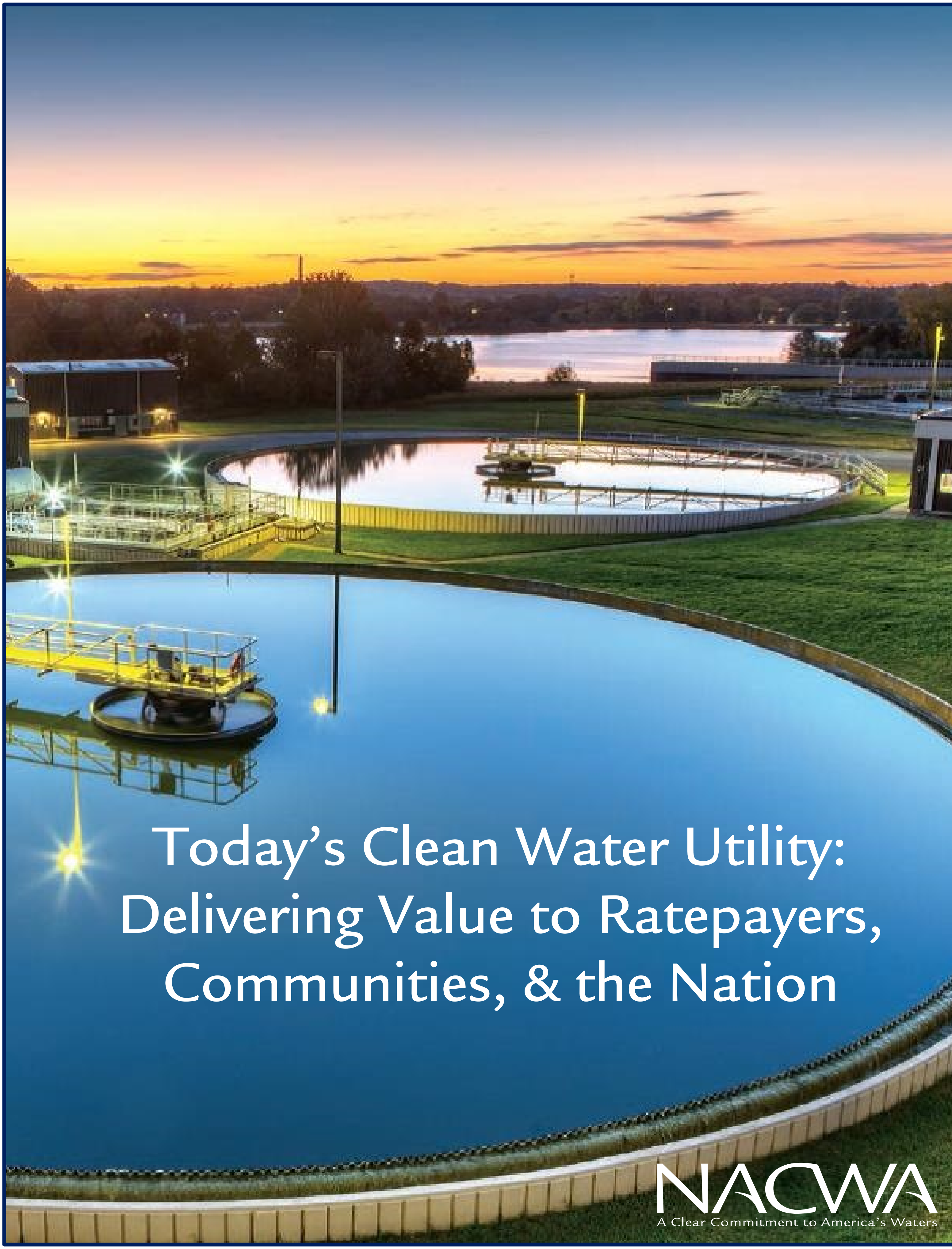

Today's Clean Water Utility: Delivering Value to Ratepayers, Communities, & the Nation

NACWA

A Clear Commitment to America's Waters

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Executive Summary

Clean water utility leaders have amassed more than four decades of experience implementing the complex requirements of the Clean Water Act (CWA). They have developed a level of sophistication that could not have been contemplated even ten years ago. They have guided their agencies in their central role of managing waste streams to ensure that the Nation's precious water resources remain clean and safe. Increasingly, however, these utilities are doing even more and their leaders are redefining their role in the communities they serve as they reconsider the economic value of their inputs, like water, nutrients, and organic matter, as well as their own ability to create direct value for the nation. In essence, clean water utilities are redefining themselves as managers of sustainable resources.

While traditional public health and environmental objectives will always be central, the model of the Water Resources Utility of the Future (UOTF) is evolving in new and exciting directions. The UOTF separates, extracts, reuses and generates valuable water, energy, nutrients and other commodities from wastewater while using utility assets in innovative ways to reduce costs, increase revenue, and strengthen the local and national economies. The UOTF also seeks to engage more fully with the communities they serve, as well as other clean water interests in their watersheds, to deliver more cost effective water quality solutions.

This white paper focuses on how utilities can tell their traditional and UOTF stories by focusing on the value they provide to ratepayers in the form of high-quality services at a fair price, to the community in the form of jobs and local economic opportunity, and to the nation in the form of environment amenities and gross domestic product (GDP) growth.

This paper acknowledges that clean water utilities have become so dependable, effective, and efficient over the last several decades that for most people, they are largely "out of sight, out of mind." This is a remarkable, but too-often untold and unheralded success story. This "out of sight, out of mind" status also means that ratepayers and other stakeholders pay too little attention to the vital role that clean water infrastructure plays in their welfare, in the delivery of direct value to individuals and businesses, and in provision of broad environmental gains to all Americans.

The goal of this white paper is to provide a framework and specific language to help utilities tell their story in terms that resonate locally and nationally. This clean water value proposition builds on the pioneering 2013 report *The Water Resources, Utility of the Future . . . Blueprint for Action* (NACWA, the Water Environment Federation, and the Water Environment Research Foundation) and the subsequent NACWA publication, *The Water Resources Utility of the Future — A Call for Federal Action,* which provided a detailed advocacy agenda around the UOTF effort.

From an economic perspective, the return on investment in clean water is impressive: employment opportunities, enhanced productivity in the private economy, higher standards of living, and a more favorable trade balance. Environmentally, its impact is clear – we all know life depends on clean and safe water. But the public needs to understand how far the water sector has come, as well as the vast potential for the future if utilities communicate clearly about their contribution to local communities and society as a whole. The full potential of the transition to the UOTF will be unleashed when regulators and governing boards acknowledge the substantial returns associated with making this transition and based on that, support new ways of doing business. By re-examining current policies from the perspective of the UOTF, environmental and public health outcomes will be enhanced and emerging objectives like resource recovery, water reuse, energy efficiency, and sustainable communities will be enabled.

The Utility of the Future: It's Here & Now

In 2013, a Task Force of industry leaders organized by the National Association of Clean Water Agencies (NACWA), the Water Environment Federation (WEF), and the Water Environment Research Foundation (WERF) documented the remarkable transition of today's clean water utilities from managers of waste to managers of resources. The Task Force coined the term, Utility of the Future, to describe in simple terms what these institutions were up to.[1]

What is the Utility of the Future?

Historically, clean water utilities sought to collect human and industrial wastewater and pipe it as far downstream, as quickly as possible, to central treatment works to remove harmful constituents so that receiving waters would meet applicable environmental standards. For decades, that model worked well: today, more than 90 percent of the U.S. population enjoys such services through more than $500 billion in public assets into which the nation as a whole invests more than $55 billion a year to remove more than 90 percent of organic inputs, an estimated 55 percent of nutrients, and nearly all harmful bacteria.[2] Environmental outcomes are equally impressive — according to the U.S. Environmental Protection Agency (EPA) and state analyses, municipal wastewater discharges account for less than 10% of remaining water quality impairment of the nation's rivers, streams, lakes, reservoirs, and coastal shoreline and only about 30% of impaired estuaries.[3]

While traditional public health and environmental objectives will always be central, the model for the Utility of the Future (UOTF) is evolving in new directions. It contemplates a new business approach where instead of simply collecting, treating, and disposing of wastewater, the UOTF recognizes that its inputs are valuable resources. As such, its objectives are to separate, extract, reuse, or convert valuable water, energy and commodities from wastewater while using utility assets in innovative ways to reduce costs, increase revenues, and strengthen the local economy. The UOTF also seeks to engage more fully with others that share the water resource through watershed-based approaches, innovative partnerships, and adaptive management techniques to ensure that actions maximize environmental benefits at least cost to local households and businesses.

What Forces are Behind the UOTF?

In large part the UOTF is emerging today in response to a series of unprecedented challenges. First, costs of removing the initial few increments of pollutants from wastewaters in the 1970 and 1980s – even in the 1990s – were relatively low compared to the current and future costs of advanced treatment to remove nutrients and to store and treat wet weather flows. Compounding the financial situation further, much of our existing infrastructure is old and must be replaced over the next several decades. For an increasing number of utilities, these combined costs are proving untenable.

Second, funding for clean water has shifted dramatically over this period from a shared, intergovernmental approach to an almost exclusively local, user-financed approach. According to the U.S. Bureau of the Census, the local share of investment in clean water capital works increased steadily from about 50% in the late 1970s/early 1980s to more than 95% today (operations and maintenance costs have always been locally-financed). With rising costs of basic infrastructure, new costs of regulatory requirements, and the shift to all local financing, annual sewer bills on average, nationwide, have crept upwards at 3% above inflation each year for the last decade. Doubling or tripling in sewer costs raises questions of affordability for many types of ratepayers in more and more utilities across America.

Third, the nature of our future clean water challenge has changed. According to EPA's Needs Analyses[4], much of the capital invested in the 1970s and 1980s built basic treatment plants and connected populations and industry to them to manage sanitary and industrial wastewaters. In the 1990s, and to an even greater degree in the 2000s and 2010s, the focus of investment shifted toward managing wet weather flows and nutrients. These latter targets impose very large capital expenses, but they do not affect every clean water utility. A wider range of solutions can be used to address wet weather and nutrient issues than the solutions that apply to traditional sanitary and industrial wastewater problems, creating opportunities for process and technology innovation.

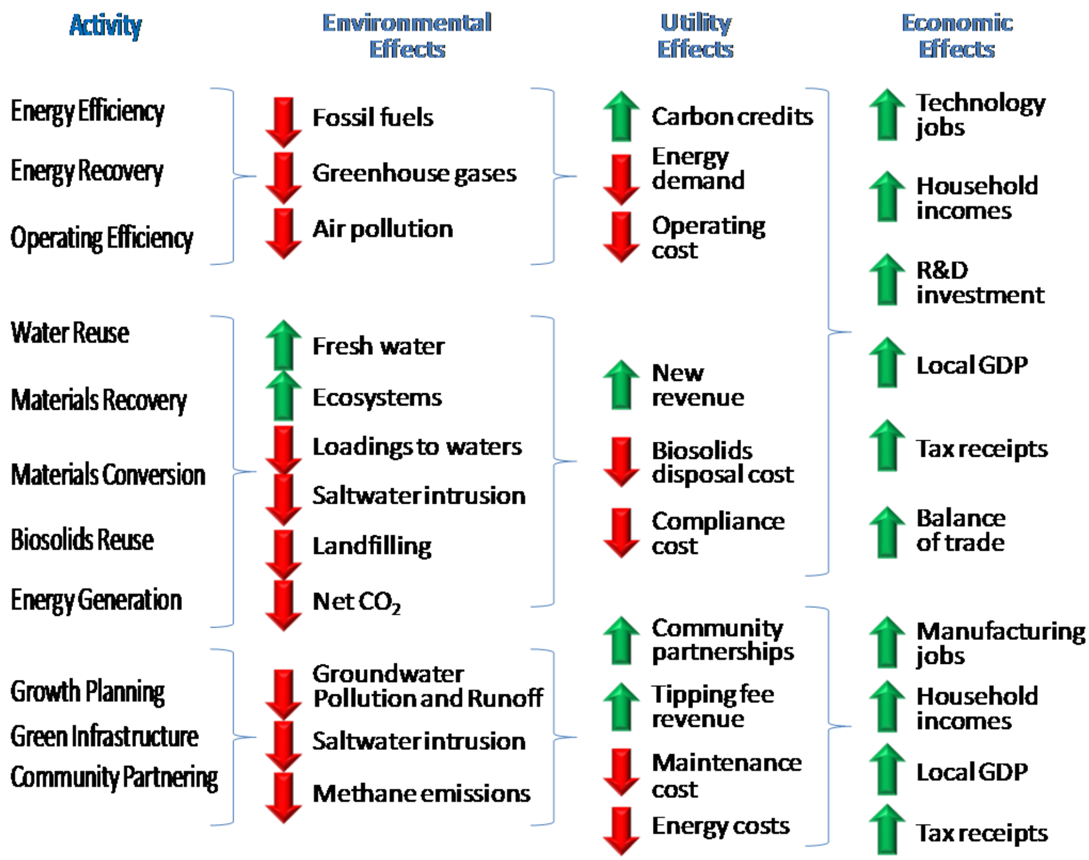
Finally, U.S. clean water utilities that for decades established their roots as technical engineering entities, have evolved and matured into some of the most sophisticated management enterprises in the world. While these enterprises will always be cautious, since their products are environmental protection and public health, utility leadership and management today are more likely to innovate. Why? They are increasingly networked to each other and to information about technology, they participate in community and watershed initiatives to a much greater extent than ever before, and as stated above, they have strong fiscal incentives to find ways to do business differently.

Why is the UOTF Important to Ratepayers, the Environment, & the Nation?

The UOTF is a natural outcome of the convergence of fiscal pressure, technological opportunity, and enlightened leadership. The nation's clean water agencies are becoming more energy and operationally efficient; reusing effluent and biosolids; recovering energy from biosolids; recovering nutrients and other constituents; transforming waste streams into valuable new commodities; taking steps to support economic expansion by setting capital investment priorities to meet the needs of industry, and working collaboratively with other water quality interests within their watersheds.

Utilities that undertake transformative measures toward the UOTF, from treatment and disposal of wastewater to sustainable resource management, generate from their own perspective, net benefits in the form of reduced costs and increased revenues. UOTFs streamline their organizations; create more effective, highly trained staff; eliminate non- and under-performing business practices; and, use technology to automate, monitor, and control standard transactions. Utility savings are passed along to the community in the form of mitigated rate increases and new investments to strengthen service delivery and environmental quality.

Importantly, these actions also result in a cleaner environment, healthier communities, and more productive local and the national economies. Fewer residuals are released into the environment. Those that are released are generally in a more benign form. Many UOTF elements capture methane, a greenhouse gas 85 times more powerful than CO_2, for example, before it can escape to the atmosphere. Clean water agencies that substitute their own renewable forms of electricity for purchased electricity from carbon-based fuels also reduce CO_2 emissions. UOTFs that pursue green infrastructure to manage stormwater create multiple green spaces that beautify and transform the urban landscape and increase property values. All of these initiatives create permanent, U.S. jobs. These effects are summarized in the graphic which follows:



In the next section, we will explore in more detail how these effects generate value for the utilities that undertake them. In subsequent sections, we will examine the value that UOTF activities add to the communities they serve, and the nation as a whole.

Delivering Value to Ratepayers

There is no standard for a Utility of the Future. Every UOTF innovates around its own regulatory, fiscal, and community conditions. Yet, all UOTFs create value in the form of reduced operating and capital costs, increased rate and non-rate revenues, and/or stronger communities that in turn, lead to a stronger utility bottom line and reduced rates charged to households and businesses. They do this through energy and operational efficiency; energy recovery and energy generation; water and materials reuse; green infrastructure; and, community and other partnerships.

Energy & Operational Efficiency

For years, clean water utilities have been taking steps to streamline their organizations, increase workforce productivity, re-engineer business processes, and reduce energy and chemical use. When they do this, savings drop directly to the bottom line.

Energy costs represent 9-12% of clean water utility operating budgets, on average, or about $2.5-$3 billion a year across the nation. Even a relatively modest reduction of 3-5% in energy use from routine energy efficiency activities such as improving blower or motor efficiency, use of heat exchangers to capture waste heat, or motion-sensitive lighting, can reduce annual energy costs for this sector by $100-$150 million. Clean Water Services, just west of Portland, Oregon, for example recently completed a series of energy efficiency activities at their plants, pump stations, and headquarters buildings including upgrades to variable-speed, high-efficiency pumps and motors, day lighting systems, and optimizing UV disinfection systems to use less energy. As a result, they saved about 15% of their $3.4 million yearly energy bill.

Operational productivity improvements also reduce utility costs and customer rate increases – sometimes dramatically – by adopting methods like Lean Manufacturing or Six Sigma.[5] Clean Water Services recently escalated its productivity improvement program, netting an operating cost reduction of $3 million a year (about 10% cost reduction). Labor productivity increased by 35% in part because of new pay-for-performance and gain-sharing systems. The District used these savings to forgo any rate increases for several years at the outset of the program and fund major capital improvements to meet new regulatory requirements. Continuing gains held rate increases to only 3% between 2009 and 2013 even though at the same time, the utility installed tertiary treatment, instituted a water reuse program, invested in energy efficiency, and installed the most advanced nutrient removal technology in the nation.

Nearly every major clean water utility in the U.S. has undertaken some form of productivity program with the effect that the rate of increases in real annual operating costs (in 2009 dollars) for a random sample of about 100 major urban clean water agencies have declined by about 8% from about $80/capita in the 1980s/1990s to about $74/capita in the 2000s.[6] Over this same period, revenue efficiency nearly doubled from about $200,000/employee to about $380,000/employee (all 2009 dollars). Interestingly, these changes occurred at the same time that service area populations expanded by nearly 30% from 170 million people in 1985 to 220 million people in 2005 and capital investments as a percent of total expenditures grew from 56% to nearly 60% to meet new regulatory requirements and service standards.[7] Productivity improvement is a continuous process, however, and as new "smart" technologies are introduced and success shared across the sector, gains will surely continue.

Energy Recovery & Generation

According to a recent industry analysis, heat and embedded energy in biosolids that could be extracted by U.S. clean water agencies can make a significant contribution toward meeting the nation's electricity demand. Many clean water utilities are now capturing this energy and using it to reduce energy costs.

NEW Water, for example, the public clean water utility serving Green Bay and northeastern Wisconsin, has embarked on a $147 million Resource Recovery & Electrical Energy (R2E2) program with two new anaerobic digesters to convert biosolids into methane biofuel used onsite to produce electricity. Energy from these facilities will offset half the utility's electrical demand in its first year of operation. Over time as NEW Water augments inputs to its biosolids methane generators with organic waste from local dairies and food processing plants, the program will reduce energy needs further. NEW Water also will heat its buildings by fueling a state-of-the-art incinerator coupled to heat exchangers with residuals from its anaerobic digesters. When complete, all of these initiatives will reduce NEW Water's demand for natural gas by 90%. Energy savings from electrical generation and heat recovery will offset the initial investment in 8-10 years. Thereafter, the program saves $2.2 million in energy costs every year for another 10-20 years.

The story of NEW Water is not unique. In fact, there are more than 1,000 clean water utilities across the nation that are doing similar things.[8] A few, like East Bay Municipal Utility District outside of San Francisco, produce more electricity than they need, generating net revenue for the utility by selling the excess to the local grid. Many are now co-digesting by taking in food waste, which boosts electricity production even further. According to the EPA, if only half the food waste generated each year in the U.S. was anaerobically digested, enough electricity would be generated to power more than 2.5 million homes for a year.[9] That represents about $2.6 billion in electric savings and/or new revenue for clean water utilities.

Similarly, clean water utilities are capitalizing on their horizontal assets like land and building roofs to install solar photovoltaics (PV) and, in many locations, prevailing winds by installing windmills to generate supplemental energy. The Narragansett Bay Commission serving Providence, Rhode Island and the surrounding region, for example, has installed 3, 1.5 MW wind turbines at a cost of $14 million. The wind turbines supply half the power needs of the utility's larger treatment plant, saving about $1 million a year in energy costs. The Camden County Municipal Utilities Authority serving 500,000 customers in New Jersey recently installed a 1.6 MW solar PV system comprised of 7,200 panels erected directly above the open water of the utility's primary and secondary treatment works, changing conventional thinking that urban clean water facilities were unsuited to solar PV. Financed and maintained entirely by a private partner, this system will save the utility $300,000 in energy costs in the first year of operation, and about $7 million over the 20-year power purchase agreement.

These options are not just for large utilities. The Poolesville, Maryland clean water utility, which serves a population of 5,000, partnered with a private developer who financed and will maintain a $2.7 million, 800 kW solar PV system on six leased acres, saving the town about $30,000 a year or one-third of the energy needed to operate its facility. The City of Perry, Iowa (population: 7,700) partnered with a private developer to finance and maintain a 50 kW turbine at the City's clean water utility that cuts the utility's electricity costs in half.

Water and Materials Reuse

Water is one of the most valuable commodities in large parts of the nation. As a result, many clean water utilities, especially those in water-short regions, actively market their effluent for industrial cooling, industrial processing, landscape and agricultural irrigation, fire fighting, ecological enhancement, and groundwater recharge. Aside from "de-facto" indirect reuse, which occurs across the U.S. when drinking water utilities intake river water mixed with discharges from upstream clean water utilities, purposeful indirect and even direct potable reuse appears inevitable.

The economic benefits to clean water utilities and their ratepayers are obvious – every gallon of reused wastewater represents new income, or offsets the cost of potable water supply for which recycled water substitutes. But this revenue stream is still largely untapped. While non-potable wastewater reuse has doubled over the last decade to about 2 billion gallons a day, this represents only about 5 percent of total municipal wastewater discharged, according to the WateReuse Association.[10] The potential for additional reuse, and with it, generation of new revenue, is significant. According to the National Research Council of the National Academy of Science, some 12 billion gallons of municipal wastewater effluent is discharged each day to an ocean or estuary (where water rights issues do not impair reuse). Reusing these coastal discharges would be the equivalent of adding 6 percent to the total U.S. use of fresh water or 27 percent to public supplies.[11]

Clean Water Services in Oregon supports one of the nation's most innovative water reuse programs, although their objective is not strictly financial. One component reuses highly-treated effluent to enhance an area of local wetlands, Fernhill, which is used widely by the public for nature study and birding. Fernhill wetlands also improve water quality as aquatic plants absorb nutrients and slow down water flow enabling solids to settle. A second component of the program seeks industrial partners to reuse "fit-for-purpose" wastewater of varying quality for cooling and processing.

The West Basin Municipal Water District in southwest Los Angeles County produces five distinct types of recycled wastewater for different end uses. In total, the District supplies about 28 million gallons a day (MGD) of treated wastewater to 200 customer sites within the service area. The cleanest— about 17.5 MGD treated beyond drinking water standards—is sent into underground wells that line the coast and act as barriers against seawater intrusion into local groundwater sources of drinking water. On the other end of the scale, water used for irrigation of public lands in the nearby Cities of Inglewood and Torrance undergoes a less intensive level of treatment. In between, about 0.5 MGD of high-quality water goes to the El Segundo power plant for further processing before use as product water in their boilers. Another 5 MGD of recycled water goes to the nearby Chevron oil refinery for additional finishing before use in industrial processes. The District is planning to more than double deliveries of recycled water by 2020.

More than 90 percent of the City of Phoenix's wastewater is highly treated and used to irrigate crops and turf, as well as for industrial applications. The same is true of many western cities in desert environments including Tucson, Arizona, Las Vegas, Nevada, and Austin, Texas. Not all reuse takes place in the West, however. The Miami-Dade Water and Sewer department provides 90 MGD of highly-treated, disinfected wastewater to Florida Power and Light for cooling purposes. Loudoun County, Virginia sells highly purified wastewater to nearby data storage centers for cooling and will soon expand its program to supply additional effluent for irrigation, space cooling, and other non-potable uses, especially to customers that are seeking LEED certification for their new office buildings.

America's clean water utilities are also reclaiming and reusing materials, which both reduces processing and disposal costs of residuals, and creates opportunities for new revenue streams. Capturing phosphorus and processing it into fertilizer is one of the best examples. Madison, Wisconsin, Clean Water Services, Oregon, Hampton Roads, Virginia, and York, Pennsylvania (plus Chicago, Illinois and Gwinnett County, Georgia in 2015 and three other cities in Canada) have each partnered with Ostara Nutrient Recovery Technologies, Inc. to build state-of-the-art facilities that recover about 85% of phosphorus and 25% of the nitrogen from waste streams and convert these nutrients into eco-friendly "Crystal Green" fertilizer. This process enables utilities to meet stringent nutrient discharge regulations with little or no capital investment (which is provided by Ostara), create new revenue from a marketable commercial fertilizer, and increase overall plant operating efficiency.

Dried biosolids can be used as a substitute for oil, gas, and especially coal since its calorific value is identical to that of wood. A cement kiln in Union Bridge, Maryland uses about 40,000 tons/year of dried biosolids pellets in place of coal. Another kiln in Rialto, California uses 1,640 wet tons/day of biosolids converted to 300 tons/day of dry biosolids fuel (95% solids) with 5,529 Btu/lb in energy value (slightly less than low grade coal). Detroit, Michigan's Water & Sewerage Department is planning to construct a biosolids drying facility by 2016 to produce up to 200 dry tons/day of biosolids pellets, which may be used as a fuel source in electric power plants in place of coal, helping meet the state's mandate of 10% of its power from renewable sources. Dried pellets also may be used as a fertilizer/soil amendment.

Research efforts are underway in the U.S., Europe, and China to commercialize processes that will recover valuable metals, inorganic chemicals, and other materials.

Green Infrastructure

Green infrastructure uses vegetation, soil, and other simple mechanical methods in upstream community locations to trap, store, and purify stormwater (or solve other water quality impairment issues) before it enters combined and storm sewers for more costly central treatment downstream. Communities can save tens of millions of dollars using an appropriate balance of grey and green infrastructure. NACWA refers this balanced approach as "sustainable infrastructure." Beyond water quality, cities are increasingly improving the ways people live, work, and play in urban environments by embedding green infrastructure within broader initiatives to green the urban landscape. Significant opportunities exist to create green spaces in or on vacant lots, roofs, roads, bridges, corridors, medians, parking lots, and other paved spaces that also manage rain where it falls, rather than in more expensive central treatment works located downstream.

New York City's Green Infrastructure Plan estimates that every fully vegetated acre of green infrastructure will provide city residents annual benefits of $8,522 in reduced energy demand, $166 in reduced CO_2 emissions, $1,044 in improved air quality, and $4,725 in increased property value. Washington DC's proposed $90 million green infrastructure program reduces their cost of deep tunnel storage while also providing green spaces and cooler summer temperatures for District residents. Further, it reduces long-term disruption to busy tourist areas like Georgetown, enhances property values, and mitigates rate increases for District residents. To keep rainwater out of combined sewers, and thereby reduce sewer overflows and basement backups, the Metropolitan St. Louis Sewer District in Missouri has proposed a $100 million green infrastructure program as part of "Project Clear," which stands in stark financial contrast to the alternative deep tunnel storage and other grey solutions at a cost of about $4 billion.

In one dramatic example of green infrastructure, rather than install a costly chiller to cool its discharge to comply with temperature restrictions in its discharge permit, Clean Water Services in Oregon has chosen to plant trees (as well as other plants) along stream corridors in the basin. This vegetative cover shades the receiving stream and mitigates thermal impacts from their treatment facility. Savings from this green alternative is about $150 million over the life of the project. Chillers would have been effective for only a short stretch of the river – less than a mile downstream from the two discharge points – while riparian area restoration and stream shading has improved more than 35 miles of streams, most of which provide critical fish habitat.

Community Partnerships

Clean water utilities are increasingly turning to various forms of partnerships with others in their communities or surrounding regions to solve watershed problems, especially those caused by nutrients (nitrogen and phosphorus). This is because both the science and the economics of these alternatives are clear. Commercial and manure fertilizers applied to farms and lawns are the predominant sources of nitrogen and phosphorus in most agricultural watersheds.[12] Across all watersheds impaired by nitrogen and phosphorus, agricultural sources cause 3-4 times more impairment than municipal sources.[13] Even if nutrients were eliminated completely from utility discharges, nutrient contamination in these watersheds – and in many cases, far downstream into near-coastal waters – would persist. Further, pound for pound, the cost to remove nitrogen or phosphorus from farm runoff and drainage is typically 4-5, sometimes 10-20, times less than the cost to remove the same amount from municipal wastewater or stormwater.[14]

By engaging others in the watershed, innovative UOTF leaders are saving utilities and ratepayers money through a wide range of solutions that focus on watershed results as opposed to strict point source controls. Two types of programs stand out: water quality trading, and adaptive management. One recent program that enables trading of nutrient reductions from all sources across nine states in the Ohio River Basin could serve as a model for other watershed-based trading programs. Launched in 2009, with some states joining as recently as 2012, the project is a first–of-its-kind interstate multi-credit trading program. It represents a comprehensive approach to developing markets for nitrogen, phosphorus, and potentially greenhouse gas reduction credits. At full scale, it would become the world's largest water quality trading program potentially creating credit markets for 46 power plants, thousands of wastewater facilities and other industries, and up to 230,000 farmers.

As part of its program to meet nitrogen load reductions to Long Island Sound, the State of Connecticut has established a successful nitrogen credit exchange/trading program. During the period 2002-2009, some $46 million in nitrogen credits were bought and sold, providing a cost-effective alternative for 79 clean water agencies to meet their nitrogen waste load allocations as part of the total maximum daily load (TMDL) adopted for Long Island Sound. Compared to other alternatives, these facilities have saved between $300 and $400 million through trading.

The Wisconsin Department of Natural Resources is working with utilities in Milwaukee, Madison, and Green Bay on modified regulatory compliance strategies. Under these strategies, permitted point sources work towards water quality compliance with state designated water quality standards by developing partnerships within their watersheds to balance load reduction from both point and nonpoint sources. The intent is to reduce discharges of parameters of concern by the most cost effective methods from all sources rather than compel only point sources to install costly tertiary treatment. Point source dischargers are afforded flexibility and can defer or avoid costly infrastructure installation by facilitating load reductions within the agriculture or other nonpoint sectors. In Green Bay, for example, only 2.5% of total phosphorus loadings entering the bay of Green Bay come from NEW Water's two treatment plants and to reduce this to 1% would cost more than $200 million. Reducing nonpoint source loadings would remove at least five times the phosphorus at a fraction of the cost while delivering other positive environmental benefits.

Adaptive management differs from water quality trading in that it doesn't require trade ratios or margins of safety, but does require demonstration of eventual compliance with the ambient water quality criteria in the receiving water. Adaptive management activities often achieve complementary improvements in the watershed, like reduction in sediment loadings, in addition to the reduction of the specific parameter of concern. Agricultural best management practices (BMPs) also can reduce farm operating costs since they typically keep more soil and fertilizer on-farm requiring less fertilizer to be purchased and applied.

Delivering Value to Communities

Modern clean water utilities deliver value to communities far in excess of customer savings from operational efficiency, energy recovery, materials reuse, and the like. They deliver direct economic value to individuals and businesses in the form of improved property values, good jobs, reduced costs of potable water services, or enhanced farm productivity, for example. They also provide value indirectly that improves quality of life in various ways through access to clean local waterways, aesthetics and recreational opportunities that come with green urban spaces, and less congestion from fewer trucks moving biosolids residuals. And, they provide value to local economies by enabling economic growth and development, which in turn, creates employment, increases household income, and creates new government tax revenue.

Direct Economic Value

The most tangible forms of direct value are associated with the services that modern clean water utilities provide: removal of wastewaters from homes and businesses; management of stormwater to prevent flooding and pollution; and, improvement and protection of clean surface waters for all to enjoy. Some activities that fall under the UOTF umbrella enable utilities to deliver these traditional services more quickly, at higher quality, at less cost, and with fewer environmental residuals. Other UOTF initiatives deliver their own forms of direct and indirect value to communities.

Water quality improvements, and the value they deliver to local communities, can be found across the nation. After the Narragansett Bay Commission in Rhode Island completed the first phase of its combined sewer overflow program, for example, water quality in the upper bay improved dramatically. Noting this, Rhode Island's Department of Environmental Management revised applicable shell fishing rules after rain storms, providing local shell fisherman an extra 55-60 days on the water. Rates of local beach closures declined by 85% and fin fish returned to the bay in commercial numbers. Not unimportantly, motorists enjoyed significant improvements from local roads that were repaved after the Commission completed its sewer separation work.

At each step of this evolution – since the time when human waste was simply tossed in gutters – the cost of meeting clean water mandates has gone up, as have the direct economic benefits of making needed investments. According to a recent poll of 11,341 readers conducted by the British Medical Journal, the advent of modern sanitation — collection and treatment of human wastewater prior to discharge — was the single most important public health advance of the last two centuries.[15] The direct economic value associated with a healthy population is likely inestimable, but few would choose to revert to 19th or even 20th Century conditions. Similarly, the direct economic value of living or working next to a clean river or swimming or fishing in a clean lake is well worth our collective investments to achieve these standards for a clean environment.

Some types of value can be estimated, even measured, relatively precisely. In one of its earliest analyses, EPA case studies of various watersheds showed that clean water increased the value of single family homes up to 4,000 feet from the water's edge by up to 25%.[16] Since that time, many others have documented similar effects: a six percent increase in waterfront property values associated with meeting bacteria standards along the western shore of Maryland's Chesapeake Bay; 3-13% higher property values along seven restored stream in California compared to similar homes on damaged streams; an estimated 10% increase in the value of homes that abut a proposed $26 billion Great Lakes water quality restoration project; and, 2-5% increase in property values in Philadelphia associated with green stormwater infrastructure.[17]

The City of Philadelphia, Pennsylvania offers perhaps the most widely known example of the contribution of green infrastructure to local communities. Uncontrolled, urban stormwater runoff causes physical destruction of aquatic habitat, increased dredging to remove siltation in navigable waterways, property damage from local flooding and sewer backups, among other effects. The City estimates that over 40 years, their green infrastructure program designed to reduce these damages will create more than $2 in benefits for every $1 invested. Their program will generate at least $500 million in economic benefits, $1.3 billion in social benefits, and $400 million in environmental benefits.[18]

Other UOTF activities have similar outcomes in terms of delivering value to local communities. In 2006, Sheboygan, Wisconsin's clean water utility partnered with a local distributor to install ten 30 kW micro-turbines, along with heat exchangers and gas conditioning equipment, which allowed the plant to burn biogas from its anaerobic digesters. At that time, the plant generated 2,300 MW of electricity annually, saving about $78,000 in energy cost savings per year. Biogas fuel is provided by the plant, the electricity produced is sold by its partner to the City and the heat is used by the plant to maintain the proper temperature in the digesters. By taking in about 17 million gallons a year of high-strength dairy waste from their community and surrounding region, the utility increased biogas production three-fold and now generates 80-100% of its annual energy needs, saving $270,000 a year in electricity and gas costs. This arrangement saves the local dairy industry nearly $700,000 a year in disposal costs and offsets significant local demand for land disposal. NEW Water in Wisconsin partners with a local printing plate engraver to take its spent ferric chloride, which is then used for phosphorus removal and odor control at the utility. Prior to this arrangement, the engraver spent $129,000 to transport and dispose this waste stream and NEW Water paid $37,000 to buy ferric chloride from a chemical supplier. Combined savings to the community is $166,000 a year. In response to another industry request, NEW Water found a way to support local economic expansion while increasing its own non-rate revenue by leasing surplus land on the Fox River to a company that wanted to build a new petroleum offloading facility there.

Wet weather management programs like Project Clear in St Louis are designed to prevent rain from entering the region's sanitary and combined sewers, prevent blockages within the sewer network especially during wet weather, and build system improvements to better manage wet weather flows. To be sure, the objectives of Project Clear are to protect local waterways and reduce basement backups, but this program could drive urban renewal, transforming previously undesirable, undevelopable land into prime development sites, new urban parks, and green spaces. In turn, these changes to the built environment will increase property values, create demand for new outdoor activities, and improve the quality of urban life. Because the program is so comprehensive across a service area the size of Los Angeles, with a third of its population, the Metropolitan Sewer District of St Louis must ramp up communication and involvement with the public and local industry. Once "out of sight" and "out of mind," MSD is emerging as a high-profile driver of change within the City. Industry has taken notice, with many long-time companies that had considered relocating pledging to stay as a result of Project Clear.

Indirect Economic Value

Clean water utilities create indirect value through changes they cause in local economies. One such change is in the local workforce where utility operations create demand for qualified workers in such fields as engineering, construction, management, and finance. Each $1 billion invested in clean water infrastructure generates 20,000 to 30,000 such jobs (effects vary from place to place), many of them local. A $305 million stormwater management program in Montgomery County, Maryland, for example, employs 3,300 local construction workers. All stormwater programs in the Chesapeake Bay watershed over the next five years will employ roughly 36,000 construction workers in Maryland, 10,000 in the District of Columbia, 80,000 in Pennsylvania, and 52,000 in Virginia.[19]

As utility expenditures for labor and materials filter through local economies, their value multiplies. According to the U.S Department of Commerce's Bureau of Economic Analysis, for example, for every job serving the clean water industry another 3.68 jobs are created to support it. Wages from these workers create demands for goods and services across the economy, much of it local, for food, gas, transportation, housing, and other necessities of life. Every $1 billion invested in wastewater infrastructure, for example, results in between $2.62 and $3.46 billion (varies from place to place) in such demand.[20]

UOTF activities, especially in green infrastructure, tend to create mostly local jobs. To ensure that the workforce is well-trained and ready to meet their needs over the next decade, the District of Columbia's DC Water has partnered with a local green job training organization, DC Greenworks, to conduct training in various maintenance procedures for green roofs and other green infrastructure. DC Water also has created satellite job centers in several District communities and they post job openings on their website on behalf of contractors trying to fill openings for jobs. DC Water is also piloting a program of bonuses to contractors that increase as the percentage of local workers increase, and apprenticeships through local labor groups to promising District adult residents that want to enter the clean water workforce.

Some forms of indirect value are less obvious than job creation, but their effects on local communities can be just as important. The Narragansett Bay Commission (NBC), for example, provides the only hands-on science program for some of the urban schools in and around Providence. Commission scientists regularly teach classes in ecology at local elementary schools and conduct guided field trips to the Bay, the NBC laboratories, and other facilities. Similarly, Columbus Water Works (CWW), serving Columbus GA and the region, collaborated with Columbus State University and the City of Columbus to build Oxbow Meadows Environmental Learning Center on the utility's land at the southern end of the City's RIverwalk, a linear park that CWW created as part of its stormwater improvement plan for the service area. School groups regularly visit Oxbow Meadows to take classes on the ecology and natural history of the region and enjoy the Center's exhibits, hike nature trails, and observe live animals in their habitat.

Delivering Value to the Nation

Because their products literally flow downstream, clean water utilities generate value well beyond their own political and geographic boundaries. Value to the nation can be found in forms such as safe, water-based recreation; healthy freshwater and salt water fisheries and shell fisheries; and, robust aquatic habitat and biodiversity for all American to enjoy. From an economic perspective, the return on investment in clean water is impressive: employment mobility, enhanced productivity in the private economy, higher standards of living, and a more favorable trade balance.

Investments in Clean Water

Investing in clean water generates direct economic value within the private economy. Clean coastal areas, rivers, and lakes, for example, support a large recreation and tourism industry that attracts investment, provides jobs, and generates substantial personal and corporate taxable income. Each year, Americans make an estimated 1.8 billion trips to go fishing, swimming, boating, or enjoy other activities at water destinations that they judge are clean and safe for these activities. While pursuing recreational activities that depend on clean water, they spend money and create jobs in the process. Nearly $45 billion of the $380 billion annual sales in 1993 for the U.S. recreation and tourism industry was for fishing, boating, bird watching and waterfowl hunting. Each year, each of about 50 million anglers spend on average, about $500 annually for recreational fishing, ultimately generating about $70 billion for the U.S. economy. The Indian River Lagoon, an estuary in Florida that has been protected and preserved through investments in wastewater infrastructure and other programs, delivers more than $700 million a year in value to the regional economy through water-based tourism, such as recreational fishing, swimming, boating, and nature observation.[21] The $45 billion commercial fishing and shellfishing industry depends on clean water to sustain fisheries and deliver products that are safe to eat. Our commercial fishing fleet delivers fish and shellfish products worth about $4 billion annually, a value that increases tenfold or more in the retail marketplace. The industry employs 250,000 people harvesting over 10 billion pounds of fish and shellfish from the Great Lakes, Gulf of Mexico, Puget Sound, and other water bodies.[22]

Our collective investments in 16,000 clean water utilities across America also provide a network effect in the form of environmental equity and productivity of labor and capital. People and businesses that move from place to place can do so with confidence that they will receive at least a standard set of clean water services regardless of location. Mobility in the workforce and in industrial location enables unconstrained deployment and redeployment over time of labor and capital to the most productive sectors of the U.S. economy in the most productive locations across America.

Investments in clean water infrastructure pay dividends in tourism, manufacturing, and other sectors of the private economy that rely on clean water for their own productivity. Consider, for example, the findings of the U.S. Treasury and the President's Council of Economic Advisors, who in a recent analysis concluded:

> "Many studies have found evidence of large private sector productivity gains from public infrastructure investments, in many cases with higher returns than private capital investment. Research has shown that well designed infrastructure investments can raise economic growth, productivity, and land values, while also providing significant positive spillovers to areas such as economic development, energy efficiency, public health and manufacturing."[23]

The upside can be dramatic. Economists at the University of Massachusetts found that one percentage point increase in the growth rate of core infrastructure (water, wastewater, energy, and transport) leads to an increase in the growth rate of private sector GDP of 0.6 percentage points. For every $1 billion in new investment in core infrastructure, we can expect an extra $840 million added to GDP each year from the private economy, of which about $141 million is increased output from the manufacturing sector.[24] Specifically with respect to clean water, a recent study estimates that one dollar of water and sewer infrastructure investment increases private output in the long term by $6.35.[25]

Nowhere is the relationship between clean water and industrial value added more striking than in the soft drink and beer sectors. A recent National Soft Drink Association analysis found that the soft drink industry, which relies on clean water to produce its product, employs 175,000 people, creates 1.6 million jobs, generates $8 billion each year in salaries and wages, and pays $17 billion in federal and state taxes. According to the Beer Institute, the U.S. beer industry adds about $275 billion in value to the economy. The beer industry directly or indirectly employs some 2.5 million workers, who earn $60 billion in wages and benefits.

Utilities of the Future

Utilities of the Future play a special role in the delivery of value to the nation. They generate low-cost clean water outcomes, reduce emissions of greenhouse gases, extract materials for reuse yielding fewer residuals for eventual disposal, and extend fresh water supplies by recycling effluent.

NEW Water's unique combination of anaerobic digestion and thermal oxidation, for example, will offset $2 million a year in electricity costs and will reduce CO_2 emissions by 22,000 metric tons each year, the equivalent of taking 15,000 cars off the road. DC Water's combined heat and power facility – the first in the U.S. to use a unique pre-digestion thermal hydrolysis process – will save $10 million a year in energy costs; generate 10 MW of electricity or enough to meet roughly a third of the needs of the plant; reduce hauling and land application of biosolids by 50% eliminating the need for 30 trucks a day; and, compared to the current "Class B" biosolids, produce a much cleaner "Class A" residual that can be reused as a soil conditioner and fertilizer in an urban setting. This process will eliminate emissions of more than 50,000 metric tons of CO_2 every year. In the longer term, DC Water will add 50 acres of solar panels above its treatment tanks, which will generate another 8 MW of electricity, nearly doubling the plant's energy savings during daylight hours and generating substantial renewable energy credits every year. If every U.S. clean water utility followed these examples, the clean water sector would reduce total US CO_2 emissions by some 298 million metric tons a year, or about 5% of total US emissions of CO_2. That is the equivalent of taking 79 million cars off U.S. roads, slightly more than 30% of all registered cars in the nations.

Clean water utilities making the transition to the UOTF demand more innovation and are more willing to embrace new technology than ever before. On balance, this shift has implications at the national scale, sending signals to technology developers that their efforts will increasingly be rewarded, to design engineers that they should think more expansively, and to regulators and environmental interests that they should partner with utility leadership to define new ways to meet environmental objectives at less cost. The market is beginning to reflect this shift – according to the Cleantech Group, which tracks global investment in technology by sector, investment in water and wastewater technology companies more than doubled from $181 million (36 deals) in 2007 to $410 million (82 deals) in 2013.[26]

Technology innovation has very positive macroeconomic effects, although since the clean water sector is at the very beginning of the UOTF transition, we are not yet at the stage where these effects will be very large. One of the most important is the gain in productivity and with it, a dampening effect on inflation and ultimately a higher standard of living. Other effects include enhanced exports of U.S. technologies and a more favorable balance of trade, although at the outset of this or any change in technology adoption, the world market will first equilibrate before domestic innovation will have a meaningful effect on U.S. exports. During the period of rapid innovation entire new industries are formed, as is the case, for example, in the green infrastructure industry. Jobs will shift from lower-paid sectors with limited employment opportunities to emerging sectors that offer entry for appropriately skilled workers at higher wages. As this shift continues, on balance, household incomes will increase.

The full potential of the transition to the UOTF will be unleashed when regulators and governing boards acknowledge the substantial returns associated with making this transition, and based on that, support new ways of doing business. Much of this support will require only administrative and procedural changes with few or no changes to laws or regulations.[27] By offering the right incentives and removing unnecessary barriers to innovation, the nation can help utilities be more efficient stewards of the environment and suppliers of public health services, all the while, generating high rates of economic and social return. In short, by re-examining current policies from the perspective of the UOTF, we can further enhance environmental and public health outcomes while enabling emerging objectives like resource recovery, water reuse, energy efficiency, and sustainable communities.

Full funding the UOTF is equally important. Utilities pursue UOTF initiatives because they reduce operating costs, increase revenues, or support local economic growth, which in turn, increases future utility income. Some initiatives like new anaerobic digesters can require substantial investments of public capital. Others, like solar, wind, or nutrient recycling facilities are typically financed by private partners. But regardless of the way these initiatives are financed, local ratepayers – principally households and businesses – will pay for UOTF activities through rate revenues. The good news is that UOTF initiatives are almost always the lowest cost way to meet (or go beyond) regulatory requirements, so the public and their elected representatives should rest assured that they are investments well worth making.

Endnotes

[1] See: *Water Resources Utility of the Future: A Blueprint for Action*, and, *Water Resources Utility of the Future: A Call for Federal Action*, 2012, available through NACWA, WEF, and WERF.
[2] National Association of Clean Water Agencies, *Two Sides of the Same Coin: Increased Investment and Regulatory Prioritization*, one in a series of the Money Matters publications, 2012.
[3] Agriculture is by far, the greatest source of pollutants that impair U.S. waters. Other sources of impairment or rivers and lakes that exceed municipal sources include atmospheric deposition, hydro-modification, and runoff from urban and rural lands. For details, see: USEPA ATTAINS database and Section 305(b) reports to the US Congress, various years.
[4] See U.S. Environmental Protection Agency's "Needs Surveys" Reports to the US Congress in 1973, 1980, 1982, 1984, 1986, 1988, 1990, 1992, 1996, 2000, 2004, 2008, and forthcoming report for 2012.
[5] Lean operations or simply, "Lean" is a business improvement approach designed to eliminate non-value adding activity or "waste" using methods developed for manufacturing industries including automotive. Practitioners often combine Lean methods with Six Sigma tools, developed by Motorola and embraced by GE, that use statistical analysis to eliminate defects and variation. Lean and Six Sigma are widely used across the industrial sectors to identify and drive productivity gains through organizational, business process, and technological change.
[6] Figures derived from annual financial surveys of the National Association of Clean Water Agencies between 1989 and 2009.
[7] Figures derived from data in the U.S. Environmental Protection Agency's, *Clean Water Needs Survey to Congress, 2008* and the U.S. Bureau of the Census.
[8] See: http://www.americanbiogascouncil.org/pdf/biogas101.pdf
[9] See: http://www.epa.gov/region9/waste/features/foodtoenergy/
[10] By comparison, Israel reuses 70 percent, Singapore reuses 30 percent and Australia reuses 8 percent, with a national goal of 30 percent reuse by 2015. For details, see:
http://www.nvwra.org/storage/2011/conference/presentations/presMillerWade.pdf
[11] National Research Council, Water Science and Technology Board, National Academy of Science, *Water Reuse: Potential for Expanding the Nation's Water Supply Through Reuse of Municipal Wastewater,* The National Academies Press, Washington D.C., 2012.
[12] See: Dubrovsky, N.M., Burow, K.R., Clark, G.M., Gronberg, J.M., Hamilton, P.A., Hitt, K.J., Mueller, D.K., Munn, M.D., Nolan, B.T., Pucket, L.J., Rupert, M.G., Short, T.M., Spahr, N.E., Sprague, L.A., and Wilber, W.G., The *Quality of Our Nation's Water— Nutrients in the Nation's Streams and Groundwater, 1992-2004,* U.S. Geological Survey Circular 1350, 2010. Man's activities, especially the production and application of fertilizers, cultivation of nitrogen-fixing crops, disposal of animal waste, discharge of municipal and industrial wastewaters, and combustion of fossil fuels over the last decade, have significantly increased loadings of nitrogen to surface and ground waters. These same activities have also doubled the rate of phosphorus loadings from the land to waterways.
[13] U.S. Environmental Protection Agency, national Water Quality Inventory Report to Congress, various years, See: http://water.epa.gov/lawsregs/guidance/cwa/305b/
[14] See: National Association of Clean Water Agencies, *Controlling Nutrient Loadings to U.S. Waterways: An Urban Perspective*, October 2011.
[15] BMJ 2007; 334:111.2 *http://dx.doi.org/10.1136/bmj.39097.611806.DB* (18 January 2007)
[16] U.S. Environmental Protection Agency, *Benefit of Water Pollution Control on Property Values*, EPA-600/5/73/005, 1973.
[17] C.G. Leggett, et. al., Evidence of the effects of water quality on residential land prices, *Journal of Environmental Economics and Management*, Vol. 39:121-144; J.P. Poor, et. al., Exploring the hedonic value of ambient water quality: a local watershed based study, *Ecological Economics*, Vol. 60: 797-806; J.C. Austin, et. al., *America's North Coast, A Benefit-Cost Analysis of a Program to Protect and Restore the Great Lakes*, Brookings Institution, Great Lakes Economic Initiative, 2007; Philadelphia Water Department, *Green City: Clean Waters: The City of Philadelphia's Program for Combined Sewer Overflow Control*, Summary Report. 2009.
[18] See for example: *http://aslathedirt.files.wordpress.com/2013/12/dupontsummit-asla-120613_final.pdf*
[19] Chesapeake Bay Foundation, The Economic Argument for Cleaning Up the Chesapeake Bay and Its Rivers, May 2012.

[20] See, for example: Emily Gordon, Jeremy Hays, Ethan Pollak, Daniel Sanchez, and Jason Walsh, *Water Works: Rebuilding Infrastructure, Creating Jobs, Greening the Environment*, The Economic Policy Institute and American Rivers, 2011.

[21] Natural Resources Defense Council, *Testing the Waters—1999: A Guide to Water Quality at Vacation Beaches*, July 1999.

[22] U.S. Environmental Protection Agency, *Liquid Assets: A Summertime Perspective on the Importance of Clean Water to the Nation's Economy,* EPA-800-R-96-002, May 1996, p.17.

[23] U.S. Treasury Department with the Council of Economic Advisors, *An Economic Analysis of Infrastructure Investment*, October 11, 2010.

[24] James Heintz, Robert Pollin, and Heidi Garrett-Peltier, Political Economy Research Institute of the University of Massachusetts, *How Infrastructure Investment Support the US Economy: Employment, Productivity and Growth*, prepared for the Alliance for American Manufacturing, January 2009.

[25] See: Richard A. Krop, Ph.D. Charles Hernick Christopher Frantz, *Local Government Investment In Municipal Water And Sewer Infrastructure: Adding Value To The National Economy,* prepared for the US Environmental Protection Agency, August 14, 2008 Washington, D.C.

[26] Deal flow during this period was not steadily upward quarter on quarter or year on year, but the general trend was upward as reflected in annual totals. See: Cleantech Group, *Accelerating and Sustaining the Water Innovation Ecosystem: What's Next?,* October 2013.

[27] For details, see: *Water Resources Utility of the Future: A Blueprint for Action*, and, *Water Resources Utility of the Future: A Call for Federal Action*, 2012, available through NACWA, WEF, and WERF.