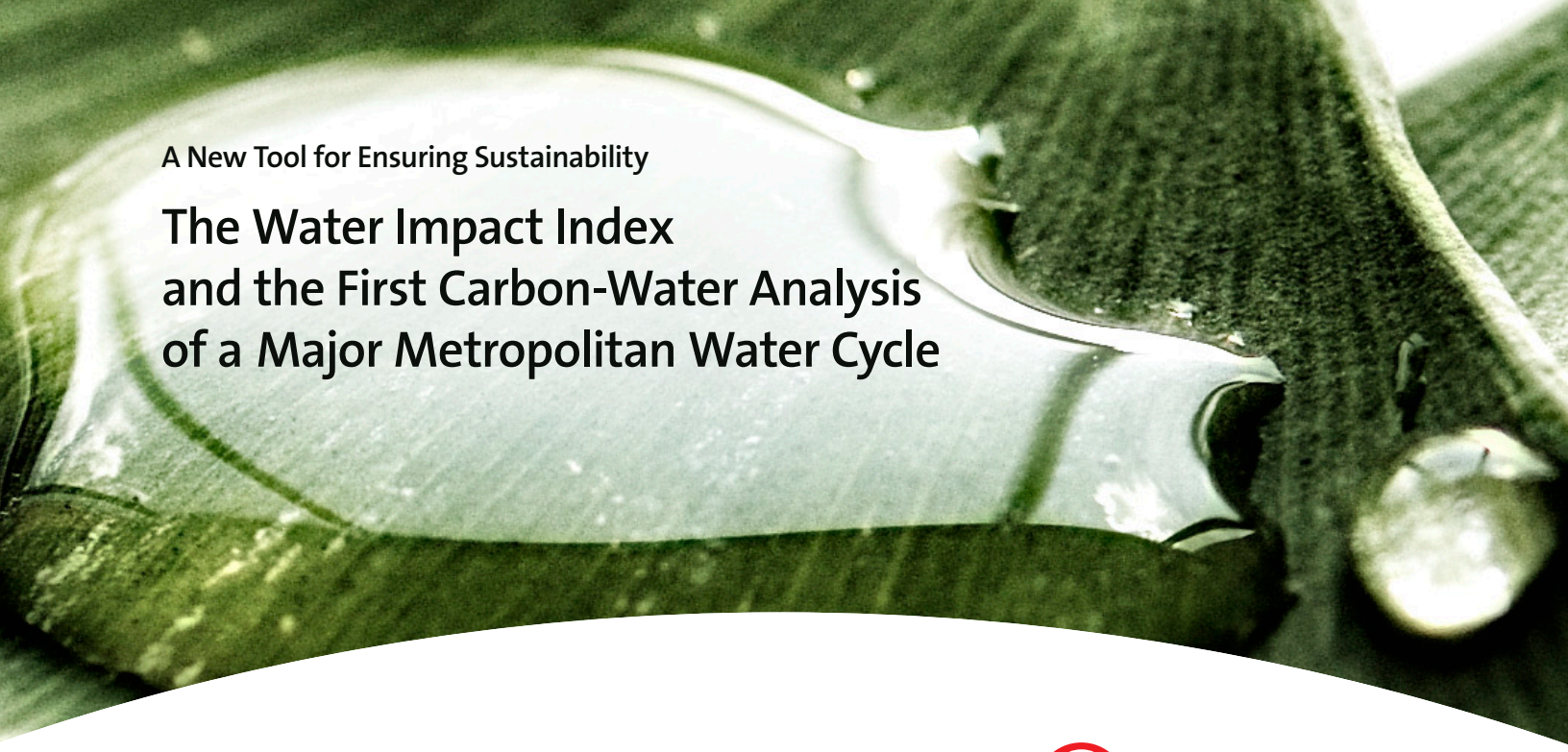
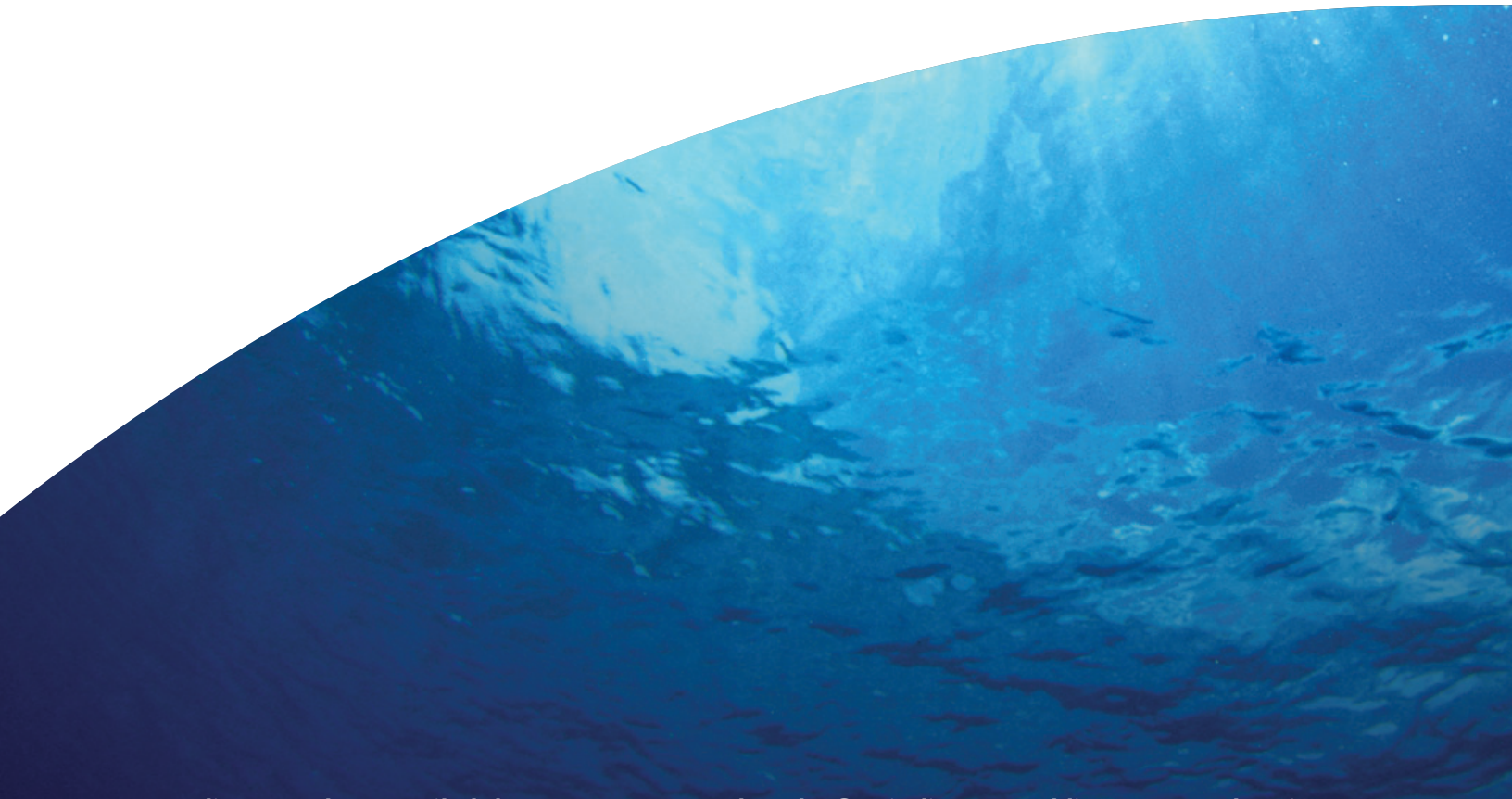


A New Tool for Ensuring Sustainability

The Water Impact Index and the First Carbon-Water Analysis of a Major Metropolitan Water Cycle

VEOLIA WATER



Veolia Water has unveiled the Water Impact Index, the first indicator enabling a comprehensive assessment of the impact of human activity on water resources. This paper shares details on this new index, along with a company study believed to be the first-ever simultaneous analysis of water and carbon on a major metropolitan area's water cycle.

A WHITE PAPER BY VEOLIA WATER

"Public authorities, citizens and industries must all work together to ensure the sustainable future of our local water resources. Richer and more robust data is required for building the necessary solutions."

Laurent Auguste
President and CEO
Veolia Water Americas

Pressure on water resources. The next challenge for growth?

70% of the planet is covered by water, but only 0.7% of the global water resource is freshwater available to us, and it is very unevenly distributed across the planet.

Unlike oil, for which there are multiple energy options, freshwater has no substitute. And unlike oil, our needs for water cannot be sustainably addressed by transporting water from water-rich areas to water-poor, high-demand areas. Over the next three decades, projected population and economic growth levels will, locally, push to the limit the stress on this finite resource. In turn, limits in freshwater availability could become the world's main growth limitation factor, as areas such as Southern California have already begun to experience.

There are solutions to this forming crisis. They will require that we become smarter in the way we manage water, which begins with understanding the impact we are having on this crucial resource. In short, we must become more water aware.

People continue flocking to urban areas and will continue doing so. For the first time, cities house 50 percent of the world's population – and by 2050, cities are expected to house 75 percent of humankind. Locally, this means greater population density and increased economic activity in and around cities, creating more pressure on local water resources through increased consumption and greater pollution from domestic and industrial sources. (In the developing world, 2.6 billion people do not have access to basic sanitation systems, and in the developed world the lack of smart management of aging infrastructure leads to growing pollution.) Globally, increased populations (literally, more thirsty mouths) prompt a greater water demand through increased need for:

1) food production (Agriculture represents already more than 90% of the world's water consumption and is expected to increase by 50% with population and economic development. It is also a key source of pollution to freshwater resources),
2) energy production (the so-called water-energy nexus, which demonstrates how energy production requires significant water resource) and,
3) continued economic growth (most manufacturing processes can't function without water).

In states as far flung as Georgia and Nevada, communities are experiencing service inconveniences or stating serious concerns over their long-term water supplies. In other states, industrial projects have been halted as water resources are strained or their long-term availability becomes uncertain. Peering into the future and considering the escalating use of our limited freshwater resources essential for our direct use and for the ecosystems we depend on, it is easy to see how this strain can affect the lives of generations to come on each continent, in developed and developing nations alike.

> "Business and governance as usual will not suffice as competing demands for water escalate."

Business and governance as usual will not suffice as competing demands for water escalate. We need to manage this limited resource in a better and more sustainable manner by not wasting it, not polluting it, and by reclaiming more. Not doing so will limit our ability to grow our economies, and will put our industries and existing societies at risk.

So, where do we start? To be smarter in our decision-making processes, we need to better understand the specific local nature of our water challenges and the specific impacts of our activities on freshwater resources. For this, cities, industries and citizens need data, smart-planning tools, and more effective best practices to ensure a successful, sustainable future that takes into account our new realities.

Veolia Water has unveiled the Water Impact Index, the first indicator enabling a comprehensive assessment of the impact of human activity on water resources. This paper shares details on this new index, along with a company study believed to be the first-ever simultaneous analysis of water and carbon on a major metropolitan area's water cycle. As water, carbon and economics become more intertwined, our intent is to provide a first attempt at a new decision-making process grounded on sustainability. It is critical that we build a better understanding of how water resources and human activities can be managed to offset our collective environmental impact.

The Freshwater Landscape

Freshwater availability has been predicted to become a major limitation factor for growth for cities and industries in many locations around the world, and the need to understand and quantify the impact on water resources is essential to maintaining their sustainability and future prosperity because there is no substitute to water. This reality requires an understanding of the factors needed to make the most appropriate, sustainable decisions.

Just as historians have connected the rise of great cities and economies with water (and in some cases, their demise), access to quality water resources is increasingly a focal point for those who plan for the future. In the developed world, urban planners, engineers, regulatory officials, environmentalists, politicians and those in charge of manufacturing operations are now focusing on whether their communities or operations will continue to have reliable access to water, necessary to ensure their continued development. Meanwhile, in the developing world, officials continue to grapple with the lack of infrastructure for basic access to water or sanitation that slows their ability to develop their societies and economies, and can even quite literally mean the difference between life and death.

Are concerns about freshwater resources overblown? Are these matters for people far removed from our respective safe havens, especially for those located on lakes and riverways? Not when considering the EPA has already cited 36 states in the USA as facing water shortages and that industrial companies and investors are placing water risks on top of their list of strategic issues to address.

Consider the following:

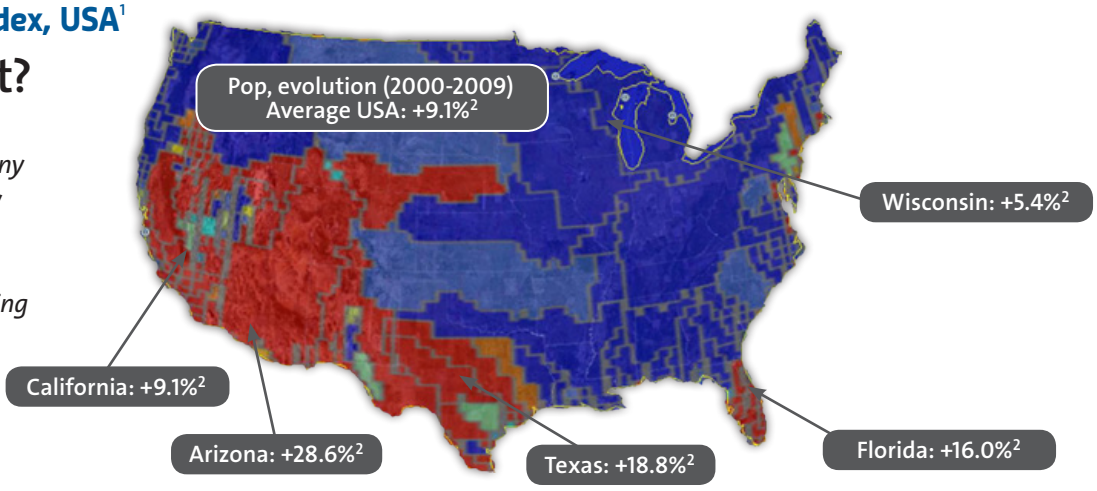
- In the developing world where infrastructure is lacking, close to 1 billion people do not have proper access to healthful water, and 2.6 billion people are without sanitation systems. This triggers an incredible storm of health issues and water-borne fatalities, not to mention freshwater pollution and water resource pressure.
- At the same time, leakage rates in distribution networks in developed countries can exceed 50%, while the lack of proper maintenance of wastewater and stormwater collection networks leads to growing pollution.
- 80% of all childhood deaths and illnesses in developing countries are directly or indirectly caused by lack of proper access to water or sanitation.
- By 2050, 75% of the world's population will live in cities, increasing pressure on already strained water resources.
- Global demand for water will increase by 40% in just 20 years – and is projected to double in rapidly developing countries.
- 70% of today's water withdrawals are used in agriculture. Population growth will lead to further significant withdrawals for agriculture, while fertilizing practices, if inappropriately managed, lead to an increasing source of water pollution affecting ground and surface water fresh resources.
- Climate change impacts will make the availability of freshwater resources more unpredictable. This includes droughts, floods and increased sea levels that can cause salt water intrusion in groundwater reserves.

Graphic of Water Stress Index, USA[1]

Based on the Water Stress Index, red represents areas that are experiencing higher levels of water stress while blue signifies areas with less or limited stress on water resources.

Stressed out?

- *Populations continue to grow rapidly in many areas that are already experiencing water resource limitations. Populations are growing less rapidly where water resources are abundant.*



[1] *S. Pfister, A. Koehler, and S. Hellweg, 2009 "Assessing the environmental impact of freshwater consumption in LCA," Environmental Science and Technology, no. 43, pp. 4098-4104* [2] *U.S. Census Bureau, 2010*

Half of the world's population now lives in cities. By 2050, that number will increase to 75%, further straining water resources and systems.

Similarly, consider how demand for water, coupled with a 2008 non-historic drought in the Southeastern United States, sparked fighting words between public officials, as well as a legal attempt to relocate a state line to secure more water resources. Concerned that water supplies would be exhausted within three months, Atlanta soon banned lawn watering, car washing and the filling of swimming pools. Lack of water has stopped commercial or industrial projects not just in California, but in Georgia, Tennessee, South Carolina, Idaho, Arizona and Montana.

As populations shift more toward urban areas, current water and wastewater treatment programs may not be sufficient to address this and other trends involving climate change, energy consumption, pollution and the impact of human activity on ecosystems. In an age when our development often occurs further away from a local water resource or our use pushes them to their limit, ecosystems are being even further stretched.

Current budgetary and economic challenges lay atop hard facts already on the table. As each drop of water becomes more precious, many cities are finding their leakage rates increasing. Even in North America, some cities can't account for up to half of their water production! Analysis of federal data by *The New York Times* indicates that "more than 20 percent of the nation's water treatment systems have violated key provisions of the Safe Drinking Water Act over the last five years," adding that "the other major water law – the Clean Water Act – has been violated more than half a million times." [3]

Mandates exist but cities are clearly struggling in a ping-pong match between the EPA's demand to do the right thing and the cities' lack of resources or lack of political will in situations where mayors are often trapped between their citizens' long-term needs and short-term expectations. Similarly, cities and states are not routinely aligning their governance structures to match watersheds nor are they responding with more efficient management approaches:

- Our drinking water systems are aging; some are more than 100 years old.
- The American Society of Civil Engineers has given a "D-" to U.S. drinking water infrastructure and a "D" to U.S. wastewater infrastructure.
- The U.S. Conference of Mayors estimates that the EPA's projected funding gap ($500 billion over 20 years) represents only 10-20 percent of what is needed ($2.5-$4.8 trillion over the next 20 years).
- Water-quality concerns about agricultural runoff and pharmaceuticals continue to be raised.

With these challenges in mind, our decisions must consider many factors – not just whether water comes from our tap today.

[3] *http://www.nytimes.com/2010/03/23/business/23water.html "U.S. Bolsters Chemical Restrictions for Water," Charles Duhigg, March 22, 2010.*

A New Model: The Water Impact Index

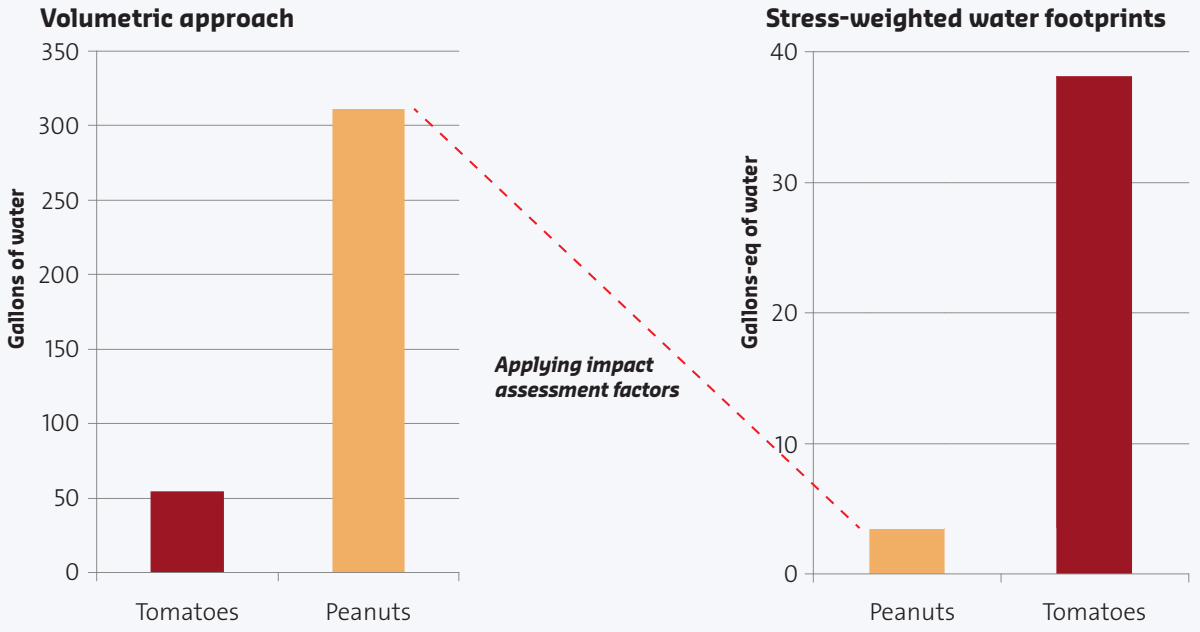
Water is a very local resource and, unlike oil, there are no alternatives to water.

Oil and natural gas can be transported over long distances, but transporting large quantities of water is not a practical option, especially considering sheer weight and the associated energy required to move such a heavy liquid. In Wisconsin, oil equivalent consumption is 8 tons per year on a per capita basis – water consumption is 2,140 tons per year per capita.

Current sophisticated water footprints focus almost exclusively on volume – a very good indicator to raise awareness but not sufficient to represent the impact on a water resource. For instance, we know that approximately 2,900 gallons of water are required to make one pair of blue jeans. But what is the impact on a given freshwater resource – a reservoir, lake, river, etc.? Two examples illustrate this point.

First, looking at two products – tomato sauce and peanuts – strictly by the volume of water needed, peanuts would appear to have a much higher water-use impact than tomato sauce. However, according to a study[4] on water stress-weighted footprinting, the opposite is true. Tomato sauce has a ten-fold greater impact on water resources than peanuts because tomatoes require more fertilizer and are produced in water-stressed areas with a significant reliance on irrigation.

Why go beyond a volumetric approach?



In terms of sheer water usage, the production of peanut candies requires 6 times more water than the production of tomato sauce. However, tomato sauce impact is 10 times higher when factoring in water stress.

A second example: the volume of water needed to produce one pound of beef – 1,857 gallons – appears to be the same regardless of whether the beef comes from a water-rich or water-poor area. But the impact on the water resource in two different states or, for that matter, two different areas of one state (East and West Texas, for example) can vary considerably.

> "The Water Impact Index expands on existing volume-based water measurement tools by incorporating multiple factors such as volume, resource stress and water quality."

[4] *Ridoutt, B.G., Pfister, S., 2010. A revised approach to water footprinting to make transparent the impacts of consumption and production on global freshwater scarcity. Global Environ, 20 (1), 113-120.*

The Water Impact Index expands on existing volume-based water measurement tools by incorporating multiple factors such as volume, resource stress and water quality. It examines the impact of human activity on water resources and provides a methodology for establishing positive and negative implications of how water resources are managed. The new tool provides additional parameters needed to make informed choices about effective water management.

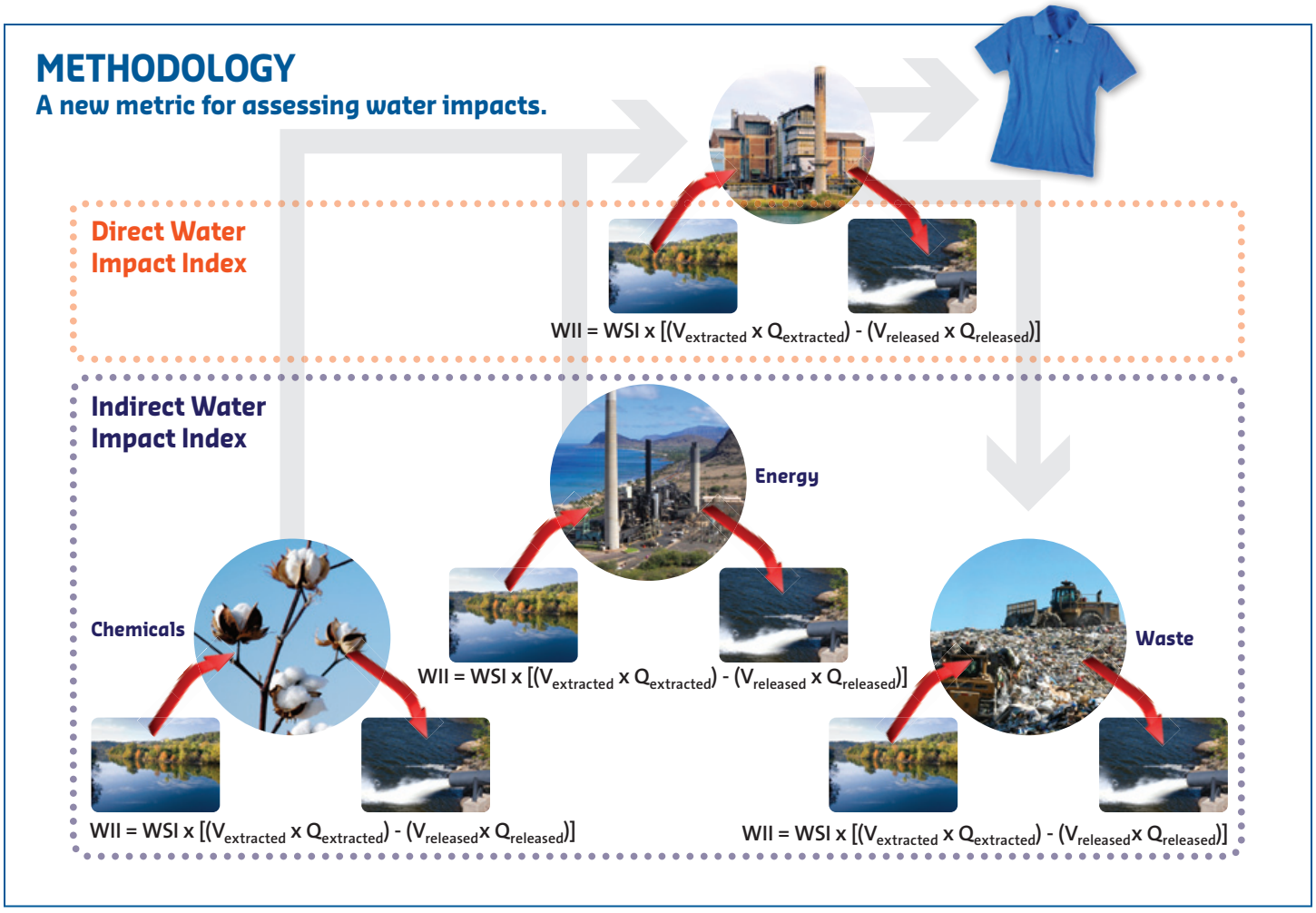
Through the Water Impact Index, decision makers can factor in three essential elements – quantity of water used, level of stress upon water resources, and overall water quality – and develop a much more detailed, holistic and inter-related understanding.

The Water Impact Index considers both direct and indirect influences of an activity from "cradle to grave"– whether managing a textile production facility or a wastewater treatment facility. It incorporates the volume and quality of the water extracted and released back into the environment and adds the Water Stress Index (which accounts for the level of stress on the resource). This new index gives us the water impact – and it includes indirect elements from the production chain such as energy, raw materials, chemicals, and waste generated. (See methodology on the next page.)

Through the Water Impact Index, one can better evaluate how water users (humans and ecosystems) could be deprived of water resources through mismanagement of water or wastewater systems.

A new metric for assessing water impacts.

The Water Impact Index accounts for the impact of water resources generated by a human activity. It enables evaluation of how other water uses (both humans and ecosystems) could potentially be deprived of this resource - expressed in Gallon-WII-equivalent.



A Water-Carbon Analysis – the Milwaukee Example

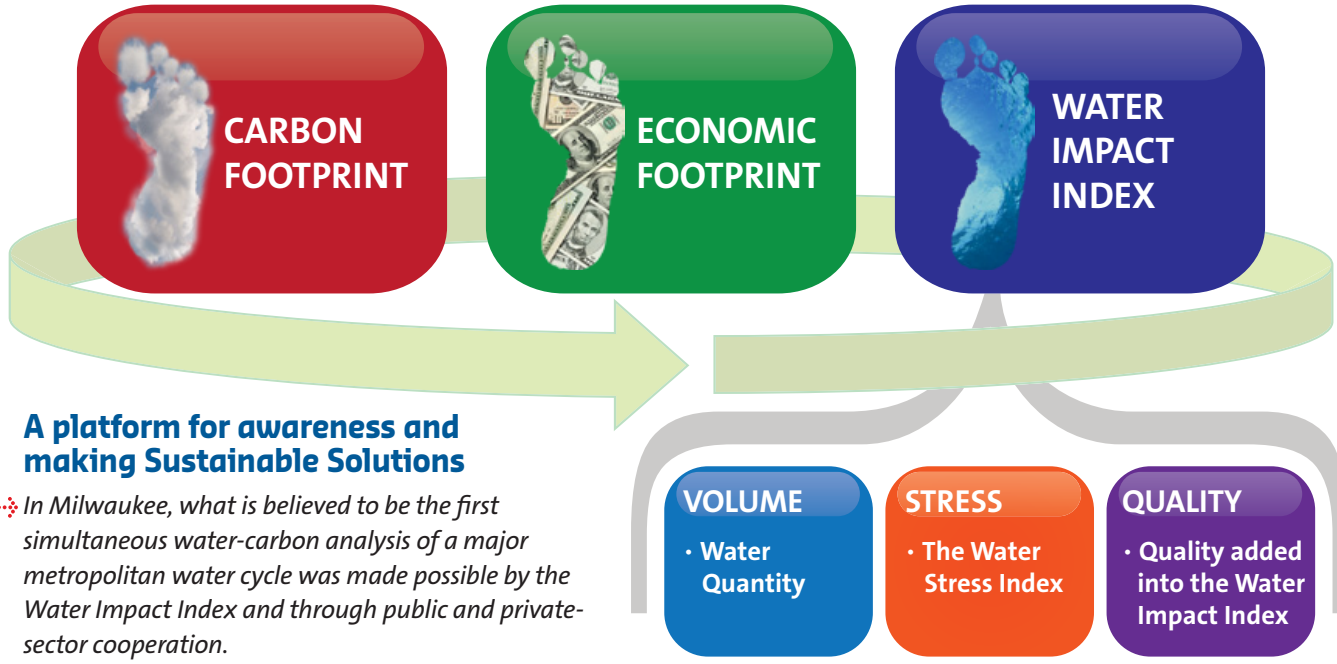
Carbon and water represent two major areas of impact on the environment that have broad economic and social ramifications.

Producing energy and undertaking industrial activity require fresh water, and energy is needed to produce, move and treat water. This interdependence is often referred to as the "water-energy nexus."

Viewing carbon and water together provides a more comprehensive picture of the challenges to sustainability. Using less energy and less water results in lower pollution and less stress on ecosystems and water resources, preserving the balance for future generations. Also, reduction of energy and chemical consumption can limit wear and tear on assets and equipment, which can save money – an economic benefit for water utilities and the public.

Developed in conjunction with Veolia Water's Water Impact Index, a study of the greater Milwaukee area's water and wastewater systems (serving more than 1 million people) assessed the interaction of carbon (energy) and water and their associated economic and environmental impacts. The study's methodology assigned a value to water based on quality, quantity and resource stress. In essence, this study and the Water Impact Index open a door to benchmarking water and air impacts from different activities throughout the world.

One goal of this water-carbon analysis is to foster greater collaboration and continued dialogue around water and carbon measurement. As environmental efficiency grows in importance, organizations will be able to use this tool to determine business locations that create a smaller footprint. Similarly, water managers can recognize and adopt best practices that are meaningful for the environment, customers, and capital and operating budgets. Such actions, in turn, will help cities, businesses and organizations make the best possible decisions regarding sustainability when weighed against environmental outcomes and economic viability.



A platform for awareness and making Sustainable Solutions

In Milwaukee, what is believed to be the first simultaneous water-carbon analysis of a major metropolitan water cycle was made possible by the Water Impact Index and through public and private-sector cooperation.

Veolia Water's study of Milwaukee's urban water cycle is believed to be the first-ever combined analysis of the water-energy nexus in a major community. The company chose Milwaukee for its pioneering study based on the city's Lake Michigan location and because of its progressive actions in managing water resources.

Milwaukee, in fact, is the only United Nations Global Compact City focused on freshwater management, which requires it to conduct a variety of water-quality projects that other cities can emulate. Veolia Water North America's Technical Direction Group and the company's global R&D team led the study in conjunction with the Milwaukee Metropolitan Sewerage District (MMSD), the City of Milwaukee, the Milwaukee Water Council, and other local partners and utilities.

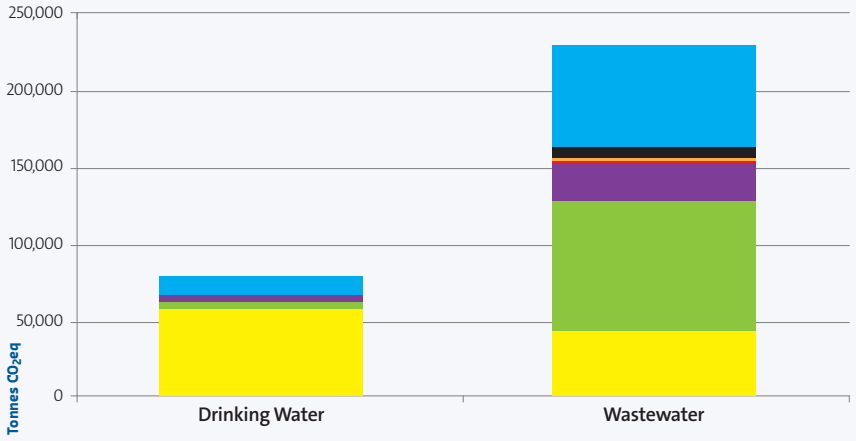
It should also be noted that Veolia Water and Milwaukee are partners in the largest U.S. wastewater partnership, allowing an efficient collaboration and facilitating data gathering and analysis.

Findings in Milwaukee

The Milwaukee-based water-carbon analysis yielded a number of findings on the local urban water cycle. These findings are local and results and findings may differ in other locations and for other utilities:

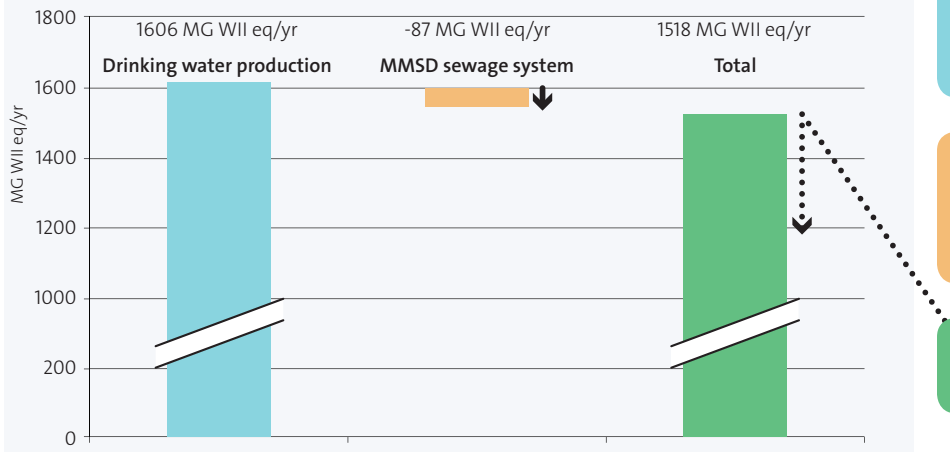
The carbon footprint for wastewater services is more than double the size of activities related to providing drinking water services.

The Carbon Footprint of the area's water services is more than 310,000 tons CO_2 eq



The Milwaukee area's water and wastewater system has a carbon footprint equal to the carbon footprint of approximately 15,000 people.

Water Impact Index of Milwaukee-area's drinking water and sewage system



Drinking water production contributes to the Water Impact Index.

Water of very good quality is extracted from its natural environment

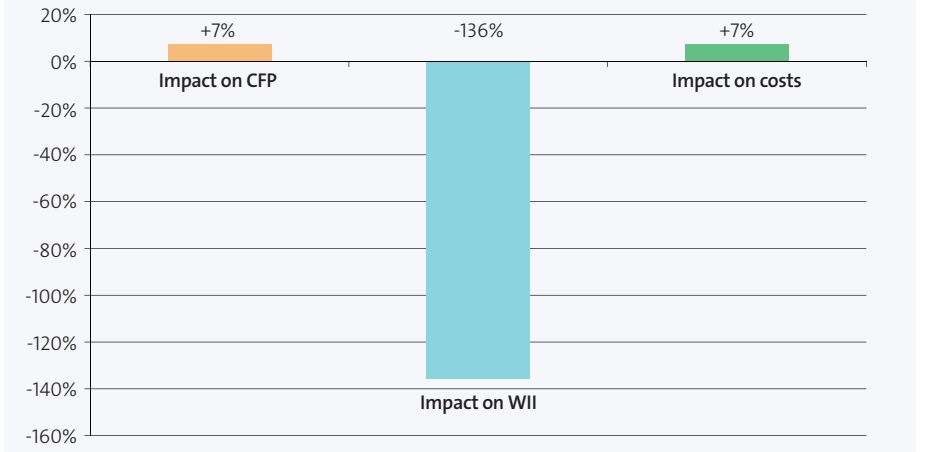
MMSD sewage system reduces the Water Impact Index.

Water quality is improved and brought back closer to environmental requirements

The Water Impact Index should be as low as possible to protect our resource.

- Water extracted from Lake Michigan is of a very good quality – and the MMSD system provides an improvement of -87 million gallons Water Impact Index equivalent, bringing wastewater quality closer to the environment's requirements.
- Public water conservation has a positive impact on water resources and carbon emissions, even in a water-rich urban environment like Milwaukee.
- The Water Impact Index shows that in Milwaukee, the positive impact of one gallon of treated wastewater returned to the environment is more than 400 percent lower than the Water Impact Index from one gallon of a combined sewer overflow (CSO).
- The Water Impact of proposed green solutions such as wetlands development, where stormwater would be separated from wastewater and sent to a wetland, is 170% lower than treated wastewater.
- Since the development of the MMSD's deep tunnels, annual overflows have been reduced by almost 8 billion gallons, based on 2009 levels, reducing very significantly the impact on local water resources.
- To reduce phosphorous levels in the wastewater effluent from approximately 0.66 mg/l to 0.3 mg/l (under consideration by MMSD), would reduce the Water Impact Index by more than 100% while slightly increasing the carbon footprint by 9% (for this part of the treatment).
- Chloramination (replacing the sodium hypochlorite disinfection by chloramination) would reduce related operating costs by 60%, the carbon footprint by 61% and the Water Impact Index by 65%.
- The carbon footprint from the drinking water distribution network of the main water utility (Milwaukee Water Works) is more than 20% higher than the one from its drinking water production side.
- Two-thirds of the carbon footprint from the works on the water distribution network of Milwaukee Water Works is embedded in the metal pipes.

Improving phosphorous removal - a substantial gain at a slight cost



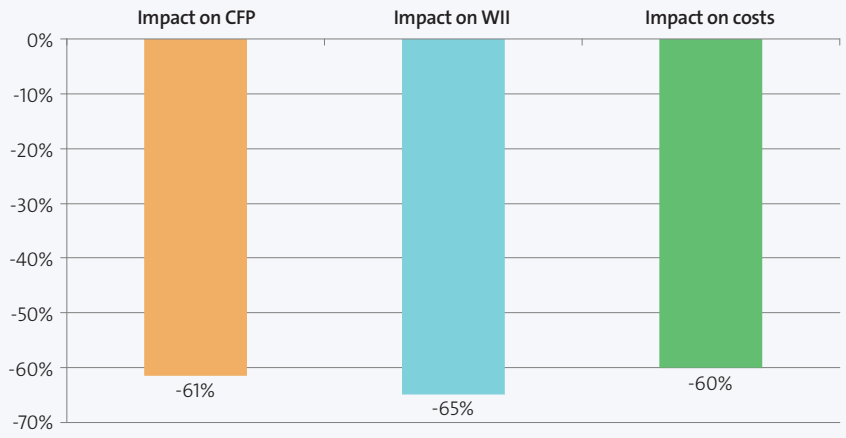
- *A reduction of phosphorous concentration in MMSD's treated wastewater discharged into Lake Michigan to a 0.3mg/l level (concentration averages for 2006-2007 were 0.66 mg/l) reduces the Water Impact Index by more than 100% while slightly increasing the carbon footprint (around 400 tonnes CO2eq per year) due to increased use of chemicals and energy.*

- A new project to replace natural gas and electricity demand via the use of landfill gas will significantly reduce the city's carbon footprint and Water Impact Index equivalent. Over 19 years, this would result in a savings of 1 million tons CO2eq (the annual carbon footprint output of 50,000 people) and 51 million Gallons of Water Impact Index equivalent.

This landmark study of Milwaukee's water cycle represents the first attempt at testing Veolia Water's methodology. More important, it establishes a tool for determining the most sustainable course of action based on available resources. For example, the study showed that air and water impact assessments do not replace thorough economic evaluation of a project or activity. Rather, they complement it by providing a multi-criteria analysis to achieve a "best-in-class" decision-making process. The unique circumstances of particular locations, ecosystems, economies, community needs and goals could lead to varied conclusions.

One of the next steps will be to extend the analysis to additional urban or state areas. Through this study, public and private sectors have worked closely in a way that provides a model for governments, organizations and businesses to provide best practices toward responsible water management and sustainable living.

Chloramination represents a win-win-win situation



- *Switching from sodium hypochlorite disinfection to chloramination would reduce the Water Impact Index of chemicals, the carbon footprint and generate savings.*

Milwaukee's Jones Island Wastewater Treatment Facility

Conclusion

There is no question that human and environmental preservation requires sensible use of water resources, but we also come to a point where economic growth will also dramatically depend on it.

The challenge – for cities, governments and companies – is to find solutions that make a minimum impact on the environment not only in terms of water resources but also when it comes to energy use while maintaining and promoting economic growth.

Rapid development is putting a strain on cities, particularly their water resources. Those communities that have not addressed their infrastructure needs will face huge wake-up calls that will challenge their political and economic stability. Today's economic downturn only exacerbates the problem in budget-constrained cities and towns.

Veolia Water's Water Impact Index and water-carbon analysis are important steps in a broader dialogue about water, energy and the environment. As the need for environmental efficiency and resource management intensifies, organizations and communities will be able to use these tools to determine business practices (locations, operations, technologies, etc.) that create the minimum environmental impact and pose reduced risks to water and air.

When communities optimize their water and wastewater systems through technical and operational solutions, the benefits in service improvements, environmental impacts and cost savings for the public can be immediately realized. They also provide a framework for economic growth and prosperity.

Everyone has a responsibility to conserve and manage natural resources wisely and with an eye to the future. Through the creation of the Water Impact Index, Veolia Water has made a start toward a more rational and objective way to manage water and energy for years to come.

Milwaukee's Southshore Wastewater Treatment Facility

About Veolia Water and the Milwaukee Partnership

As the world's leading provider of comprehensive water and wastewater services and technologies, Veolia Water brings 150 years of experience, leading-edge technology and unmatched management skills to municipal and industrial customers worldwide.

Based in Chicago, Veolia Water North America is the leading provider of comprehensive water and wastewater partnership services to municipal and industrial customers, providing services to more than 14 million people in approximately 650 North American communities. The company is part of the Veolia Environnement companies in North America, with 30,000 North American employees providing sustainable environmental solutions in water management, waste services, energy management, and passenger transportation.

Veolia Water North America and Milwaukee are partners in the largest U.S. wastewater partnership, providing operations and maintenance (O&M) services for two large wastewater treatment facilities, a substantial biosolids operation producing Milorganite® (a branded Class A Exceptional Quality organic fertilizer), along with system management of a 411-square-mile service area with a 3,000-mile system of interceptor and main sewers. Veolia Water is also funding a $1.5 million, 10-year R&D program in partnership with the Great Lakes WATER Institute – at the University of Wisconsin-Milwaukee, Marquette University and the MMSD.

Veolia Water, the water division of Veolia Environnement, is the world leader in water and wastewater services and technological solutions. Veolia Environnement (NYSE: VE and Paris Euronext: VIE) is the worldwide reference in environmental services. With more than 312,000 employees, Veolia Environnement recorded annual revenues of $50 billion in 2009. Visit the company's Web sites at www.veolianorthamerica.com and www.veoliawaterna.com.