GE INK.

Water

Getting to Clean & Plentiful

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GE THE Green Economy

WATER: THE 'NOW' BIG THING'

Water isn't the 'Next Big Thing'. It's Here.

Letter from the Publisher

Meeting the water challenge is the biggest threat and the largest opportunity facing businesses today. Water affects our health and our prosperity, since over 40% of our water is used to create energy.

Water technologies go back to the Romans, who used clay filters to trap salt from seawater. Early Greek sailors boiled salt water, making potable water from the condensation. In 1970, Thomas Jefferson invented a method for desalination that was printed on the backs of newspapers distributed on ships so sailors could produce drinking water. In the US, after World War II, the government needed to find economical ways to increase the water supply during a water crisis. Congress passed a 'Saline Water Act' in 1952 to provide federal support for desalinating seawater.

Currently, in the Northeast the challenge is the price of clean water. Increasing storms overflow sewers, dumping raw sewage into rivers and lakes. Unregulated nutrients flowing into freshwater supplies are costly for municipalities charged with making our water potable. The parched Southwest has faced increasingly hot and dry summers, threatening livestock, agriculture and people. Cities and towns are regulating water use — how much, for what and when.

Throughout the United States, droughts of one to five or more years have caused Americans to learn to curb their water use. But when the drought ends, the lessons learned are lost. At 100 gallons per person per day, the US is the world leader in per capita water use. Should the growing economies of the world catch up with the US, we would need 3.5 times all the fresh water on the planet to meet that need.

Some of that will come from the oceans, some of that will come from conservation and recycling of existing water supplies. Already, the Middle East gets almost 50% of their water supply from the ocean, and are thirsty for more.

In this issue we look at the Northeast clean water and Southwest desalination opportunities. We feature companies that are inventing the future, along with the public private partnerships fueling this trillion dollar industry.

A. Tana Kantor, Publisher

US: 100 GAL /DAY /PERSON

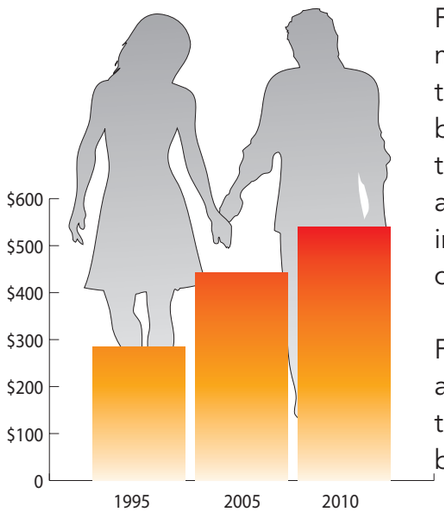
EUROPE: 50 GAL /DAY /PERSON

AFRICA: 15 GAL /DAY /PERSON

WATER QUALITY

As Ratepayers Balk, Private Enterprise Invents New Solutions

Water quality is a huge business opportunity, and will be for years to come. Escalating water prices (in some cases as much as 200% in a single year), and regulations on water management are making executives sit up and look for ideas and solutions they would not have considered even two years ago.

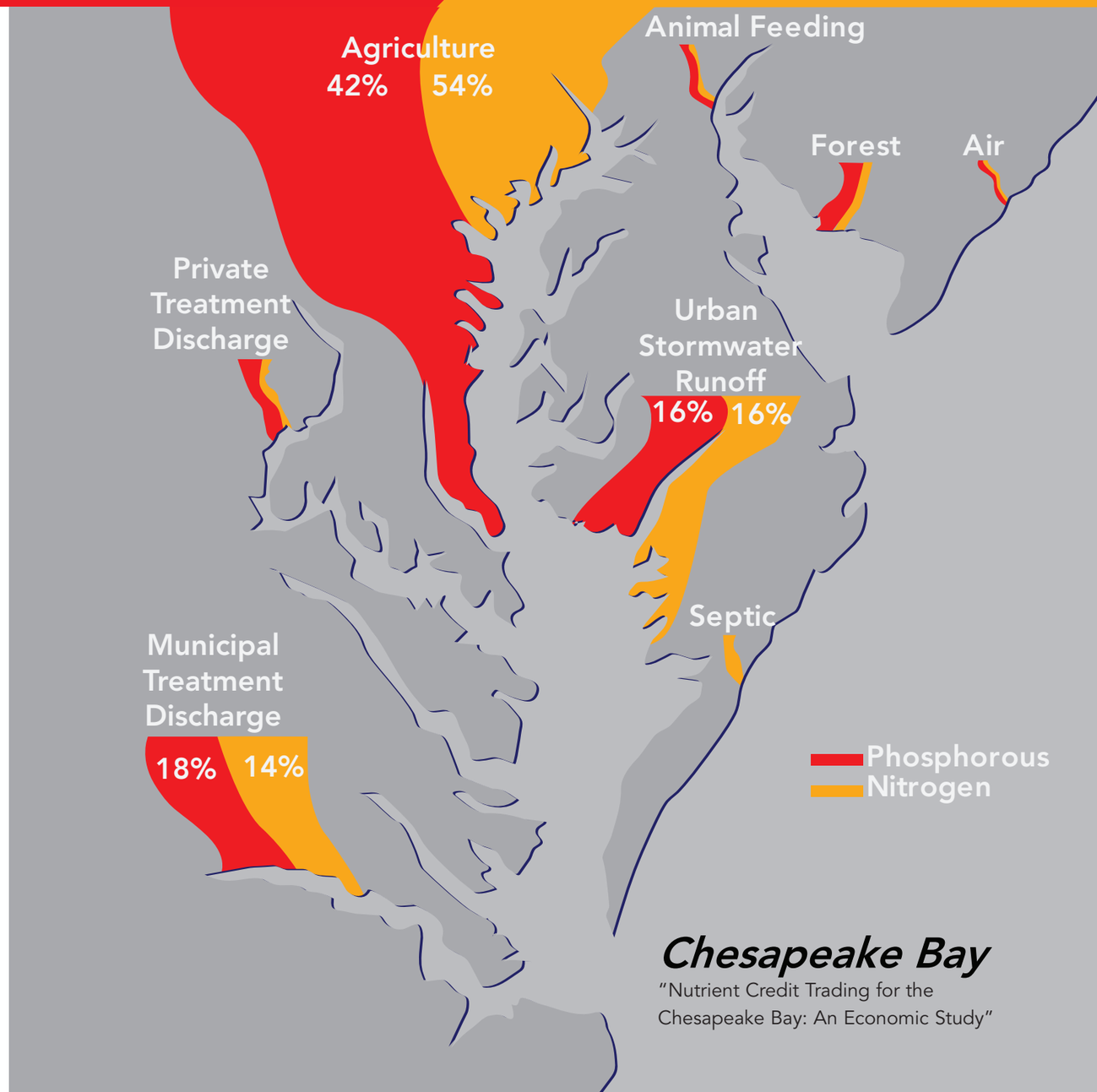


PER CAPITA WATER SPENDING

For some, water is the opportunity for fresh ideas that can manage price and regulatory risk. Others look to invest in technologies that may be tangential to their core business, but that could become products sold in the US or exported to water-stressed countries like India and China. Still others are looking to support policies to make them financial players in what the *US Conference of Mayors* calls a $1.7-$3.7 trillion dollar market.

For Edward Shafer, former Governor of North Dakota as well as a US Secretary of Agriculture, the private sector is needed to help find market-based solutions that haven't been tried before.

"This is changing the investment community. How can we deal with private sector investment on critical issues, instead of taking tax dollars and making decisions on risk not opportunity?"



He believes that the free enterprise system can provide the innovation to radically reduce the amount we spend on water quality.

The Challenge of Clean Water

Strapped municipalities can't keep up with clean water regulations. Public water investments grew through the Great Recession of 2008-2010, even though local government revenues declined. In 2012, Maryland estimated the cost of compliance at $11 billion, while the cost for Frederick County, Maryland, which needs to reduce 500,000 pounds of nitrogen, was estimated at nearly $1 billion. In Pennsylvania, projects combine water quality and aging infrastructure needs. Ratepayers then absorb the infrastructure costs within a compliance time-frame: a ten-year infrastructure upgrade gets pushed through in two or three years. The resulting sticker shock is bringing ratepayers to mayor's offices and water boards. The US Conference of Mayors report cites the following challenges.

"How can we deal with private sector investment on critical issues, instead of taking tax dollars and making decisions on risk not opportunity?"

Population: Cities are expected to grow 32% by 2042, leading to 85 million people living in urban areas.

Inflation: Costs of clean water exceeds the inflation rate in the economy.

Replacement: Over the next 20 years, between $2.8-$4.8 trillion will be needed to replace aging infrastructure. In Washington, DC, wooden pipes are still in use.

Regulatory Compliance: Combined sanitary and sewer overflow enforcement will force some communities to choose between funding infrastructure upgrades or compliance.

Affordability: The ability of local government to indefinitely continue making annual investments increases should not be taken for granted.

Rate Structure and User Fees: When capital investments are involved, double digit rate increases usually follow, severely affecting poor and middle class families.

Putting all the stresses together, Rich Anderson, PhD, an author of the reprort, noted, "Some in the public have come to register a suspicion of profiteering by public water services and a fear that rates are heading toward exclusionary pricing." Alleviating tax and ratepayer pain should start with an accessible problem: nutrient loading.

Nutrients: The Low Hanging Fruit

One of the largest problems is 'nutrient loading': nitrogen and phosphorous that clog waterways with algae, making the water undrinkable and, in many cases, unswimmable. *The Chesapeake Bay* alone drains an area of over 64,000 square miles and averages a mere 21 feet in depth. The U.S. Environmental Protection Agency (EPA) estimates that in a year with average rainfall, this water carries with it over 250 million pounds of nitrogen and almost 20 million pounds of phosphorus. These nutrients come from a wide variety of sources, including sewage treatment plants, industrial facilities, runoff from agricultural fields and urban areas, and even air pollution. The 'big three' are sewage treatment plants, storm water runoff and agriculture.

Sewage Treatment Plants:

The way the problem is currently addressed, wastewater treatment plants are mandated to clean water that has accumulated nutrients along the entire length of the watershed. The costs for 'the last mile' of nutrient reduction can be very high. According to George Hawkins, general manager of the Blue Plains Wastewater Treatment Plant in Washington, DC, a decade ago it cost $100 million to reduce nitrogen discharges from 15 milligrams per liter to 5 milligrams. Reducing it one milligram more – to 4 milligrams – will cost $1 billion. Municipalities and

In the early stages of public water treatment, filtration was considered satisfactory. As typhoid and cholera caused death rates of 300 or more per 100,000, municipalities had to act. Chlorination was added, with an amazing overnight reduction of the waterborne microbes that caused the diseases, leading to a dramatic rises in longevity.

regulated businesses pass these costs along to ratepayers or customers, often with heavy, up-front costs for projects that could have been paid for over a ten to twenty year life span.

A better plan is to examine the largest causes of nurtrient loading, and make plans to stop those nutrients from traveling down waterways to end up at sewage treatment plants. This means focusing on storm water runoff and agriculture. Although estimates vary, the savings of such an approach could be up to 80% of the costs of compliance.

Storm Water Runoff

Storm water runoff has two implications for clean water. The first is that impermeable surfaces, such as parking lots, drain large amounts of unclean water into the watershed during storms. Secondly, in urban settings unexpected influxes of storm water overwhelm sewage systems, leading to raw sewage being dumped into the basin. Many cities are instituting storm water regulations that mandate how much impermeable surface is allowed in new construction, and charging a surtax on buildings that cannot comply. While the mechanisms vary, they result in unexpected costs that are passed directly to commercial and residential owners, who pass them on to tenants.

Agriculture

Farms are by far the largest contributors to nutrient-loading, releasing 42% of phosphorous and 54% of nitrogen found in waterways. But agriculture is exempt from the Clean Water Act, which means that there is no regulatory incentive for farms to capture nutrients before they enter the waterways. Stopping the nutrient load at the source, rather than waiting for it to enter the waterway to be cleaned downstream, is much more cost effective. One way to achieve this goal is through a public-private partnership based on water quality trading or procurement.

Water Quality as a Commodity

'Water quality' as a commodity can be bought, sold and traded. Commoditization would create a market, and that market can engage the private sector. The goal would be to maximize efficiencies and drive innovation to produce solutions that address problems cost-effectively and efficiently. A *Stormwater Report* cites the benefits.

- **Efficiencies and Economies of Scale**: Cost savings are incentivized through economies of scale — purchasing higher quantities at reduced cost — and the self-interest that comes with long term contracts that include maintenance.

- **Standardization:** One of the challenges associated with urban-retrofit storm water practices is that there is limited guidance on the latest practices. Most guidance is associated with new development. However, as more retrofits come on line, firms will develop and apply best practices among several projects.

- **Innovation:** Companies have the flexibility to innovate and conduct research and development as needed. For urban retrofits, installers combine the latest technologies, while innovating on-the-spot at sites that have limited space or utility conflicts.

- **Technology Partners:** Private enterprise can engage additional partners — other companies or universities — to develop and deploy higher-efficiency, lower-cost technologies without complex public RFP processes.

- **Job Creation:** The public win is more than clean water. Projects that clean water take time and people. In some cases, that's thousands of long term jobs in the community.

Prince George's County plans to retrofit about 8,000 acres of existing impervious surfaces at a cost of over $1.2 billion. The County estimates the program will create 5,000 to 7,000 new jobs.

Mechanisms for Engaging the Private Sector

There are several ways currently used to create partnerships between the public and private sector: Public/Private Partnerships, Water Quality Trading and Water Quality Auctions or Procurement.

Water Quality Trading

For over ten years, the US Conference of Mayors, among others, has been urging the EPA to adopt water quality trading. Kurt Stephenson, PhD at Virginia State, added:

"Water quality trading, particularly for nutrients, is increasingly being advocated and proposed by professional economists and regulatory agencies as a means for achieving pollutant control requirements for point sources under the Clean Water Act."

Water quality trading is not a new idea. The state of Virginia is implementing one of the largest scale nutrient trading programs in the United States.

The way a nutrient market works is by establishing a mandatory cap on the combined pollution loads from multiple sources. It then allows trading of specific loads among individual sources to determine where and how the load reductions occur to meet the cap. It takes advantage of the fact that the multiple sources face different costs when seeking to accomplish the load reductions. In essence, entities are given two options:

1. Implement pollution control practices on site, or
2. Purchase the load reductions from other sources that reduce loads by more than their requirement.

Red	Orange
Meets current standards.	Does not meet standards.
Could upgrade for $120,000.	Must upgrade for $200,000.
Upgrades.	Does not upgrade.
Sells 10,000 lbs. per year of verified nutrient reductions from upgrade.	Buys offset (10,000 lbs. per year of verified reductions).
Upgrade is paid for.	Saves up to $80,000 per year over doing their own upgrade.
In compliance.	**In compliance.**

In the example on the previous page, a company that does not need to upgrade, does so anyway in order to sell their verified nutrient reductions to another company for which upgrades are too costly.

A *real world example* is water quality trading along the Ohio River. In that case, utilities that cannot meet their total discharge reductions can buy credits from farmers who turn farmland into forest along the banks of the river, creating a barrier between crops and stream. Through a formula established in the statute, the utility can use that agricultural offset to come into compliance as they work to upgrade their facility.

Auctions or Procurement

Both rely on contractors providing specific remediation based on requirements set out by the purchaser. A request for proposals (RFP) by the procuring entity can identify cost-effectiveness in relation to the amount of nutrient reduction as the "primary criterion." As a result, two radically different technologies could meet the standard, since it is outcome rather than process specific. The winning company would then be required to comply with the guidelines set out by the RFP. Such RFPs could set out long-term contracts — as much as 20 years — which would spread costs, helping rate and tax payers while providing the certainty that business needs to perform efficiently.

One example cited by Dr. Rowland, is a water quality project along the Colorado River. A 1988 study conducted for the US Bureau of Reclamation (BOR) estimated annual damages of $311–$831 million due to excess salinity in Colorado River. Damages could exceed $1.5 billion per year if salinity was not properly controlled. The BOR initially expected the cost-effectiveness of controls under a competitive procurement program to average $50 per ton. After the initial four years of the program, selected projects averaged just over half of

that estimate ($26 per ton), with a range of $11 to $36 per ton, and slightly over a third of the average cost-effectiveness of controls under the previous program ($70 per ton).

P3 or Public/Private Partnerships

Arrangements between government and the private sector can transfer risk to the private sector, according to the *Stormwater Report*. A company assumes control over financing, constructing, and maintaining large projects. Government repays the private sector over the long term as the infrastructure projects are built and maintained according to specifications.

This echoes an *initiative by the Army* to eliminate inadequate family housing through long-term contracts with private partners. The private sector is repaid for upfront investments through rent that is equal to the resident's Basic Allowance for Housing. These partnerships spread the costs over a long time line by paying back the installers over time. In the water economy, this means that the up-front 'sticker shock' that has water utilities passing on sizable sums to ratepayers can be avoided.

Kurt Stephenson, PhD, Department of Agriculture and Applied Economics, Virginia State

Technologies

There are several technologies designed to limit discharge at the source, whether it is urban storm water or agricultural runoff.

Sequestration:

One route is to sequester nutrients, either creating barriers between the bay and pollutants, building retention ponds to capture runoff, creating land filters, removing septic systems, or using natural habitats that can absorb and clean water. Dr. Stephenson and his team have created an overview of the costs in dollars and the feasibility for a 1 million gallon development.

Approach	Annual cost to remove 1 pound of Nitrogen	Technical Feasibility for a 1 million gallon development
Agricultural Nonpoint Offsets		
Early Cover Crops	$26 to $400	16,300 to 64,300 acres
15% Nitrogen Reduction	$8 to $56	4,370 to 16,215 acres
Continuous No-till	TBD	10,055 to 20,930 acres
15% Nitrogen Reduction + Continuous No-till	TBD	3,530 to 10,910 acres
Crop to Forest Land Conversion	$66 to $556	1,555 to 4,850 acres
Urban Nonpoint Offsets		
Storm water wet ponds	$1,294 to $3,131	10,900 to 54,600 acres
Storm water wetlands	$437 to $749	10,900 to 54,600 acres
Bio-retention areas	$230 to $378	6,550 to 32,730 acres
Sand Filters	$3,518 to $13,370	8,190 to 41,860 acres
Septic Retirement	min $60/lb	750 to 1,500 houses
Nutrient Assimilation Offsets		
Oyster Aquaculture	$0 to $150	21 to 69 million oysters
Algal Biomass Harvest	TBD	6 acres
Restored Floodplain Wetlands	$14 to $377	50 to 200 acres

As the chart shows, while some of these approaches may be economically feasible, in many instances the amount of land – or oysters – may be prohibitive.

Reduce at Source

Another approach is to capture the nutrients at the source, either cleaning the nutrients or, best case, returning those nutrients to productive use. An essential element of any such technology is the ability to verify actual phosphorous and nitrogen reductions. Such verification is the corner stone of putting a price on water quality that allows it to be traded, bought or sold. [See Market Leader next page].

This approach was recently supported by the Pennsylvania Legislative and Budget Committee. It released a study advocating adopting a competitive bidding program for verified nitrogen reductions. This could reduce Chesapeake Bay

costs to Pennsylvania taxpayers by as much as 80%. The proposed policy initiative enables low cost verified nitrogen reductions from agriculture, primarily livestock, to replace high cost municipal and storm water reductions to comply with the Chesapeake Bay federal mandate.

Barriers to Acceptance

Anything new in the utility industry has an immediate barrier. Utilities are mandated by law to provide 7/24/365 service to millions of people. Even small changes have large regulatory and financial hurdles, not to mention staff and service providers who would like to keep their jobs. Dr. Stephenson sees the driver as costs, but is more skeptical about adoption of new technologies. For the US Conference of Mayors, it is an essential step to managing costs that are also needed for education, security and many other activities of towns and cities.

Edward Shafer, former two term elected Governor of North Dakota, and US Secretary of Agriculture.

Governor Shafer takes a longer view. He sees a changing financial landscape that will make water costs a ballot issue.

> *"Change is driven by the people. When people say 'We can't afford it, so you have to figure out how to lower costs so I can live in my community,' then you will see policy change."*

As a former entrepreneur, he also noted that any market-based system has cycles: innovative companies form to meet a consumer need. As they become successful, they lose sight of changing customer demands. Protecting their business, rather than innovating, they raise barriers for new entrants. Eventually, however, market forces produce change, and that change brings new competitors. In the water sector, the magnitude of the problem, along with the opportunities, is likely to mean that the time is now.■

Sources

1. "Nutrient Credit Trading for the Chesapeake Bay: An Economic Study." Prepared for the Chesapeake Bay Commission by RTI International. May 2012
2. "The Public Health Benefits of Investing in Municipal Water Treatment and Infrastructure Renewal." Richard F. Anderson, Ph.D., Dave Gatton, and Judy Sheahan US Conference of Mayors, June 2013
3. "Growth in Local Government Spending on Public Water and Wastewater – But How Much Progress Can American Households Afford?" US Conference of Mayors. April, 2013
4. "Competitive Procurement Programs Can Help Heal the Chesapeake Bay." Jeremy Rowland, COO, Bion Environmental Technologies. Printed in the *Conservation Leadership Council*. 2013
5. "Virginia Nutrient Credit Trust and Exchange: An Exploratory Proposal." Prepared by Kurt Stephenson, Department of Agricultural & Applied Economics, Virginia Tech and Leonard Shabman, Resources for the Future, Washington D.C, May 31, 2011
6. "Achieving Nutrient Water Quality Goals: Bringing Market-Like Principles To Water Quality Management." Leonard Shabman and Kurt Stephenson, *Journal Of The American Water Resources Association*, Vol. 43, No. 4. August, 2007
7. "Financing Urban Retrofits via a Public-Private Partnerships." *Stormwater Report*, July, 2013
8. "Uncle Sam Wants Your Clean Tech." The Green Economy Energy Security magazine, issue 13:01, January 2013.
9. "$1.4 Million for Water Quality Pilot Trades in Ohio." theGreenEconomy.com.
10. "Water Trading on the Ohio River." The Green Economy -The New Oil, issue September:2011

INTERVIEWS

11. Jeremy Rowland, COO, Bion Environmental Technologies, August 13, 2013
12. Governor Edward Schafer, August 13, 2013
13. Kurt Stephenson, PhD, Department of Ag and Applied Economics, Virginia Tech. August 12, 2013
14. Richard Anderson, PhD, US Conference of Mayors, August 8, 2013

THE Green Economy

NEXT:
THE ENERGY EFFICIENT BUILDING

Buildings are now storage devices, energy generators and resource hoarders. In the next issue, we feature companies that are helping other companies do much, much more with less.

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