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March 2011

Special Report

Valuing Water: How Can Businesses Manage the Coming Scarcity?

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The Initiative for Global Environmental Leadership (IGEL) and Knowledge@ Wharton have partnered to create this special report on business and the environment. We are most grateful to the Xerox Foundation for supporting collaboration and funding of this edition.

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Valuing Water: How Can Businesses Manage the Coming Scarcity?

Water is a paradoxical commodity: It seems free and plentiful, yet its supply is under tremendous strain. Use of fresh water has more than doubled over the past 50 years, and many fear that we are coming close to a frightening breaking point, a world where chronic water shortages for farmers, businesses and people is the norm. Some experts even see international conflict emerging over access to dwindling supplies. Recognizing these concerns, companies are undertaking major programs to realign their water use with core business and humanitarian interests. But while objectives like being "water neutral" and using "footprinting" — tracking the use of water throughout the supply chain — are ambitious, what is being done to achieve them? Are these goals realistic, and will they have enough impact? This special report addresses these questions.

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In a Water-stressed World, Corporations Conserve

We live on a water-stressed planet.

As the Alliance for Water Stewardship points out, "Current demand for water from cities, agriculture and industry is already unsustainable in many regions, yet is projected to increase significantly in coming years." According to a report by the 2030 Water Resources Group ("Charting Our Water Future"), just 20 years from now, global water requirements will be "a full 40% above the current accessible, reliable supply." The report concludes that a third of the world's population will live in places where this deficit is larger than 50%.

The facts underlying these projections are sobering. We all learned in school that we live on a watery planet. But over 97% of that water is salty; less than 3% is fresh and drinkable. And nearly 70% of the fresh water is frozen in the form of glaciers, ice and snow. Underground aquifers hold almost all the potable water available in liquid form. The rate of depletion of the these aquifers — which sustain agricultural and corporate users and provide drinking water for hundreds of millions of people — more than doubled, according to *Geophysical Research Letters*, from 33 trillion gallons per year to 75 trillion gallons, in the four decades between 1960 and 2000.

Surface water (a tiny fraction of liquid fresh water) also is at risk. As *Nature* reported in the fall of 2010, citing the results of a global study, "Multiple environmental stressors, such as agricultural runoff, pollution and invasive species, threaten rivers that serve 80% of the world's population." The report, written by nine academic and research institutions around the world, stated, "Our study found that vast areas across both the developed and developing world arrive at similarly acute levels of imposed threat to their freshwater resources."

Corporations Pay Attention

Corporate concern about water scarcity led to the formation of the Philadelphia Global Water Initiative, which held its fourth annual conference, "Managing the Last One Percent: Allocating Water to Meet the U.N. Millennium Development Goals," at the University of Pennsylvania on November 4, 2010. Speaking at the conference, Stanley L. Laskowski, a lecturer at the University of Pennsylvania and the founder and president of the water initiative, emphasized that some progressive high-volume corporate users of water "understand the issues well and are doing good work, sometimes even more than the governments in host countries where the plants operate." Robert Giegengack, professor emeritus in the department of earth and environmental science at the University of Pennsylvania and also a faculty member of the Initiative for Global Environmental Leadership at Penn/Wharton, agreed: "Corporations are starting to get it."

> "Water scarcity is a driver for innovation. If you tell companies to do more with less water, they figure out how to do it."
>
> —**Will Sarni,** CEO, DOMANI Sustainability Consulting

One reason is clear: It is not easy for water-intensive industries to brush off corporate critics like Vandana Shiva, who writes in her book *Water Wars*, "When water disappears, there is no alternative. For Third

World women, water scarcity means traveling longer distances in search of water. For peasants, it means starvation and destitution as drought wipes out their crops. For children, it means dehydration and death. There is simply no substitute for this precious liquid, necessary for the biological survival of animals and plants."

And global corporations take notice when the United Nations General Assembly, declaring that 1.5 million children under 5 years old die each year as a result of water- and sanitation-related diseases, unanimously adopts a resolution calling access to clean water "integral to the realization of all human rights." But as more and more corporations are realizing, there are compelling business as well as humanitarian reasons for taking a proactive approach to water issues. As a recent report ("At the Crest of a Wave") issued jointly by the Pacific Institute and Business for Social Responsibility, pointed out, "Proactive corporate action that dramatically overhauls how companies use, innovate around, and invest in water supplies will be crucial for gaining regulatory and community goodwill, improving reputation and mitigating risks."

One of the most pressing concerns is what Karin Krchnak, director of international water policy at The Nature Conservancy, calls "the social license to operate." Speaking at the Philadelphia conference, Frederick N. Scatena, chair of the department of earth and environmental science at the University of Pennsylvania, noted that when corporate water users fail to build a reputation as responsible neighbors, sometimes even scientifically sound arguments — such as the assertion that a company's water draws are separate from and don't affect community supplies — will not prevail in the court of public opinion. "They have to become good water stewards and also let people know what they're doing through well-planned education campaigns," he said. Coca-Cola learned this the hard way in 2004 when it was forced to close a plant in Kerala, India, because of local outrage over water pollution. Whether such charges are justified may not matter if a company loses its host community's goodwill.

To secure and maintain a social license to operate, many companies have had to become acutely sensitive about where they site their water-intensive facilities. In water-stressed regions, "It's a challenge for corporations to site their facilities properly and understand the needs of downstream users," Scatena said. "They have to cultivate relationships with their host communities." And then there is cost. In the short term, some companies have decreased expenses by reducing their use of water. Longer term, many are taking steps now to avoid or minimize the affect of inevitable price increases and/or expensive regulations as water becomes increasingly scarce. As Peter Brabeck-Letmathe, chairman of Nestlé, recently warned in *The Guardian*, "While our collective attention has been focused on depleting supplies of fossil fuels, we have been largely ignoring the simple fact that, unless radical changes are made, we will run out of water first, and soon. The era of water at throwaway prices is coming to an end."

Will Sarni, the CEO of DOMANI Sustainability Consulting and the author of the new book *Corporate Water Strategies* (Earthscan), summed it up at the Philadelphia conference. Water costs, he said, "are noise on a profit-and-loss statement, but this is still a critical business issue. Why? Because of reputation, brand and the need to secure a license to operate. Water is a show stopper — without water, you can't make beer or many other products. And water scarcity is a driver for innovation. If you tell companies to do more with less water, they figure out how to do it. Companies are innovating on water use because they know it's critical for their business."

Proactive Corporations Set the Pace

As the world's largest producer of non-alcoholic drinks, including bottled water, Coca-Cola is singled out for unsustainable practices despite making water conservation a cornerstone of its business model in recent years. While it has been targeted by such groups as the California-based India Resource Centre and Corporate Accountability International for its water policies, Coca-Cola insists that its efforts to conserve water began before those campaigns were launched. It says it increased water efficiency 6% from 2003 to 2004, and reduced the amount of water needed to produce its signature product. In 2007, Coca-Cola set an aspirational goal of "water neutrality," or returning "to communities and nature" a supply of water equivalent to the amount it uses for its beverages and their production. The company says it is engaged in 250 community water and watershed projects in 70 countries and in 2009 offset 22% of the water used in its beverages.

Obviously, there's more to be done. According to Lisa Manley, director of Coca-Cola's environmental communications, "All of our bottling companies in 200 countries, some 900 plants, were asked in 2009

to do an assessment of their water vulnerabilities and create water protection plans by the end of 2012. We're conducting a big push on what we think is the next layer of local understanding of water risk. We think our bottling partners can be part of the solution for a host of water challenges."

Nestlé evolved to its current proactive stance. Bottled water companies in general, said Scatena, "have not responded as well as they could" to concerns about allocation issues. Although it may be tempting to do so, suing your accusers is probably a no-win situation. But Nestlé Waters threatened to do just that when Florida's Miami-Dade County aired radio spots saying that its public water was "cheaper and safer" than bottled. *Fast Company* magazine wrote, "A water company suing the public water department is like Gymboree and McDonald's Play-Place suing the city parks department, or a tanning salon suing the sun."

That threat of a lawsuit got Nestlé Waters tarred as one of three "Corporate Scrooges" in 2008 by the activist group Co-op America. That was then. Today, Nestlé Waters, which has gone through years of conflict in Maine, where its Poland Spring subsidiary sources its water, is leading conservation efforts. "Over the last 12 months, news coverage of corporate activities and impacts has exploded, and our company has found itself on the front lines of society's emerging dialogue on sustainability," said Nestlé Waters CEO Kim Jeffrey in the company's 2008 Corporate Citizenship report. He said the company is now "best-in-class for efficient water use in the beverage industry," and is "working with stakeholders to make our siting and monitoring processes more transparent …. Nestlé Waters is committed to responsible water management, and to respecting the interests of our neighbors and the communities where we do business."

General Electric is emerging as a major force in industrial conservation. Jeff Fulgham is chief sustainability officer at the $20 billion GE Power and Water division. "We have options for replacing oil, such as renewable wind and solar," Fulgham said. "With water, there isn't an alternative. We have to use existing resources. And so slowly but surely, the least-efficient water users are learning to change their ways. It's like being an alcoholic — when you realize you're a water hog, you can change your practices. And acquainting companies with best practices is what our teams do every day."

As Fulgham pointed out, many countries are imposing regulations on the chemical, refining, mining and energy industries to dramatically reduce — or entirely end — the discharge of hazardous wastewater. Those regulations, coupled with a tripling of water demand to meet a doubling of power demand by 2050, helped create a vibrant business in water reclamation and processing. GE increased annual clean water and energy research funding from $700 million in 2005 to $1.5 billion in 2010.

The biggest opportunities for water conservation, Fulgham said, exist with fossil fuel power plant users, which account for half of industrial water use in the United States. "The low-hanging fruit is with water used for cooling. By optimizing controls, we can greatly reduce water consumption. And we can take water out of cooling towers, clean it up and reuse it in the plant." Fulgham acknowledged that water-use improvements have public relations benefits such as "a 20% reduction across the board," which has appeal to the general marketplace. But in many cases, companies have no choice because regulations or stronger competition for existing sources means they no longer have access to the same amount of water or are being asked to pay high premiums for it. "So water conservation also has big financial benefits," he said. "Green is green in this case and it drops right down to the bottom line with a direct payback to the company."

The province of Alberta, Canada, has become "very aggressive" in reducing water consumption by the companies that produce oil from its tar sands, Fulgham noted. And water-stressed Israel provides another example by strongly encouraging water reuse.

Water desalination plants and other industrial water users have become more proactive in reclaiming waste streams that become pollutants. The *New York Times* reports that salt discharged from desalination plants has caused alarm by raising ocean salinity levels in Dubai, but Fulgham pointed out that such salt, as well as other chemicals, can be extracted, dried, and then sold for industrial uses. "There is value in wastewater," he said. "We're seeing some really cool opportunities."

The city of Tempe, Ariz., upgraded to GE membrane bioreactor technology at its Kyrene Water Reclamation Facility, allowing it to double its daily output of processed wastewater, much of which goes directly to a nearby power plant.

But the reclaimed, non-potable water also can be used for recreational purposes in arid Tempe, such as irrigating a local golf course and refilling Tempe Town Lake, which loses up to two million gallons a day to evaporation. "We need to match source water to the right use," Fulgham said. "If a community does not have a lot of well or surface water, we need to leave those resources alone, look beyond the city, and start using reuse water."

Another GE success story, according to Jeff Ballew, marketing operations director for GE Power and Water, is the Soltaire luxury apartment towers in Manhattan. Using the company's treatment equipment, Soltaire recycles 98% of its wastewater in the building itself. Applied in Duckett Creek, Mo., GE technology recycles wastewater for 1,400 homes without the need for large-scale infrastructure.

Hewlett-Packard has intensely focused on recycling its printer cartridges and remaking them into new cartridges. The company recently passed a milestone: one billion cartridges produced with recycled content. According to environmental sustainability manager Jeff Walter, the company from 2005 to 2010 reduced its carbon footprint by 22% and its water use by 69%. Water is a prime ingredient in the production of virgin ink cartridges, both for energy generation and for producing raw plastics. According to Walter, "If we total up all of our water inputs, we see significant reductions on the order of 272 million gallons."

Xerox is also making dramatic cuts in both energy and water usage through its cartridge recycling efforts in a new partnership with global recycler Close the Loop. The program includes on-site "Eco Boxes" so that consumers can ship back their used toner bottles, cartridges and toner waste free of charge. Xerox monitors water consumption worldwide, and it reports a 7% drop from 2008 to 2009, partly due to process improvements in manufacturing and facility maintenance. Other factors included production reductions and seasonal variations at some sites.

ITT Corporation's Value of Water Survey, released in October, reveals that the public not only recognizes water as an increasingly important resource, but is willing to pay more than they do currently to ensure a clean, reliable supply. The study showed that 63% of those polled would pay an average of 11% more on their water bills to upgrade crumbling municipal infrastructure. According to the U.S. Geological Survey, water main breaks and leaks lose 1.7 trillion gallons of water annually in the United States.

And according to Colin Sabol, vice president of marketing and business development at ITT Fluid and Motion Control, a $4.5 billion business that makes pumps and wastewater equipment, "The survey shows that people think water is important, and they value it more than they do their heat, electricity, Internet service and cell phone," he said. But they also tend to take it for granted, along with the often centuries-old maze of pipes that deliver it to American homes and take it away as wastewater.

A prime model for municipal management of water, said Sabol, is Singapore, which has few resources of its own. After relying on neighbors such as Malaysia through the 1970s, Singapore decided to become water independent, evolving a system that combines desalination and efficient stewardship of existing water with aggressive wastewater recycling. Today, Singaporeans toast each other with glasses of "NEWater," reclaimed using microfiltration, reverse osmosis and ultraviolet disinfection from ITT Fluid and Motion Control. NEWater can meet 30% of Singapore's water needs. "Singapore charges about twice what we do in the U.S. for water," Sabol said, "and as a result they're able to keep their infrastructure working well and are now independent with water." He cited other examples where scarcity has led to strong and effective conservation plans, including drought-plagued Australia. Water stress in Spain has forced changes in agricultural processes and a switch to less water-intensive crops.

Diageo, based in the United Kingdom and owner of the Guinness brewing brand, has set a goal of improving water efficiency by 30% in water-stressed regions from 2007 to 2015, and cutting water waste 50% in the same period. In its 2010 Corporate Citizenship Report, Diageo reports that water efficiency has improved 8.3% against a 2007 baseline. But the company also acknowledged that water wasted in stressed regions had gone up 11.1%, "primarily driven by an increase in production at these sites." That's the opposite of the experience at Xerox, which had water-use reductions because of production decreases. For that reason, Diageo says in its corporate report, "Substantial work needs to be done to reach our goal of 50% reduction by 2015," resulting in some targeted conservation programs in Africa.

Despite setbacks, the corporate accountability group CERES awarded Diageo the highest score in its 2010 report "Murky Waters: Corporate Reporting on Water Risk." Other examples of corporate action abound. According to the CERES report, the mining sector has achieved the best results, followed by the beverage industry. (Homebuilding companies received the lowest scores.) Some other CERES highlights:

- Alcoa has set a target of zero process water discharges by 2020.
- Danone (Dannon in the United States) has put in place an incentive system for senior managers that ties environmental goals, including water use, to compensation.
- Pinnacle West, an Arizona utility, is using treated sewage to cool power plants in Phoenix, preserving enough drinkable water for 75,000 homes.

Watchdogs Spur Progress

The Nature Conservancy (TNC), like several other nonprofit groups including CERES and the World Resources Institute, is working to spur and support corporate action on water issues with encouraging results. According to Krchnak, also a speaker at the Philadelphia conference, corporations today "are doing much more than they have in the past to engage with us and with the global community." She pointed to recent World Water Week events in Stockholm, which attracted the participation of far more private-sector companies than in the past. "Companies are focusing on protecting watersheds and reducing their water footprint," she said.

TNC is one of seven nonprofit groups that came together to form the Alliance for Water Stewardship, which over the next two to three years will sign up corporations around the world that agree to adhere to a set of strong water policy standards. "It's like the [sustainable lumber certifying] Forest Stewardship Council, but for water," Krchnak said.

Clive Lipchin, director of research at the Arava Institute for Environmental Studies in Israel, said at the conference, "Water cannot be free. It costs to move water, it costs to protect watersheds, and we have disregarded water's true economic value." A key lesson from Lipchin was that wastewater could easily substitute for drinking-quality water for many large-scale corporate uses.

CERES, in its "Murky Waters" report on 100 companies, also recommends that companies:

- Include water risk performance data and risk factors in financial reporting.
- Provide data at the facility level for operations in water-stressed regions and also disclose what percentage of operations are in those regions.
- Develop long-range guidelines for managing water risks, including reduction targets.
- Fully disclose how they work with stakeholders to reduce water risks and with suppliers to develop performance-based supply-chain goals.
- Develop water-related products that will have market potential in our water-stressed world.

Water Neutrality: A Controversial Concept That Can Spark Innovation

Prodded by growing water scarcity and tightening environmental regulations, water-intensive corporations in the Unites States and abroad are increasingly working to achieve not "zero water waste," but the much more ambitious and problematic goal of "water neutrality." Water neutrality as a concept was defined by a group of nonprofit groups (including the World Business Council on Sustainable Development, the UNESCO Institute of Water Education, and the World Wide Fund for Nature) that met with Coca-Cola in the Netherlands in 2007. According to the subsequent "Water Neutrality: A Concept Paper," it "was chosen as an inspirational phrase that resonates with the public," and could be used to describe efforts to offset a business' water footprint.

> "Water neutrality is a devious initiative by some of the global water giants to position themselves as environmental stewards while also exercising even more control over water management."
>
> —**Richard Girard,** Polaris Institute

Central to the concept is the idea that companies can measure the "embedded" water used to create their products. Through water footprinting, companies can determine how much water went into manufacturing operations and then offset that with conservation, recycling, water replenishment efforts, and community projects. It's easier to describe than to achieve. The concept paper is peppered with caveats. "Taking a strict interpretation," it says, "no individual or entity that uses water can ever be entirely water neutral, as water use cannot be reduced to zero. However, we feel that as long as the term is used in a consistent and transparent manner to drive positive action on water issues, then it might have potential similar to that of carbon neutrality."

The groups that came together on water neutrality made it clear that in a strict sense the concept could be "troublesome" and "may even be misleading" since a residual water footprint is unavoidable. But no alternative terms, they said, have "the same gravity or resonance (inspiration) with the media, officials or NGOs ...." Nonetheless, because the name was "the subject of ongoing debate," the Water Neutrality Group that grew out of the Dutch meeting subsequently changed its name to the more easily accepted Water Footprint Working Group.

The uncertainty over water neutrality as a concept set off Coca-Cola's most vociferous water-use critic, the India Resource Center, which charged that the bottler uses this "impossible to achieve" goal simply because it "resonates well" with the media, officials and NGOs. And according to Richard Girard of the anti-corporate Polaris Institute, water neutrality is "a devious initiative by some of the global water giants to position themselves as environmental stewards while also exercising even more control over water management."

Embracing a Concept with Resonance

But precisely because the concept does have "resonance" — and parallels the well-known phrase "carbon neutral" — it can help educate the public about water scarcity and what companies are doing about it. The critical question, then, is whether companies should follow Coca-Cola's lead and adapt water neutrality as a stretch goal that will stimulate creative thinking and help launch ambitious conservation programs that would otherwise languish. On balance, and accepting that the concept is a work in progress with definition issues, it appears to be a valuable tool.

Stanley L. Laskowski, a lecturer at the University of Pennsylvania and the founder of the Philadelphia Global Water Initiative, said that water neutrality "could be a good organizing concept, one of perhaps several organizing water concepts for a progressive company. Others could include the importance of managing water at a watershed level, compliance with all water quantity/quality regulations, full transparent disclosure of decision-making processes and assistance to the global community in reaching its water goals."

Water neutrality is not necessarily new, though it has rarely been associated with consumer products. According to Robert Giegengack, professor emeritus in the department of earth and environmental science at the University of Pennsylvania and also a faculty member of the Initiative for Global Environmental Leadership at Penn/Wharton, the concept is common in communities that that ask developers to "balance the water budget" in construction projects. To help balance the city's water budget in Philadelphia, storm water runoff is collected and reintroduced to the groundwater via infiltration galleries (which use gravel to help purify the water) and other methods. The concept, often used for university construction projects, is well developed at Villanova University and other schools. "Penn is trying to do more or less the same thing [through the Green Campus Partnership] as is the city of Philadelphia via its new storm water management plan," Giegengack said.

The quest for water neutrality is not a "feel good" business exercise. The United Nations concludes that if present trends continue, two-thirds of the global population (more than four billion people) will live under water stress in 15 years. Companies doing business in regions of water scarcity will be forced to conserve, even to the point of no net reduction to the water supply.

Karin Krchnak, director of international water policy at The Nature Conservancy and a speaker at the fourth annual Philadelphia Global Water Initiative conference, which was held at the University of Pennsylvania last November, put it bluntly. "We're losing fresh water much faster than other water resources," she said, adding that many countries have made progress on developing integrated water resource management plans, but efforts to have those plans in place by 2005 fell short. "We missed that deadline in most countries," she said. "We're on that path, but it is a very challenging path."

Taking the Plunge: Coca-Cola and Water Returns

Despite the difficulty of the challenge, Coca-Cola announced its water neutrality policy in 2007 at the World Wildlife Fund's annual meeting in Beijing. The company said it would "return to communities and to nature an amount of water equivalent to what we use in all of our beverages and their production." An interim Coca-Cola goal by the end of 2010 was to "return all the water that we use for manufacturing processes to the environment at a level that supports aquatic life and agriculture."

"Companies like Coca-Cola use so much water that they've discovered it's a major benefit to recycle it and use it carefully," said Frederick N. Scatena, chair of the department of earth and environmental science at the University of Pennsylvania. "In the short term, companies are probably not competing for the resource with their host communities but as those communities and their water needs grow, it becomes more of an issue. There's more demand and more pressure to preserve local water resources."

Coca-Cola said it would reach its neutrality goal by "reducing the amount of water used to produce our beverages, recycling water used for manufacturing processes so it can be returned safely to the environment, and replenishing water in communities and nature through locally relevant projects."

Progress is being made:

In 2009, 89% of Coca-Cola facilities worldwide — accounting for 94% of its volume — were in compliance with the company's strict water treatment standards.

The company wants to improve water efficiency 20% from 2004 levels by 2012. By 2009, efficiency had improved 12.6% over the 2004 baseline.

At the end of 2009, Coca-Cola was replenishing 22% of the water used in its finished beverages by participating in 250 local water projects. The goal is a 100% replenishment rate by 2020.

Coca-Cola's replenishment work is by definition local and small scale, but it is making a real difference in far-flung corners of the world where the company operates. In Argentina, for instance, company-installed household water pumps have provided water access for 300 people. In China, 100 wells are giving consistent water access to 9,240 people. And in Ethiopia, where existing water infrastructures have been rehabilitated and new ones constructed, 26,754 people now have full water access. In addition, new pit and school latrines are providing much-needed sanitation, which further protects the local watershed.

Water Competition: A Growing Issue

Coca-Cola is just one of many companies that combine heavy water use with growing concern about it. According to *EL Insights*, the corporate water treatment market is likely to grow more than 11% annually, from $1.5 billion to $2.5 billion, from 2010 to 2015. "Water is integral to the global economy and scarcity of this resource could provide a threat to the bottom line of companies," *Insights* said. "Investors are beginning to focus their attention on improving disclosure of the strategies to reduce the potential exposure to the risk."

The Ethical Corporation survey "Unlocking the Profit in Water Savings" found that 99% of sustainability respondents believe that water-related concerns will "become more of a priority" for businesses in the next five to 10 years. And 52% identify water stewardship as one of their company's top five responsible business issues. According to the report, "Water has emerged as one of the much-discussed hot topics among sustainability professionals." More pointedly, "At the Crest of a Wave," a joint study by Business for Social Responsibility and the Pacific Institute, concludes, "In the next two to five years, companies will need to adapt to availability concerns such as water stress and flooding; quality concerns, including increasingly contaminated surface and groundwater; and access concerns, specifically competition (real or perceived) with other water users."

The good news is that although water neutrality is still a long-term goal, companies are making progress with identifying and reducing their water use. According to the GreenBiz Intelligence Panel in 2009, 31% of companies — and 46% of those with revenue over $1 billion — have conducted a water footprint analysis. And the U.S. Geologic Survey reports that U.S. water use is dropping in real terms: 5% from a peak in 1980 to 2009 despite an 80 million population increase in that period. A big reason for that decline was a 30% reduction in industrial water consumption since 1985.

First Responders: Working Toward Water Neutrality

Peter Gleick, president of the Pacific Institute, which co-authored the "Crest of a Wave" report, said the theory of water neutrality is similar to that of carbon offsets: Corporations compensate for any process water they use by providing an equal amount of previously unavailable water. "That's the theory," he said, "but the practices are going to be more difficult." Will Sarni, CEO of DOMANI Sustainability Consulting and a speaker at the Philadelphia Global Water Initiative Conference, said it could be problematic for companies to claim to have attained water neutrality. Consumers expect to see a direct exchange: a gallon of water returned to the same source that the company depleted. But that's not how offsets work.

To be effective, a water neutrality strategy would need to be able to accurately measure the water used in production and distribution of a company's products. Just such a useful water labeling system for packaged foods was developed by Arjen Hoekstra of the UNESCO-IHE Institute for Water Education, a co-author of the water neutrality concept paper. Hoekstra, who originated the concept of water footprinting, created www.waterfootprinting.org, which includes a product gallery explaining the average water content of many common products. For instance, a cup of coffee has 140 liters of "embedded water," but a hamburger, which many consumers wouldn't associate with water at all, accounts for 2,400 liters. A kilogram of chicken meat requires even more water: 3,900 liters. An apple requires 70 liters of water to grow to maturity, a single slice of whole wheat bread takes up 40 liters, and a kilogram of cheese uses 5,000 liters. These disparities can help educate consumers and companies about water allocation.

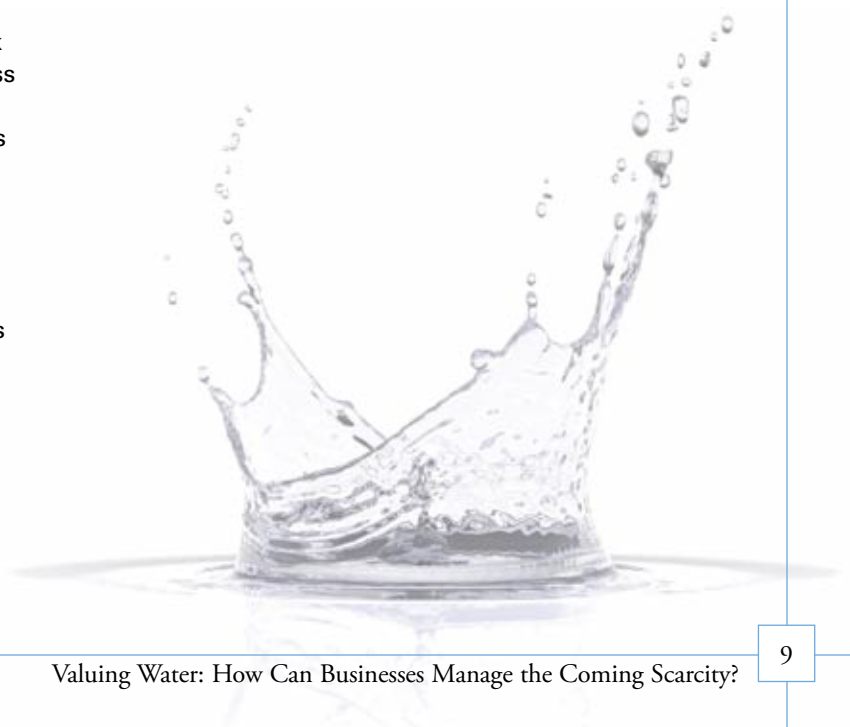
A joint 2009 report from Sustain and the Food Ethics Council in Britain calls for all food products to display water footprinting information. Co-author Tom MacMillan told *The Guardian*,

"Public awareness of water scarcity remains low." Consumers, he said, "are rarely exposed to the direct effects of severe water shortage and cannot readily see the links between their purchases and water shortage in other countries. Water use is not reflected in the price of the final product."

Companies are determining their water footprints, adopting measurement tools and then setting ambitious goals. Cadbury reduced its water consumption 10% from 2006 (10 million tons) to 2007 (nine million tons). Its Asia Pacific region has adopted a water neutrality policy at manufacturing sites with India and Australia in the lead. Cadbury India is aiming for zero water discharge, and a waterless lubrication system introduced in Australia and New Zealand is saving tens of millions of liters annually.

PepsiCo says it achieved water neutrality in its 2009 Indian operations, which include 45 bottling and snack plants. The beverage giant achieved "positive water balance" by recharging six billion liters of water and consuming only 5.17 billion liters, *The Economic Times* reported. PepsiCo Chairman and CEO Indra Nooyi said its achievements would be mirrored in other water-scarce markets, including China. Anheuser-Busch, obviously a major water user, said it hopes to achieve a 99% recycling and reuse rate by the end of 2012. It's trying to reduce water use 30% from 2007 levels, "saving enough water to fill 25,000 Olympic-size swimming pools" and claiming the title as the world's most water-efficient brewer. "We are acutely aware that water is a finite and precious resource and the principal ingredient in our products," said Carlos Brito, CEO of Anheuser-Busch InBev.

Now that water has been clearly identified as a risk factor and a possible deal breaker to doing business in specific regions, the pursuit of water neutrality has become a priority for water-intensive industries around the planet. While the goal itself may be technically impossible, it is probably achievable under the relatively narrow definition advanced by Coca-Cola, some experts note — and striving to achieve it appears to be encouraging technological innovation and creative thinking among companies that have typically paid little attention to resource management.



Thirsty Power: Confronting the Energy-water Nexus

Frequent reports suggest that peak oil and water shortages are among our biggest environmental challenges, but we hear less often that they are closely related. It turns out that most energy production uses water intensively. It's called the "Energy-Water Nexus," and it's a growing problem, particularly because some of the "greenest" forms of energy, including ethanol and biodiesel, are also the biggest users of water. And some energy production techniques, such as hydraulic fracturing for natural gas, couple large-scale water use with potential water pollution.

"In almost every type of power plant, water is a major hidden cost," reported *IEEE Spectrum* magazine earlier this year. "Water cools the blistering steam of thermal plants and allows hydroelectric turbines to churn. It brings biofuel crops from the ground and geothermal energy from the depths of the Earth. Our power sources would be impotent without water."

> "Ideally, by looking at water and energy together, we may in some cases be able to solve two or more problems at once."
>
> —**Stanley L. Laskowski,** Founder, Philadelphia Global Water Initiative

The reality of water-dependent energy means that any holistic impact analysis must take water consumption into account. "The impact on water resources is something that should be part of a larger life cycle analysis for any energy strategy," said Stanley L. Laskowski, a lecturer at the University of Pennsylvania and the founder of the Philadelphia Global Water Initiative. "This should include the impacts on water quantity and water quality. Ideally, by looking at water and energy together, we may in some cases be able to solve two or more problems at once. For example, capturing solar energy while condensing water and growing food."

Electricity: The Second-largest U.S. Water User

The Sandia National Laboratories report that "the electricity industry is second only to agriculture as the largest user of water in the United States." Producing electricity from nuclear and fossil fuels — about 75% of U.S. electric power — uses 190 billion gallons of water *every day*, which is 39% of all U.S. freshwater withdrawals. By contrast, irrigation and watering livestock uses 41% of withdrawals, and industrial and mining uses 8%. Domestic and commercial use amounts to only 12%.

Sandia quantifies the water use of the coal industry, which produces the fuel for 52% of electricity production in the United States. Every kilowatt-hour of coal generation requires the withdrawal of 25 gallons of water. "That means U.S. citizens may indirectly depend upon as much water turning on the lights and running appliances as they directly use taking showers and watering lawns," according to a Sandia Energy-Water Nexus overview.

It's important to clarify the difference between water withdrawals and water consumption. A National Renewable Energy Laboratory study found that only the small percentage of water that evaporates through power plant use (2.5% per

day in the United States) actually escapes into the atmosphere. That represents just 3.3% of the total water loss through evaporation in the United States compared with an 85% loss from irrigation. Put another way, a typical power plant withdraws 100 million to 250 million gallons of water daily, but it returns 53% of it to waterways. With this distinction between water withdrawal and consumption in mind, the findings of a 2006 Department of Energy report to Congress, "Energy Demands on Water Resources," are even more troubling. According to the study, the combination of business-as-usual power plant construction and expanding power demand means that by 2030 water *consumption* for electricity production could well be double what it was in 1995: 7.3 billion gallons per day in 2030 versus 3.3 billion gallons per day in 1995. The study added that the electricity sector alone could eventually consume (not just withdraw) as much water as the entire U.S. domestic sector did in 1995. "The U.S. should carefully consider energy and water development and management," the report concludes, "so that each resource is used according to its full value."

Fossil Fuel: A Growing Threat

Generating electricity is only a part of the Energy-Water Nexus. Extracting the fuel that power plants need to operate is another key component.

Tar Sands: Water for Oil: As fossil fuels become more difficult to reach, more and more water is needed to get the job done. In Canada, rapidly expanding tar sand production is a particularly heavy water consumer. Both ground and surface water are used to extract heavy bitumen from oil sands. Usage totals 176 million cubic meters annually, which equals a third of the City of Toronto's 2008 water consumption.

It takes four barrels of water — some of it recycled and the rest extracted from the Athabasca River — to create a single barrel of oil. The process creates a waste product called tailings, which are a mix of water, sand, clay minerals and residual oil. A recent study in the publication *Proceedings of the National Academy of Sciences* supports native Canadian claims of high cancer rates linked to contaminated water from oil sands production.

According to the *New York Times*, "Enormous quantities of fresh water and natural gas are required to process the bitumen from the Canadian reserves, which are the second-largest in the world after Saudi Arabia's. Extraction has felled large tracts of boreal forest and created huge toxic tailing ponds. Crude from oil sands releases 10% to 30% more greenhouse gases over its production life cycle than conventional crude." Canada has become America's largest foreign oil partner, producing nearly two million barrels of the 21 million barrels used daily in the United States. A planned pipeline will further swell imports.

Hydraulic Fracking: Water for Natural Gas: With its vivid images of homeowners lighting their water faucets on fire, Josh Fox's documentary *Gasland* captures the stark downside of hydraulic fracturing, or fracking, a process for extracting natural gas that involves pumping millions of gallons of water in a mixture with chemicals and sand into shale rock formations deep in the earth to free up trapped gas. It's not a new technique, but it has become a widely used and financially lucrative one. By 2020, it is estimated that 20% of the U.S. gas supply will be from hydraulic fracturing. The U.S. resource is estimated at 616 trillion cubic feet, equivalent to 106 billion barrels of oil (roughly equal to Kuwait's proven oil resources).

The number of new rigs drilling shale gas has doubled since 2007 to more than 500. The downside of "fracking" is serious damage to domestic water supplies because of chemical and natural gas contamination. Hydraulic fracking is the technology of choice as natural gas companies explore the vast gas reserve known as the Marcellus Shale, which extends through the northern Appalachian basin, including the Southern Tier and Finger Lakes region of New York, northern and western Pennsylvania, eastern Ohio, western Maryland and much of West Virginia.

The danger to drinking water has moved beyond the hypothetical stage. The EPA's Office of Research and Development recently launched a scientific study to determine the effects of fracking on drinking water supplies. "EPA agrees with Congress that there are serious concerns from citizens and their representatives about hydraulic fracturing's potential impact on drinking water, human health and the environment, which demands further study," the agency said.

Robert Giegengack, professor emeritus in the department of earth and environmental science at the University of Pennsylvania and also a faculty member of the Initiative for Global Environmental Leadership at Penn/Wharton, points out that a drama is unfolding in the western Catskills because of the potential impact of fracking on the New York City reservoirs there. Although some local

residents stand to benefit substantially from selling the mineral rights to land on top of the Marcellus Shale, such efforts could be blocked by city officials anxious to avoid the huge expense of building 800-million-gallon-daily filtration plants should the Catskill water become contaminated by fracking return flows.

The New York state legislature passed a moratorium on natural gas drilling, which was vetoed by then-Governor David Paterson as too broad. But Paterson then issued an executive order temporarily prohibiting high-volume fracking and horizontal drilling until July 1, 2011, while a state Department of Environmental Conservation study is under way.

Despite serious concerns, events are proceeding more rapidly across the border in Pennsylvania. In late 2009, the Associated Press reported that the state of Pennsylvania agreed to sell 32,000 acres of state forest to gas companies. According to the AP, "In a complex mix of area interests, the proposed drilling would bring jobs to the depressed area, and revenue to the state, but it's facing strong opposition from area residents and environmental groups." Such sales help to balance strained state budgets. "Pittsburgh is fast becoming the new Houston," Giegengack said.

But the natural gas money comes at a cost. *Bloomberg Business Week* reported last November that a bottom valve on a 21,000-gallon tank full of fracking fluids was left open and leaked between 2,400 and 13,000 gallons into two nearby waterways. The company responsible, a subsidiary of ExxonMobil, said it was "cleaning it up and taking steps to keep it from happening again."

The public is losing patience. A survey conducted for the Civil Society Institute by Infogroup/ Opinion Research Corporation in late 2010 reported that two-thirds of those polled in New York and Pennsylvania are concerned about the impact of fracking on clean drinking water. More than three-quarters of respondents (78%) said they would "strongly" (49%) or "somewhat" (29%) support tighter public disclosure requirements, as well as funding for studies on health and environmental impacts of the chemicals used in natural gas drilling.

Green Energy's Not-so-green Water Use

While "green fuels" offer an attractive alternative to such environmentally damaging energy sources as tar-sand production and hydraulic fracking, their use of water can be just as troubling. A study by Virginia Tech Professor Tamin Younos, associate director of the Virginia Water Resources Center, evaluated 11 energy sources, including coal, natural gas and ethanol. The study found that among fuel types, natural gas and synthetic fuels made from coal gasification used the least amount of water, and fuel ethanol and biodiesel the most. Among types of generation, geothermal and hydroelectric were water use misers, and nuclear the most water-dependent.

The water consumption results for ethanol and biodiesel are disturbing, considering their growing importance as green sources of energy. But according to Giegengack, both ethanol and biodiesel face economic challenges as well. "Water demand is a big factor in comparing energy alternatives," Giegengack said. "In the simplest calculus, no energy source will gain much of a market share if it costs more energy to produce it than it yields. Ethanol is an exception. By most analyses in which a full life-cycle energy cost is factored in, ethanol uses more energy to be delivered to a filling station than it yields in an internal-combustion engine." Ethanol thrives despite this poor energy balance because of political factors, he said.

"Biodiesel from crops raised specifically to produce fuel is also a loser," Giegengack continued. "Biodiesel produced from agricultural waste also uses water, but when we calculate its cost we have to include the benefit of extracting the energy from a vast amount of organic waste that we would otherwise have to expend money, energy and probably water again to dispose of properly. Under the right circumstances ... biodiesel is a winner."

Carbon Capture: A Water Hog: Beyond the development of new, renewable energy sources, water usage is also a concern in efforts to reduce greenhouse gas emissions from conventional power plants. The use of carbon capture and storage (CCS) is water intensive, according to a 2009 report on freshwater needs of thermoelectric utilities from the National Energy Technology Laboratory of the Department of Energy. "Carbon capture technologies could increase the water demand of thermoelectric power plants," said the report, which analyzed varying scenarios depending on whether the CCS technology uses freshwater and wet circulating cooling or dry cooling.

According to *IEEE Spectrum*, "The technology needed to capture carbon has a huge downside: It

could nearly double the amount of water a plant uses for every kilowatt of electricity it delivers — easily erasing any gains from techniques aimed at conserving water."

Corporate Efforts

Electric Utilities Respond: Ed Legge, a spokesman for the Edison Electric Institute, which represents 70% of the electric utilities in the United States, said, "Water usage and conservation are certainly on the utilities' radar, especially in water-scarce areas like Colorado. The industry has pilot programs to reduce evaporative use of water in cooling towers and is looking at ways to recycle water in power plants in a more robust way."

Kent Zammit, senior program manager for water and ecosystems at the Electric Power Research Institute, said work continues into air cooling for power plants. In this cooling method, steam is condensed in coils, and fans are used to blow air across those coils, with leftover waste heat ejected into the atmosphere. Unfortunately, Zammit said, dry cooling has an efficiency penalty of up to 15% and is not as effective as wet cooling in reducing operating temperatures. One alternative, he said, is the use of hybrid systems that switch to wet cooling on the hottest days.

A second approach, according to Zammit, is using degraded water sources for cooling. The Palo Verde nuclear plant in Arizona, for instance, uses sewage effluent sourced from the city of Phoenix in its wet cooling towers. The effluent is treated in an 80-acre reservoir and up to 20 billion gallons of water are recycled each year. In other cases, plants can use pool water from mining operations for cooling. Zammit said that evaporating contaminated water does contribute to air emissions, but only a very small amount (.0005%) of circulating water becomes airborne.

Large-scale concentrated solar plants are another option in water-challenged regions because they have limited cooling needs. Unfortunately, said Zammit, they operate only in daylight, which is precisely when air cooling condensers operate least efficiently. He also points out that some newer generating power techniques such as natural gas combined cycle plants, which take waste heat from natural gas electricity generation and use it in a steam generator, reduce power plant cooling burden by two-thirds. "In some areas, dry cooling works better than in others, and in some places degraded water supplies are readily available," Zammit said. "The more tools we have available, the better we'll be able to meet future water challenges in a responsible manner."

The Google Example: Looked at another way, blogger Robert Osbourne of Watercrunch.com calculates that the 300 million Google searches daily use 1,000 bathtubs of water. The reason can be traced to the huge power-hungry data centers that routinely handle that much traffic. Google is well aware of its water consumption and by the end of 2008 two of its data facilities were running on 100% recycled water. The company then adopted a goal of using 80% recycled water at all of its data centers by the end of 2010. A Google data center in Belgium is taking water from an industrial canal and treating it at an on-site facility before it is evaporated in cooling towers. Other sources of water for Google include rainwater collected onsite and city wastewater. These are some of the same techniques being employed by Coca-Cola as it seeks to become "water neutral" (see accompanying article).

Investing in Solar Hydrogen

Another application of solar energy is in creating hydrogen for use in fuel cells, which have purified water as a byproduct. Early space missions used fuel cells built by General Electric to provide both drinking water and electric power to astronauts. Tom Sullivan, founder of flooring chain Lumber Liquidators, has invested $15 million to $20 million to build a "hydrogen highway" between Maine and Florida. "It seemed ridiculous we were spending $1 billion a day on imported oil when we could make our own zero-emission hydrogen," Sullivan said. "If we can make hydrogen from wind or solar, that's as good as it gets."

The first station of what could be a dozen opened last summer at the Connecticut headquarters of Sullivan's Proton Energy. Proton's technology extracts hydrogen from water using its own electrolyzer and also produces water as a byproduct that could have any number of uses. Proton's technology raises the fascinating prospect of being able to run zero-emission cars on tanks of water instead of gasoline, but that's not currently practical because it would mean carrying around the heavy and expensive electrolyzer equipment, explains Larry Moulthrop, Proton Energy's vice president of hydrogen systems and a founder of the company.

Energy-intensive Water Production

Eric W. Orts, professor of legal studies and business ethics at Wharton, who is also director of the Initiative for Global Environmental Leadership at Penn/Wharton, points out that "energy and water are interrelated in both directions. Some fresh water production techniques like desalination are highly energy intensive. Water pumping for irrigation, drinking water systems and other technologies also depend on energy resources."

This reality is starkly illustrated in Saudi Arabia where, according to a June 2010 article in Arabic Knowledge@Wharton, running the country's desalination plants consumes 1.5 million barrels of oil daily. Saudi Arabia and the United Arab Emirates have 30% of the world's installed desalination capacity and that capacity has nearly tripled in the last decade.

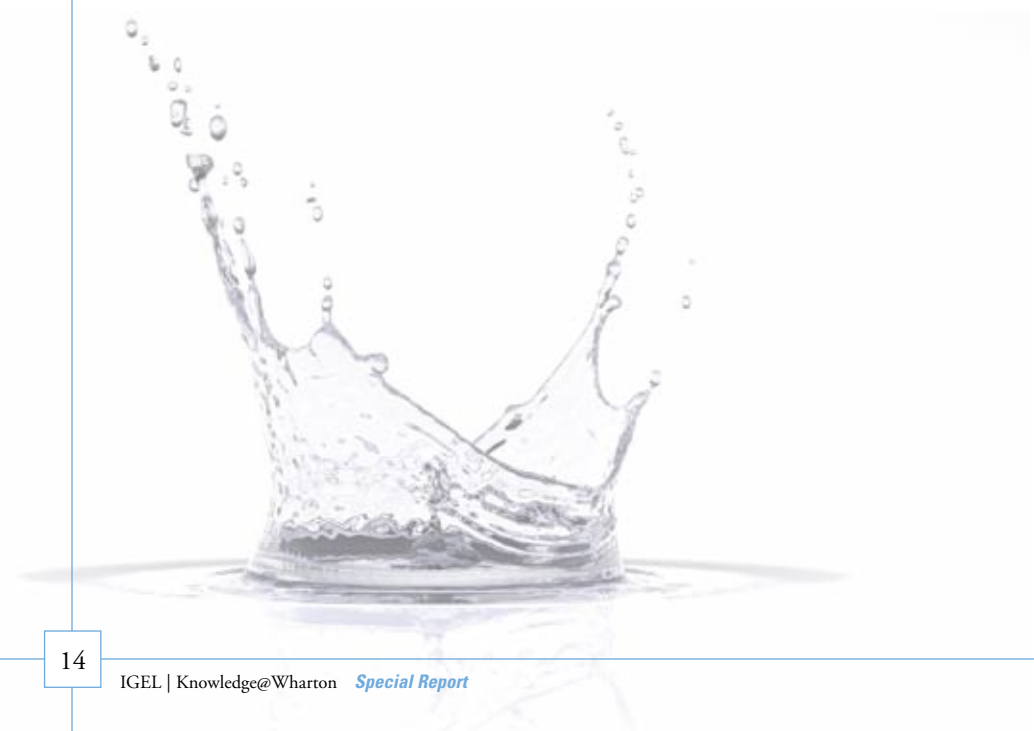
Solar Energy for Desalination

Awareness of heavy fossil-fuel consumption has led the Saudis to partner with IBM to develop a solar-powered desalination pilot plant to serve 100,000 people. The Saudi city of Al-Khafji is also installing solar desalination and Tunisia is considering the technology. Small-scale solar desalination has been in place on the African island of Mauritius since 1997 at a cost of just $200 to $250 per solar still. Each installation produces three to seven liters of fresh water from 10 liters of sea water daily.

Solar desalination has a long history. According to a report from the Higher Technical Institute in Nicosia, Cyprus, 15th century Arab alchemists used mirrors to focus solar radiation onto glass vessels filled with sea water to produce fresh water. The French experimented with solar distillation in the 18th century and the first American patent on solar distillation was granted in 1870. Effective solar distillers were constructed as early as 1872.

Solar stills took on new life during World War II, when there was a need to supply troops on dry Pacific islands with fresh water. A team from MIT took the lead in developing solar de-salters, and a variety of patents were granted, including floating types that were used on lifeboats. After the war, solar stills were pressed into service in the Australian desert for supplying human populations and livestock. In the 1960s, solar distillers were constructed on four Greek islands and also used on islands off Portugal. Most of these applications were relatively small, but those envisioned in the Saudi plans are much larger and could herald the coming of commercial-scale solar desalination. And of course, wind power, one of the fastest-growing forms of energy, can be harnessed for water desalination and other energy-intensive purification efforts.

With water shortages already plaguing many parts of the world and threatening many more, the Energy-Water Nexus — the use of water to generate energy and the use of energy to provide drinkable water — is only going to grow in importance as an environmental issue even if it's mostly below the radar now.



Water Footprinting: Getting Serious about Water Risks to Business

Amid drought in the Pacific Northwest in late 2001, Anheuser-Busch, the producer of the world's largest-selling beers, seemed likely to be affected. After all, beer is about 90% water. It turned out that the drought did significantly affect Anheuser-Busch. But it was not the water used in brewing beer that was the issue. Instead, it was barley that was in short supply because irrigation in Idaho had been curtailed. And the company's cost of packaging increased as well because less water meant less of the cheap hydroelectric energy needed to manufacture the aluminum used in making beer cans.

Anheuser-Busch wasn't the first and won't be the last company to confront the risks associated with the "virtual water" embedded in its products (both in the company's direct operations and all along its supply chain). What's new is the growing interest in these water-related risks. More and more companies (including, Nestlé, Jain Irrigation Systems, Heineken, Coca-Cola, Unilever, C&A, and SABMiller) and investors have begun to realize that while the cost of water itself remains near zero in much of the world, a company's profitability – and in some cases its viability – can depend on the availability of water at crucial stages along the supply chain.

Risk Factors

The first task for companies concerned about water use is identifying and acknowledging the water-related business risks they face. Chief among those risks:

Unanticipated Water Shortages: In 2003, exceptionally high temperatures lowered water levels of rivers in France. According to a report by J.P. Morgan, "Water Watching: A Guide to Evaluating Corporate Risks in a Thirsty World," Electricité de France (EDF) had to "shut down a quarter of its 58 nuclear power plants, even after water-temperature regulations were softened, to guarantee the provision of electricity to the country. The average electricity price spiked 1,300% and EDF lost $410.6 million as it had to import power."

Such water shortages are only going to grow worse with climate change, according to the 2009 report

> "If we acquire the best possible inventory of water supply and demand and then use that information to maximize efficiency of use and minimize waste, we will be getting somewhere. That's what resource managers have been doing, with more or less success, ever since humans began to extract and use natural resources."
>
> —**Robert Giegengack,** professor emeritus, department of earth and environmental science, University of Pennsylvania; faculty member, Initiative for Global Environmental Leadership at Penn/Wharton

"Water Scarcity and Climate Change: Growing Risks for Businesses and Investors," authored by the Pacific Institute and published by CERES. The companies most threatened are those in water-intensive sectors, such as the beverage, semiconductor and fuel industries (both fossil fuel and biofuel). But according to Will Sarni, director and practice leader of enterprise water strategy for DOMANI at Deloitte Consulting, "The need for water cuts across all sectors; every company needs water."

Water Regulation: As populations grow and climate change intensifies, the CERES report predicts that local governments will increasingly be pressured by local residents to take steps that may seriously impact business, whether it's imposing new regulations, placing caps on usage, suspending permits or establishing stricter water quality standards. In Kerala, India, says the report, "both PepsiCo and Coca-Cola's bottlers lost their licenses to use groundwater after drought spurred community dissention and increased competition for local aquifers."

Reputation Risk: With so much riding on brand image, corporations cannot afford to alienate customers, suppliers or investors by mishandling water-related issues. The United Nations has declared water a basic human right and companies jeopardize huge investments in goodwill if their operations appear to conflict with the welfare of local populations. Beyond brand image, companies stand to lose their legal and/or social license to operate because of local perceptions. The Perrier Group of America seemed to do everything right when it entered Mecosta County, Mich. It acquired the proper permits and even hired a public relations firm. Yet the company's efforts to tap local water for profit outraged enough residents that legislative proposals, political upheaval and ultimately a lawsuit forced Perrier to close four wells.

Financial Risk: There are obvious and immediate financial risks involved in all of the issues mentioned above. Reconfiguring supply chains and dealing with stricter regulations have their costs. The price of water itself poses a slightly more distant, but no less dire risk to water-intensive businesses. According to Noam Lior, a professor of mechanical engineering and applied mechanics at the University of Pennsylvania's School of Engineering and Applied Science, while water is generally "not monetized properly," reflecting its actual costs and value, water prices are already rising sharply in some regions and are likely to keep rising in the future in regions where demand outstrips supply. The exceptions, notes Lior, are places as diverse as Southern California and Kuwait, where local governments have insulated their citizens from the huge real costs involved in bringing them water.

Fiduciary Risk: According to "Murky Waters: Reporting on Corporate Water Risk," a 2010 benchmarking study by CERES, "Even for companies operating in sectors and regions of the world facing significant water risk, disclosure of risk and corporate water performance was surprisingly weak. While most of the companies mentioned water-related risks in their 10-Ks, or annual reports, the study found, "the vast majority of these disclosures consist of vague, boilerplate language, … fail to reference specific at-risk operations or supply chains, and do not attempt to quantify or monetize risk. Only six companies report any water accounting data within their financial filings."

Investors are not happy with this situation, and new efforts are underway to gain the transparency that the investment community insists on. The Carbon Disclosure Project (CDP), for instance, recently launched a global Water Disclosure Program on behalf of 137 investors with assets of $16 trillion. Its goal is to help investors factor water risk into their investment strategies, which will naturally focus companies' attention on ways to mitigate those risks.

In addition to the CDP project, General Electric and Goldman Sachs are sponsoring an ambitious project by the World Resources Institute (WRI). Aqueduct: Measuring and Mapping Water Risk is aimed primarily at investors looking for actionable information on corporate water risks. The Securities and Exchange Commission has also acted, issuing "an interpretative guidance" that urges more disclosure of environmental, social and governance issues, including, specifically, water.

The Allure of Water Footprinting

Water footprinting is a logical next step once companies have recognized the variety of water-related business risks they face. As defined by the creator of the concept, Arjen Y. Hoekstra, a professor in multidisciplinary water management at the University of Twente and the scientific director of the Water Footprint Network (WFN), the process of water footprinting is detailed and specific. In the 2009 edition of the WFN Water Footprinting Manual, (the 2010 edition was to be released free online),

Hoekstra and his three fellow authors provide 131 pages of explicit instructions and formulas to use in conducting water footprint studies. In summary, water footprints should measure the volume of fresh water used (consumed or polluted) to produce a specific product (or group of products) in a specific region during a specific period as measured over the full supply chain.

When Hoekstra introduced water footprinting as a concept in 2002, his primary concern was — and still is — measuring the movement of "virtual" or "embedded" water as part of international trade. As he writes in "The Relation Between International Trade and Freshwater Scarcity," a recent working paper, "Import of water-intensive commodities reduces national water demand, which is attractive for water-scarce countries … in the Middle East and North Africa. Export of water-intensive commodities, on the contrary, raises national water demand and thus enhances national water scarcity. This happens for instance in the U.S. and Australia. Trade patterns thus influence patterns of water use and scarcity."

In fact, Hoekstra believes that the value of water footprinting by a single company is "debatable," since the issues involved transcend the actions of any one corporation. However, Hoekstra agrees that well-conducted studies can be of real value to corporations and the regions in which they operate.

Giegengack cautions that water footprinting should not be seen as just "a catchy buzzword," modeled on carbon footprinting but not actually leading to anything productive. Tara Lohan, editor of *Water Matters: Why We Need to Act Now to Save Our Most Critical Resource* (AlterNet Books, December 2010), notes that footprinting can be a great tool, "but corporations can't just jump on board and say they're going to do water footprinting, thinking it's the next green thing. If their goal is simply to help improve their image or sell their product, I don't think it will produce meaningful results."

Case Studies

The best way to understand water footprinting is to look at an actual case study. Pilot studies by SABMiller PLC, a global brewing company, offer guidance to any company that is serious about uncovering its own water-related risks and opportunities. Conducted in collaboration with the World Wildlife Fund (WWF), the company looked at its operations in South Africa and in the Czech Republic. (In 2010, working again with WWF and also with Deutsche Gesellschaft für Technische Zusammenarbeit, SABMiller launched four new studies in Peru, Tanzania, Ukraine and South Africa.)

A close look at these studies reveals four key aspects of water footprinting:

1. Consider the whole supply chain in determining a company's water footprint. As with carbon footprinting, it is critical that companies look beyond their own direct, operational uses of water. In both South Africa and in the Czech Republic, SABMiller found that more than 90% of the company's water footprint was related not to the actual brewing of beer, but to the growth of crops. This is far from unusual. Remember Anheuser-Busch's experience. And Coca-Cola, in its own study of its signature product in the Netherlands, found that water as an ingredient represented just 1% of its water footprint. Growing sugar beets accounted for nearly half.

Outside of the beverage industry, Unilever, which saved about $26 million by reducing water waste in its factories from 2001 to 2007, estimates that agriculture, not operations, accounts for about half of its water footprint.

According to WFN's website, "Most companies will discover that their supply-chain water footprint is much larger than their operational water footprint. As a result, companies may conclude that it is more cost-effective to shift investments from efforts to reduce their operational water use to efforts to reduce their supply-chain water footprint and associated risks."

2. Like politics, all water issues are local. While modeled on the success of carbon footprinting, water footprinting is fundamentally different. There are several important differences (no one considers carbon a basic human right, for instance), but one of the most important is that carbon is carbon no matter where it is used or conserved — the reason many advocate a geographically broad cap-and-trade system. But according to Piet Klop of the World Resources Institute, "Water footprinting in Spain is not the same as water footprinting in Maine."

The SABMiller studies found, as others have, that water footprints vary by region. For example, the company's water footprint in South Africa was more than three times greater than it was in the Czech Republic. This had nothing to do with operational efficiency (or lack of it). South Africa had a bigger water footprint because it is hotter and drier and

therefore loses more water to evaporation and relies more heavily on irrigation. In addition, South Africa has to import more ingredients from farther away, a water-intensive process.

Even within South Africa, there were significant variations between regions. In one part of the country, barley and maize were almost totally dependent on irrigation; in another area, rainfall alone was sufficient. But as the company notes in its study, "The importance of local context is illustrated by the fact that despite the high reliance on irrigated water for maize in the Northwest, the region has sufficient water resources to support this without detrimental impacts on local ecosystems or other users. However, barley grown in the Southern Cape, despite being rain-fed, is vulnerable in the long term due to changing climatic conditions and population pressures predicted for the area."

3. Time frame is also critical. According to the WFN *Water Footprint Manual*, "Whatever water footprint study is undertaken, one should be explicit about the period of data used, because the period chosen will affect the outcome." A crop-related product, the *Manual* points out, will have a much larger footprint during a rainy period than it will during a dry spell, when more irrigation is required. Variations in rainfall are not all that change with time. SABMiller, for example, found that, over the three years of its pilot study in the Czech Republic, the last year studied, 2008, had the least rainfall but surprisingly the smallest water footprint. The reason: "Crop yields for both barley and hops increased gradually over the three-year period," which more than compensated for the increase in irrigation needed.

4. The color of water: Green, blue and grey. In working to standardize water footprinting, the *Water Footprint Manual* defines three kinds of water use. There is green water, which refers to rainwater that is either stored in the soil as moisture or that sits temporarily on the surface of plants. A company's green water footprint includes all the water that evaporates from the soil and plants involved in a supply chain as well as the water "embedded" in the plants that the company harvests.

Blue water is fresh surface or groundwater in lakes, rivers, reservoirs and aquifers. A company's blue water footprint is a measure of how much fresh water it takes out of a given region, whether through evaporation, incorporation into its products (often as an ingredient), or any other uses that prevent the water from being returned, unpolluted, to the same area. ("Net green water" refers to the difference between consumption due to a company's activities minus consumption by naturally occurring vegetation.)

Green and blue water are considered consumed when they are no longer available for downstream use within the same watershed. (Even though water that evaporates is not "lost" — it will eventually return as rain somewhere — it is considered consumed because it is lost to the local region.)

Unconsumed green or blue water that is returned to an area but not available for use because it has been polluted is labeled grey. To determine its grey water footprint, a company has to compute the amount of clean water needed to dilute the polluted water to locally acceptable standards for downstream use.

It is important that companies distinguish among these different "colors" of water because the challenges and solutions differ for each. In the Czech Republic, for instance, SABMiller found that 90% of its water footprint was green water in the form of rainwater that nourished its crops. As a result of this finding, the company is, among other things, "considering projects ... in order to understand the risk of climate change on water availability and how this may impact crop growth in the future."

In South Africa, on the other hand, while green water consumption represented the largest share of the company's footprint, blue water was also significant (about one-third), as was grey water in the form of rainwater runoff polluted by fertilizers and pesticides. In this country, SABMiller launched a multi-part effort to achieve water neutrality in two water-scarce areas surrounding its breweries.

What not to do. Charles Fishman, a journalist and author of a forthcoming book on water, *The Big Thirst* (Simon and Schuster, April 2011), cites a water footprinting study by Levi Strauss as an example of an unproductive use of the concept. According to Fishman, the jeans maker included consumers in its footprinting study, identifying the water they used to wash jeans as the major factor in jeans' footprint. The problem, says Fishman, is that the company has no control over consumer washing habits; all it can do is to urge customers to buy more water efficient washers.

Klop of WRI makes the point more broadly. It is only where geographic water risk, product water footprint and corporate water governance overlap,

he says, that analysis is warranted. In other words, it only makes sense to study water use in regions where water is scarce (or likely to become so), and only for those aspects of a product's life cycle that a company can affect. As Fishman says, it makes perfect sense for Levi Strauss to look at how water is used to grow the cotton involved in making jeans (it can work with its suppliers to improve efficiency there), but it makes no sense to consider the water that consumers use to wash the jeans.

The Future of Footprinting

Many companies involved in water footprinting have remarked on the need to clarify definitions, identify best practices and adopt clear standards in the future. The 2010 *Water Footprinting Manual* from the WFN should help resolve some key areas of concern, especially concerning grey water.

In addition, a new working group at the International Organization for Standardization promises to bring uniformity to the relatively young field of water footprinting. Stanley L. Laskowski, a lecturer at the University of Pennsylvania and the co-founder and president of the Philadelphia Global Water Initiative, sees "a lot of room for research" as universities and think tanks "work through definitional problems and which approaches work best."

The CDP's *Water Disclosure Project*, launched in November 2010, will also make a valuable contribution. While it is primarily intended to provide institutional investors with solid information relating to companies' water risks and opportunities, its findings (due out by the end of this year) should help raise businesses awareness of water risk, support the development of standards and benchmarks, and encourage concrete action by companies.

Three other major projects will help future water footprinting efforts. The Alliance for Water Stewardship will work with water authorities, companies, local communities and environmentalists over the next few years to set up a voluntary certification program. In the process, it intends to develop internationally accepted standards and to both recognize and reward companies that take meaningful action to minimize their water footprint.

The WRI Aqueduct project will develop a detailed and global Geographic Water Risk database. WRI has already completed a prototype based on an analysis of the Yellow River Basin in China. The level of granularity is impressive. According to WRI's Klop, researchers are looking at more than 20 indicators in 66 water districts and 132 units of local government. The company iScience is doing hydrological work, while WRI uses publically available databases to comb through everything from hard statistics to "soft data" such as local violations of water regulations, media coverage of pollution, water shortages, and even GDP growth. (Wealthier people tend to demand more water resources, Klop points out.)

As indicated, Aqueduct's primary audience is the investment community. But as the database grows to include watersheds around the globe, companies will be able to use it to identify key areas of risk and to establish a context within which they can evaluate their own efforts. (The information from the prototype is now available at http://projects.wri.org/aqueduct/atlas so companies can see the kinds of information that will be available and how they will be able to access the data.)

Finally, launched in 2007 as part of the United Nations Global Compact, the CEO Mandate is a public-private collaboration that is working to help businesses partner with the United Nations, civil society organizations, governments and other stakeholders to advance water sustainability solutions. Among the many useful projects recently undertaken are two reports that provide corporations with best practices ("The Human Right to Water: Emerging Corporate Practice and Stakeholder Expectations") and various ways of measuring water use, including a few online tools, less involved and expensive than water footprinting, that are well suited to companies just beginning to think about water use ("Emerging Corporate Practice and Stakeholder Expectations Regarding the Human Right to Water").

The Bottom Line

In the end, all of this work will be for naught if companies don't use what they learn to take positive steps. How well they succeed in managing their water use will be the ultimate measure of water footprinting's importance.

Water footprinting is a complex, even daunting challenge. Simply collecting the needed data can

prove difficult as businesses confront supply chains within supply chains, suppliers who jealously guard what they consider proprietary information, and numerous variables that change with the seasons and passing years.

But many observers, including Sarni, who remembers how much effort went into carbon footprinting, and how successful that program has proved to be, are not concerned. "We're in the early stages of water footprinting, says Sarni, "approximately where carbon footprinting was several years ago. I've been in environmental consulting for a long time. Carbon was considered complex, too. But we're all pretty clever; we'll figure it out if we have to.... It's the beginning of a journey."

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