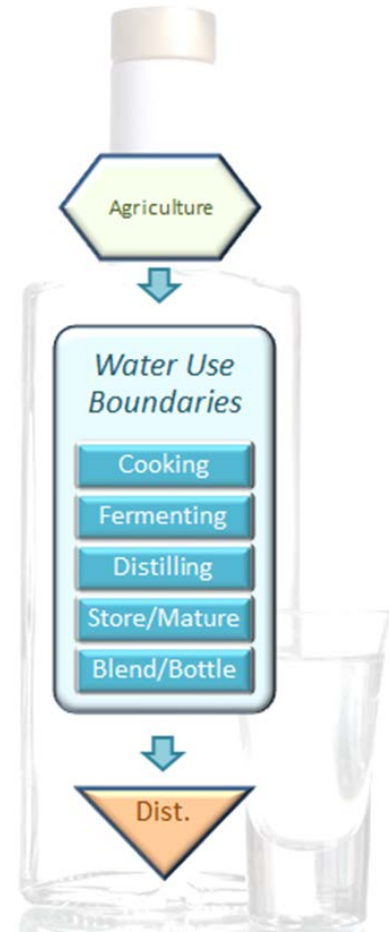
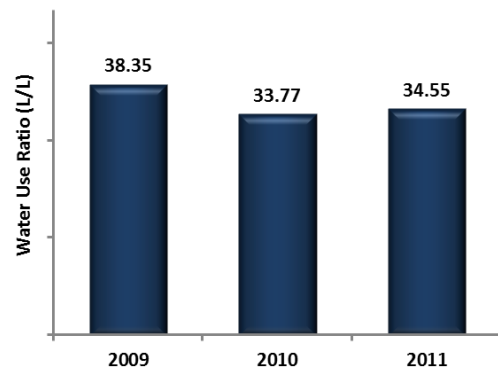


Figure 10: Distillery Performance

N=80  
Range (2011) - 7.87 - 126.32 L/L  
Improvement = 10%





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 80 facilities, 54 percent improved their water use ratio from 2009 to 2011. The distillery data set as a whole showed an improvement of 10 percent from 2009 to 2011.

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

### Winery

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

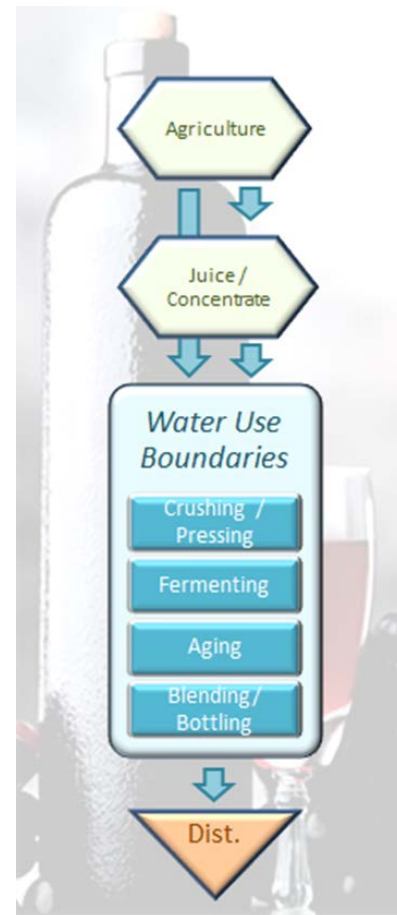
*The crushing and pressing of grapes, fermentation, storage/aging and bottling of product.*

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.

Wineries represented the smallest data set in the study, with 27 facilities reporting three years of data in 2012, 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).

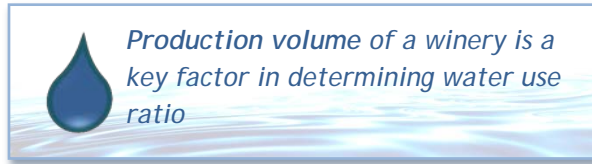
As seen in Figure 12 on the following page, the winery dataset was the only major beverage category to demonstrate an increase in water use ratio from 2009 to 2011. The dataset also reported the greatest decrease in production (25 percent) from 2009 to 2011.

Figure 11: Process Map, Winery





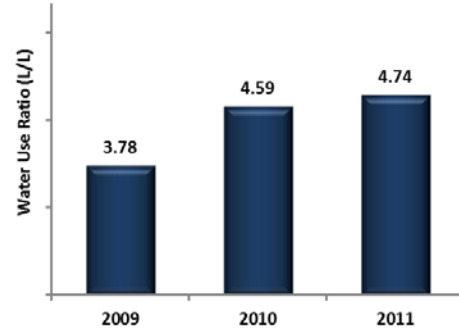
This indicated that the size (or production volume) of a winery is a primary factor in determining its water use ratio. It is likely that those facilities experiencing a reduction in production are no longer achieving economies of scale that their prior production volume achieved.



*\*Note: Wineries were the only major beverage category that did not improve water use ratio from 2009 - 2011*

Figure 12: Winery Performance

N=27  
Range (2011) - 1.99 - 18.48 L/L  
Improvement = -26%\*



### Water Scarcity Evaluation

The 2012 report also included an evaluation of water use relative to water scarce/water stressed geographies, using the World Business Council for Sustainable Development (WBCSD) Global Water Tool<sup>5</sup> and the World Resources Institute (WRI) Aqueduct Water Risk Atlas<sup>6</sup>.

WBCSD roughly defines water scarcity on the basis of annual renewable water supply per person<sup>7</sup>, denoting five levels of availability as defined in Figure 13. Precise facility location data was available and used for water scarcity mapping for 1,333 of the 1,481 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, 167 facilities operate under extreme water scarcity and 170 facilities operate under water scarce conditions. These facilities comprise approximately 28 percent of the production volume represented by the 1,333 facilities. The majority of facilities in each water scarcity category reported an improvement in water use ratio from 2009 to 2011.

Figure 13: Facility WUR Improvement vs. Water Availability

Annual Renewable Water Supply per Person, 1995 (m3/person/year)	Number of Facilities	% Reporting WUR Improvement, 2009 - 2011
< 500	167	73%
500 - 1,000	170	72%
1,000 - 1,700	193	73%
1,700 - 4,000	315	75%
> 4,000	488	72%



<sup>5</sup> World Business Council for Sustainable Development Global Water Tool (2012): <http://www.wbcd.org/web/watertool.htm>

<sup>6</sup> World Resources Institute Aqueduct Water Risk Atlas (2011): <http://insights.wri.org/aqueduct/atlas>

<sup>7</sup> Annual Renewable Water Supply Per Person - Indicates the average annual renewable water supply per person for individual river basins as of 1995. [http://www.wbcd.org/web/gwt/GWT\\_Datasets\\_2011\\_Upgrade.pdf](http://www.wbcd.org/web/gwt/GWT_Datasets_2011_Upgrade.pdf)



Figure 14: Facility WUR Improvement vs. 2025 A1B Scenario

The WRI Aqueduct Water Risk Atlas tool provides an evaluation of baseline water stress (e.g. an indicator of the level of concern for freshwater availability) and projected change in water stress based on Intergovernmental Panel on Climate Change (IPCC) emissions scenarios. Figure 14 presents an analysis of where efficiency improvements are being realized relative to the projected 2025 water stress conditions based on IPCC Climate Change Scenario A1B.<sup>8</sup> The industry is making improvements in areas where stress is expected to increase in the next 13 years - 78% of facilities located in areas expected to increase stress demonstrated an improvement in water use ratio from 2009 to 2011.

Projected Climate Change Scenario 2025 A1B	Number of Facilities	% Reporting WUR Improvement, 2009 - 2011
Exceptionally More Stressed	26	69%
Extremely More Stressed	309	79%
Severely More Stressed	262	78%
Moderately More Stressed	77	77%
Drier but still Low Stress	100	82%
Near Normal Conditions	612	66%

### Venturing Beyond the “Four Walls”

Since 2007, BIER has successfully expanded upon the Foundation Elements of Water Stewardship and Energy and Greenhouse Gas Efficiency through benchmarking studies, best practice documents, development of Practical Perspectives and other guidance for standard reporting, and providing expert industry insight into global standards and initiatives. In October 2012, BIER members met to discuss plans to continue building upon the Foundation Elements and expanding the BIER agenda beyond stewardship efforts within the operational boundaries of the facility. Future initiatives include:

- **Context-Based Metrics:** BIER plans to dive deeper into evaluating drivers for certain trends and observations associated with metrics. The first step in this process is to identify and evaluate methods that provide additional context and insight into the local impact of water use by beverage facilities.
- **Evaluate Water Use Beyond “Four Walls”:** After six years of benchmarking water use within the facility, BIER is naturally progressing towards evaluating water efficiencies in the value chain, and developing tools and guidance to assist beverage companies in water accounting and assessing, prioritizing and mitigating water-related risks along the complete value chain. BIER members have developed sector guidance tools to assist the beverage sector in these processes:
  - December 2011: *A Practical Perspective on Water Accounting in the Beverage Sector* was developed to provide suggested approaches to the water footprinting process.

<sup>8</sup> IPCC Scenario A1B - a realistic projection of the future incorporating rapid economic growth, population growth that peaks mid-century, and introduction of efficient energy technologies that are balanced across all energy sources (e.g. not reliant on just one energy source, like fossil fuels). WRI Aqueduct Drought Severity Interpretive Guidelines (2011): [http://docs.wri.org/aqueduct/freshwater\\_sustainability\\_analyses.pdf](http://docs.wri.org/aqueduct/freshwater_sustainability_analyses.pdf)



- November 2012: BIER released *Managing Water-Related Business Risks & Opportunities in the Beverage Sector*. This guidance provides for methodology member perspectives on challenges and opportunities through the water risk management process.
- **Beverage Category Modeling:** In June 2012, BIER released research on the carbon footprints of five beverage categories: beer, bottled water, carbonated soft drinks, spirits, and wine. This research provides further insight into supply chain metrics and efficiency drivers.

### Benchmarking Next Steps

Since the first benchmarking study in 2007, BIER has gained exceptional insight into trends and figures that members continue to share with stakeholders and peers. Benchmarking water use has provided great value to members in helping individual members assess their performance across a peer group, demonstrate efficacy, and serve as a basis for individual facility target setting. The 2012 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 and areas that are forecasted to be more stressed in the near future. BIER continues 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. In 2013, BIER will continue to develop the energy benchmarking component initiated this past year, to ensure data accuracy and quality prior to releasing select results to the public. In addition, BIER hopes to incorporate context-based metrics into the study, through additional focus on supplemental process data and available scarcity information. Acknowledging the importance of transparency, BIER plans to continue publishing select results of the benchmarking study to external stakeholders on an annual basis.

*Benchmarking water use has provided great value to BIER members in helping individual members assess their performance across a peer group, demonstrate efficacy, and serve as a basis for individual facility target setting.*





## Beverage Industry Environmental Roundtable

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### About the Beverage Industry Environmental Roundtable (BIER)

The core mission of Beverage Industry Environmental Roundtable (BIER) is to advance the sector's environmental sustainability by developing industry-specific methods and data. In other words, we seek to create tools and methodologies that accelerate sustainability and its journey from analysis to action.

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

Additionally, 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 Services: An Introduction", Beverage Category Greenhouse Gas Modeling, 6th Annual Water Stewardship Benchmarking Study, "A Practical Perspective on Managing Water-Related Business Risks and Opportunities in the Beverage Sector", and dialogue initiatives with several trade, NGO and customer organizations.

BIER is facilitated by the Global Corporate Consultancy of Antea Group ([www.anteagroup.com/gcc](http://www.anteagroup.com/gcc)).

