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MEMORANDUM

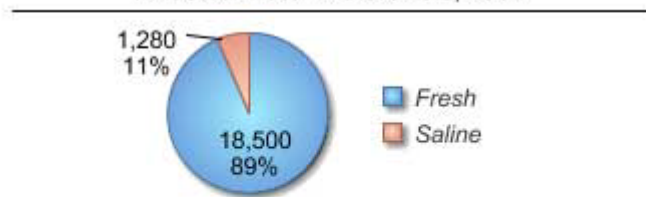
To: Jacqueline Debets, Humboldt Bay Municipal Water District
From: Adrienne Harling, OECD Competitive Intelligence Research Service
Date: October 28, 2009
Subject: Research Summary

What industries/products are the most water-intensive within the United States?

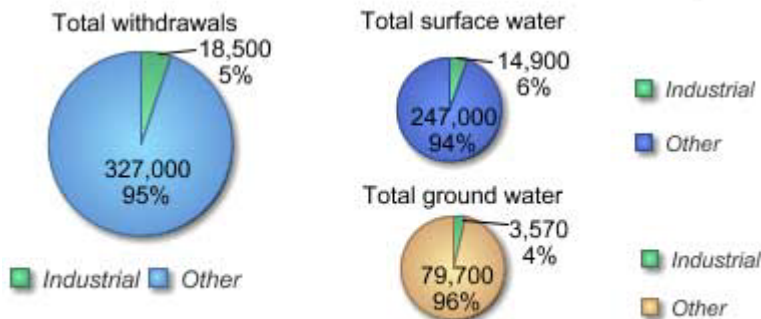
Overview of Industrial Water Use on a National Level (Source: 2)

- In 2000, total US industrial water withdrawals were an estimated 19,700 Million gallons per day, with 18,500 (89%) freshwater and 14,900 Mgal/d surface freshwater.

- Industrial water withdrawals, 2000

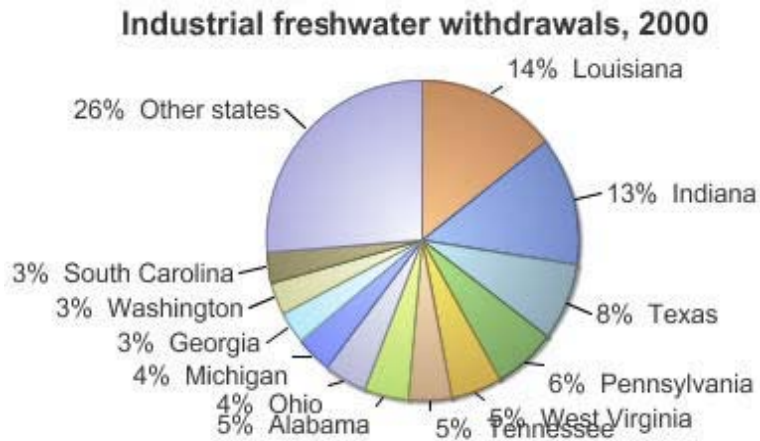


Industrial freshwater withdrawals, 2000



(Withdrawals are in million gallons per day)

- The states using the most industrial freshwater are Louisiana (14%), Indiana (13%), and Texas (8%).



Water-Intensive Industries (National)

- Overview:
 - Industrial water use reporting on the national level is limited:
 - “The USGS Water Use Program does not provide industrial water-use estimates by industry at the national level” (Source: 3)
 - Corporate reporting on water use is inconsistent and “lack of context in water reporting undermines the understandability and usefulness of the data provided” (Source: 1)
 - Appendix A of Source 6 has a detailed analysis of the water footprint intensity for eight water-intensive industries
 - **The following industries are generally identified as being the most water-intensive: Apparel, Automobile, Beverage, Biotech/Pharmaceutical, Chemical, Forest Products, Food Manufacturing, High-technology/Electronics, Metal Mining, Refining, Utility, Paper Products, Coal Products** (Sources: 1, 3, 4, 5)
 - **“Raw material production is generally the most water-intensive segment of industries’ value chains, such as in apparel, food, and beverage manufacturing”.** (Source: 6)
- Specific Industries:
 - Beverages
 - “Beverage manufacturing requires high quality source water, putting the water use of this industry in direct competition with local populations and their drinking water needs.” (Source: 6)
 - “It takes roughly 20 gallons of water to make a pint of beer, as much as 132 gallons of water to make a 2-liter bottle of soda, 39000 gallons of water to produce the average domestic car, including the tires and about 5000 gallons of water to grow a day’s good for a family of four.” (Source: 7)
 - “The total water involved in producing beer is overwhelmingly used on the farm rather than in the brewery” (Source: 8)
 - “In South Africa, the total water footprint is equivalent to 155 litres of water for every 1 litre of beer...with the vast majority of water use (98.3%) associated with crop production, both local and imported” (Source: 8)

- 75 liters of water are required for once glass (250 ml) of beer (largely from producing the barley). (Source: 16)
 - Apparel
 - “Cotton production is the most water-intensive value chain segment for the apparel sector....Cotton is a hugely thirsty plant requiring 25 cubic meters of water for each 250 grams of cotton produced – the amount needed for the average T-shirt.” (Source: 6)
 - “Freshwater is an essential resource for textile processing such as dyeing or bleaching. Yet, a large percentage of textile/garment manufacturing operations are located in water-scarce regions such as Southeast Asia, India and other areas where local communities lack access to reliable and affordable drinking water.” (Source: 6)
 - One cotton shirt requires 2700 liters of water (Source: 16)
 - High-Tech/Electronics
 - “The most significant portion of the industry’s water footprint [is] associated with semiconductor manufacturing. Intel and Texas Instruments alone used more than 11 billion gallons of ultra-pure water for cleaning and rinsing in the production of silicon chips in 2007.” (Source: 6)
 - “Electronic waste (e-waste) can cause extensive contamination of groundwater resources and local ecosystems, which, in turn, can lead to health concerns, regulatory controls, and adverse reputational impacts....e-waste is concentrated with heavy metals, such as chromium, zinc, lead, copper, manganese, selenium, and arsenic that leach into groundwater sources more than other municipal solid wastes.” (Source: 6)
 - Food
 - “Roughly 70 percent of the water used globally is for agriculture, with as much as 90 percent of water dedicated to agriculture in developing countries.” (Source: 6)
 - One 100 gram apple requires 70 liters to produce; one glass of apple juice (200 ml) costs about 190 liters of water. (Source: 16)
 - One kg of beef costs 15500 liters of water to produce (Source: 16)
 - One kg cheese requires 5000 liters of water (Source: 16)
 - Biotechnology/Pharmaceuticals
 - “Because of the high concentration of chemicals and microbial organisms in wastewater released in manufacturing processes, leaks into natural water resources and surrounding ecosystems can be quite harmful. Such spills can severely damage companies’ reputation and brand image. For example, in 2007 pharmaceutical giant Merck agreed to pay \$20 million in assorted fines, environmental improvements and cleanup costs as a consequence of polluting Wissahickon Creek in Pennsylvania with a chemical discharge that resulted in fish kills and fouled drinking water supplies.” (Source: 6)
 - Forest Products
 - “[Forest Products] is very water and energy intensive, especially in pulp and paper manufacturing. In the United States, for instance, the forest products sector is the third-largest water user among industrial manufacturers. Pulp and paper manufacturing is also the third-largest consumer of fossil energy among U.S. manufacturing sectors, representing 12 percent of total energy

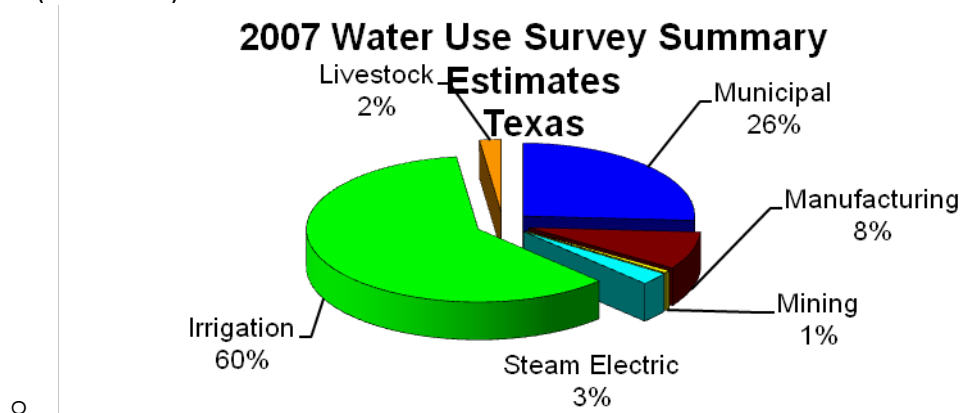
- consumption by U.S. manufacturing industries in 2002. Paper and pulp manufacturing also produces a significant amount of wastewater.” (Source: 6)
 - “[Water Footprint Network] states that the paper industry uses 10 liters of water to produce a sheet of A4”. (Source: 14)
 - Metals/Mining
 - Mining locations are determined by the location of ore and therefore cannot be relocated on the basis of water availability. (Source: 6)
 - Electric Power/Energy
 - “The electric power industry requires a consistent supply of water, and accounts for 39 percent of total freshwater withdrawals in the U.S. Fossil fuel plants and nuclear power plants require about 140 liters and 200 liters of water per kilowatt-hour of electricity produced, respectively.” (Source: 6)
 - “Heated discharges from power plants have a harmful effect on water quality and local ecosystems.” (Source: 6)

Selected State Information on Industrial Water Use/Water-Intensive Industries

- Louisiana (Source: 4)
 - “Industry in Louisiana withdrew approximately 3100 Mgal/d of water in 2005”, with 2800 Mgal/d from surface water sources.
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Standard Industrial Classification	Surface Water Withdrawals (Mgal/d)
Oil and Gas Extraction	2.58
Nonfuels/nonmetals mining	.05
Food Products	25.88
Paper products	109.08
Chemicals	2218.84
Petroleum refining	486.02
Primary metals	1.00

- Indiana (Source: 9)
 - “Indiana water users withdraw approximately 10,700 million gallons of water per day from our ground and surface water resources. Surface water for energy production (water used for cooling in coal-fired power plants) accounts for the largest part (65%) of the state’s total reported water use. Indiana continues to rank among the highest industrial self-supplied water users in the U.S. (2,300 Mgal/day)...”
- Texas (Source: 10)



Last updated on 08/28/2009 - Estimates may be revised as additional or more accurate data becomes available through survey responses.

- California (Source: 15)
 - Industrial water use in 2000: 665,000 Acre Feet/Year
 - California’s most water intensive industries in 2000 were: Refining (84 Thousand Acre Feet (TAF)), High Tech (75 TAF), Fruit and Vegetable Processing (70 TAF), Beverage Processing (57 TAF), Textiles (29 TAF), Paper (22 TAF), Fabricated Metals (20 TAF), Dairy Processing (17 TAF), and Meat Processing (15 TAF)
 - **Table C-1 Water Use Coefficients by SIC Code, Industrial Sector**

SIC	Description	Gallons per employee per day (GED) ₁
20	Food and kindred products	1,967
21	Tobacco manufactures	N/A
22	Textile mill products	1,530
23	Apparel and other textile products	37
24	Lumber and wood products	2,144
25	Furniture and fixtures	53
26	Paper and allied products	1,000
27	Printing and publishing	98
28	Chemicals and allied products	833
29	Petroleum and coal products	11,399
30	Rubber and misc. plastics products	120
31	Leather and leather products	32
32	Stone, clay, glass, and concrete prod.	1,304
33	Primary metal industries	1,318
34	Fabricated metal products	738
35	Industrial machinery and equipment	110
36	Electrical and electronic equipment	284
37	Transportation equipment	228
38	Instruments and related products	142
39	Misc. manufacturing industries	86

₁ Based on a 225-day year

Other regional campaigns for attracting water-intensive industry

- Milwaukee, WI.
 - See http://water.mpw.net/files/MWW_for_Business.pdf for their brochure advertising their water resources to businesses
- Dayton, OH (Source: 5)
 - “The Dayton municipal water system sees daily consumption of about 70 million gallons, with an additional total capacity of 100 million gallons daily.”

- Dayton Development Coalition has launched a campaign to attract industry to their water abundance (called H2Open for business)
- “IT, food and beverage, utilities, those are just a few [water intensive industries] that just jump out”
- “It’s not just business. Those involved hope to capitalize on the recreation possibilities of a river system ‘that’s still flowing in the warmer months’”
- An idea to host an annual water conference/trade show came up in recent discussions by business development participants in the area.
- See <http://www.h2openforbusiness.com/>, and <http://www.getmidwest.com/regionOverview/watersupply.cfm?sectionID=ro&subNav1D=10&subNav2ID=0>) to see more details about the H2Open for business campaign

Information about non-use value of freshwater resources

- Decreasing water use is a trend within water-intensive industries (Sources: 12, 13, 14)
- See <http://www.csc.noaa.gov/coastal/economics/index.htm> for an overview of economic valuation of non-use values of environmental resources
- Direct Utility Avoided Costs/Environmental Benefits Models: “The purpose of the Direct Utility Avoided Costs and Avoided Benefits Studies project was to conduct research and develop a model that will assist water utilities with calculating avoided costs and developing methods to quantify for the first time the environment benefits and costs associated with implementation of water efficiency programs”: <http://www.cuwcc.org/resource-center/technical-resources/bmp-tools/direct-utility-ac-eb-models.aspx> (Source: 17)

Sources:

1. Pacific Institute’s Corporate Reporting on Water: A Review of Eleven Global Industries (http://www.pacinst.org/reports/water_reporting/corporate_reporting_on_water.pdf)
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3. email correspondence on October 29, 2009 between Adrienne Harling (researcher) and Nancy Barber (USGS Water Use Team)
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10. 2007 Texas Water Use Summary Estimates (Texas Water Development Board) <http://www.twdb.state.tx.us/wrpi/wus/2007est/2007wus.htm>
11. California Urban Water Conservation Council <http://www.cuwcc.org/default.aspx>
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16. Water Footprint Network Product Gallery
<http://www.waterfootprint.org/?page=files/productgallery>
17. California Urban Water Conservation Council <http://www.cuwcc.org/>

Estimated Value of Services

Humboldt State University is offering Competitive Intelligence Services free of charge to qualifying businesses during the first year of the Competitive Intelligence Research Service. After this pilot year, we will implement a fee schedule for these services at approximately 20% of what it would cost from an independent source. We estimate that the value of the services we have provided, as described in this memo and if provided through an independent source, is approximately \$2400.

Because Humboldt State University is dedicated to community and economic development of the North Coast, we intend to secure grant support for this service on an ongoing basis to keep the fees as low as possible. Therefore, the estimated value of this research assignment provided by our office after December 2009 would be \$480. Please consider budgeting for Competitive Intelligence Research Services in the future.