

Taking the Waste Out of Wastewater:

Water Risk and Reuse in the Food and Beverage Industry

Spun out of a NASA research grant, our breakthrough technology in wastewater treatment isn't simply cutting the cost of water reuse – it's making recycling water *the* cost effective choice for food and beverage producers. Cambrian Innovation solves industrial resource challenges by leveraging advanced biotechnology. We can provide wastewater treatment and resource extraction as a service by creating a renewable micro-utility at our partner's site. Expert water audit engineers execute a five-part plan to solve water-related problems, allowing our partners to focus on their core business priorities while transforming wastewater streams into clean energy and clean water. The plan includes:

- 1) Conduct Comprehensive Water Audit
- 2) Identify Areas for Efficiency Improvement
- 3) Deliver Full Engineering Package for Reuse
- 4) Produce Exhaustive Hazard Assessment Critical Control Point (HACCP) Plan
- 5) Implement

BACKGROUND

In a 2013 industry survey of S&P 500 companies, 74% percent of food and beverage manufacturers reported water-related risk in their supply chain operations.ⁱ As these companies expand, they face increasing resource challenges, including water, energy, and wastewater treatment needs. With drought intensity increasing across the United States, and the rate of local water depletion exceeding that of renewal in many regions, water shortages are predicted to become more frequent than ever.ⁱⁱ Water-related risk, however, is not limited to availability; it encompasses quality, infrastructure, demand, regulation and pricing.

WHY REUSE WATER

A well-managed water reuse project using Cambrian's distributed, modular, and automated architecture can dramatically reduce costs. As water-related risks take shape across the country, local municipalities are putting caps on withdrawals and discharges by production facilities. By turning to water reuse, companies can expand their production capacity and boost revenue streams without exceeding their consumption ceiling.

The economic case for reusing water is clear. The capital and operational costs for a reuse treatment train are not negligible (with electricity accounting for over 25% of annual expenses). However, with Cambrian's technology, the price of a gallon of recycled water is competitive with or lower than that of a fresh gallon.

The table below shows the reuse scenario for a mid-sized food or beverage manufacturing plant in several cities across the country. The Marginal and Annual Savings columns show the dollar amount that a Cambrian Innovation system can provide. Significantly, these calculations *do not* include the costs of an unstable water supply. Facilities lacking water security experience intangible and large-scale costs related to the risks of supply shock.

City, ST	Electricity Rate (\$/kWh)	City Water Rate (\$/hcf)	City Sewer Rate (\$/hcf)	Surcharge (\$/lb)	Marginal Savings (\$/hcf)	Net Annual Savings (\$/year)
Austin, TX	\$0.0127	\$4.67	\$6.60	\$.504	\$1.34	\$26,100
Brunswick, ME	\$.0228	\$3.55	\$4.68	\$.720	\$19.84	\$387,200
Houston, TX	\$0.0872	\$2.93	\$0.00	\$.705	\$7.04	\$137,300
Longmont, CO	\$0.0578	\$2.19	\$3.12	\$.630	\$8.01	\$156,300
Napa, CA	\$0.0898	\$4.08	\$4.58	\$1.05	\$43.19	\$842,900
Oxford, NC	\$0.0664	\$3.07	\$5.16	\$.670	\$8.58	\$167,400
Portland, OR	\$0.0535	\$3.68	\$9.06	\$.622	\$16.03	\$312,800
San Francisco, CA	\$0.0517	\$5.79	\$6.15	\$.440	\$4.33	\$84,400
Santa Rosa, CA	\$0.0898	\$4.01	\$9.90	\$1.15	\$52.68	\$1,028,200

Table 1. Water and Wastewater Rates Compared to Savings with a Cambrian Solution
Marginal & Annual Savings = [Avoided City Fees (volume, strength)]-[Reuse System Costs]

GETTING STARTED

In water conscious areas such as the arid west and the southeast, local water quality boards are enthusiastic about water reuse projects. While permitting can be a potential roadblock, detailed plans and hazard assessment protocols will win over willing agencies. Cambrian Innovation’s five-part plan delivers fast and reliable results for clients.

Cambrian water audit engineers go through the client’s entire production facility process by process, identifying water consuming and wastewater producing operations. Final deliverables for this in-depth audit include a process flow diagram for water through the facility, a value stream diagram for water streams as they pick up value through various processes, and a mass balance for the entire production line.

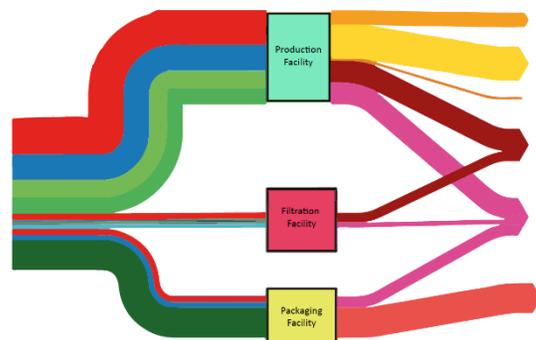


Fig 1. Sankey diagram of water movement in a facility

Leveraging our industry experience and extensive knowledge of water-using processes, Cambrian rapidly identifies areas for improving water efficiency throughout the facility. Examples include CIP tank rinse adjustments, high-efficiency spray nozzles, and opportunities for water capture.

Once the client is primed to use water as efficiently as possible, Cambrian delivers with state-of-the-art design packages to start reusing water. For bulk organic contaminant removal (85% BOD removal) we offer our first-in-class EcoVolt® Reactor. A next-generation anaerobic digester, this bioelectrically enhanced, containerized and modular solution generates high-quality biogas (80-85% methane content in comparison with the typical 60%) which can power an entire reuse equipment train. For water polishing Cambrian deploys our proprietary EcoVolt® MBR (a membrane bioreactor). Removing up to 99% of contaminants, this packaged system slots into the EcoVolt’s architecture to provide seamless treatment. Finally, reverse osmosis membrane skids are added as necessary to achieve required water purity levels. In all, our self-powered treatment train produces water at the EPA’s primary and

secondary drinking water quality standard. This recycled water can be used for non-contact industrial processes like floor cleaning, external bottle rinsing, vacuum pumping, cooling towers, boiler make-up, and landscaping.



Fig 2. Cambrian Innovation's Self-Powered Wastewater Treatment Train

Finally, while recycled water never directly comes in contact with product water, Cambrian produces an exhaustive HACCP plan. The plan identifies hazards that exist in the reuse system and critical points where concentration levels of various chemicals need to be constantly monitored. The HACCP provides the ultimate safety protocol, ensuring the quality of the client's products and serving as a touchstone for any regulating bodies concerned about cleanliness.

As a start-to-finish solution provider, Cambrian Innovation has the experience to identify water and wastewater problems and the innovative tools to enable an attractive, packaged and technical solution. From the comprehensive water audit to our EcoVolt and reuse skid, Cambrian turns industrial wastewater from a cost-center into a revenue stream. With our assistance, typical breweries, wineries and other producers can cut sewer discharge volumes by up to 75% and fresh water consumption by up to 50% (not including offsite irrigation options!).

CONCLUSION

The 2030 Water Resources Group, a "neutral public-private-expert-civil society partnership" led by The International Finance Corporation and McKinsey & Company and comprised of an extended business consortium from Barilla to Coca-Cola, demonstrates an appreciable gap between reliably available water and current water withdrawals. By the year 2030 they predict a 40% aggregated global gap between water supply and water demand.ⁱⁱⁱ There is a new paradigm in water consumption. In order to ensure water security and maintain the uninterrupted flow of their most critical input, food and beverage manufacturers will need to readjust.

To begin this process companies can start by comprehensively understanding their water and wastewater consumption. Determine your wastewater-to-product metric to provide a concrete benchmark against which you can measure improved efficiency. Hire an engineering firm or water auditing company, and request proposals for treatment and reuse skids when appropriate. Wastewater is a misnomer. By tapping into the resources suspended in their discharge water streams, manufacturers can cut costs, capture energy, expand production, and eliminate volatility from their business equation; taking the waste out of wastewater

ⁱ CDP Global Water Report, <https://www.cdp.net/CDPResults/CDP-Global-Water-Report-2013.pdf>

ⁱⁱ US National Climate Assessment 2014 (p. 771-2); Demand for Water Outstrips Supply (Nature), <http://www.nature.com/news/demand-for-water-outstrips-supply-1.11143>; Colorado River Depletion (NASA) http://www.nasa.gov/press/2014/july/satellite-study-reveals-parched-us-west-using-up-underground-water/#.VDanG_lUpw; Colorado River Drought (NY Times) <http://www.nytimes.com/2014/01/06/us/colorado-river-drought-forces-a-painful-reckoning-for-states.html>

ⁱⁱⁱ The 2030 Water Resources Group report Charting Our Water Future (2009), http://www.2030waterresourcesgroup.com/water_full/Charting_Our_Water_Future_Final.pdf