SUSTAINABLE WASTEWATER INFRASTRUCTURE

(111–5)

HEARING

BEFORE THE

SUBCOMMITTEE ON
WATER RESOURCES AND ENVIRONMENT

OF THE

COMMITTEE ON
TRANSPORTATION AND
INFRASTRUCTURE
HOUSE OF REPRESENTATIVES

ONE HUNDRED ELEVENTH CONGRESS

FIRST SESSION

FEBRUARY 4, 2009

Printed for the use of the
Committee on Transportation and Infrastructure

U.S. GOVERNMENT PRINTING OFFICE
47–258 PDF WASHINGTON : 2009

For sale by the Superintendent of Documents, U.S. Government Printing Office
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February 4, 2009

SUMMARY OF SUBJECT MATTER

TO: Members of the Subcommittee on Water Resources and Environment

FROM: Subcommittee on Water Resources and Environment Staff

SUBJECT: Hearing on Sustainable Wastewater Infrastructure

PURPOSE OF HEARING

On Wednesday, February 4, 2009, at 10:00 a.m., in Room 2167 Rayburn House Office Building, the Subcommittee on Water Resources and Environment will receive testimony from representatives from the United States Environmental Protection Agency, the Lawrence Berkeley National Laboratory, the Water Environment Federation, and other organizations on sustainable wastewater infrastructure. The purpose of this hearing is to gather information about various technologies and approaches for sustainable infrastructure in wastewater treatment facilities.

BACKGROUND

In both the 110th and 111th Congresses, legislation has passed the House of Representatives which has included provisions promoting innovation in, and the use of sustainable infrastructure for wastewater treatment facilities. This briefing memorandum introduces some of these sustainable approaches. Much of the nation's wastewater infrastructure was built in the three decades following the Second World War. This includes approximately 6,000 publicly owned treatment works (POTWs). In the process of constructing, replacing and rehabilitating wastewater infrastructure, opportunity exists for municipalities and facility operators to explore alternatives to traditional designs and technologies. These could include energy and water efficient processes and technologies.

On January 28, 2009, the U.S. House of Representatives passed H.R. 1, the American Recovery and Reinvestment Act of 2009. The legislation includes set aside grant funding for sustainable wastewater infrastructure. Funding, pursuant to this provision, would be for projects to implement processes, materials, techniques, or technologies to address water-efficiency goals, to address energy-efficiency goals, to mitigate stormwater runoff, or to encourage environmentally-sensitive project planning, design, and construction.

In the 110th Congress, the House passed H.R. 720, the Water Quality Financing Act of 2007. This legislation included provisions to implement innovative or alternative processes, materials, techniques, or technologies that may result in greater environmental benefits, or equivalent environmental benefits at reduced cost for water quality improvements.

Integration of these approaches and technologies into a wastewater facility's operations may help to reduce climate impacts, save money, and save water. Identifying approaches to integrate energy efficient practices into the daily management and long-term planning of the water sector also contribute to the long-term sustainability of water infrastructure by reducing operation costs and adding to a utility's bottom line.

Sustainable Infrastructure – Water

Sustainable water infrastructure can apply to a number of areas including the efficient use of water, water conservation, as well as more effective mitigation of stormwater impacts.

Water Efficiency: Technologies and practices that require less water to achieve an equivalent result can yield a number of benefits. These include: fewer sewage system failures caused from excess water overwhelming the system; reduced need to construct additional water and wastewater treatment facilities; elimination of excessive surface water withdrawals that degrade habitat both in streams and on land adjacent to streams and lakes. Finally, efficient water use can also reduce the amount of energy needed to treat wastewater, resulting in less energy demand and, therefore, fewer harmful byproducts from power plants.

Stormwater Mitigation: Impermeable surfaces, commonly associated with roads and rooftops and concentrated in urban areas, are a leading source of excessive stormwater flows. A pre-development landscape allows for precipitation to infiltrate into the ground, as opposed to its conveyance across the ground to enter surface waters. In a pre-development landscape, runoff is less than 10% of the rainfall volume. A developed landscape with impermeable surfaces does not allow any rainfall to infiltrate into the ground.

Urban stormwater is frequently captured by a separate stormwater system, or by a municipal sewer collection system. The former is conveyed directly to a water body, such as a stream or river, and released with little or no treatment. The latter results in stormwater being taken through the sewer collection system to a wastewater treatment facility to be treated and eventually released as a cleaner discharge.

Most U.S. cities use separate stormwater sewer systems. Any particulates or pollutants that are picked up by the stormwater are conveyed through the system and are discharged directly into the water body. The large volumes of stormwater (as a result of increased runoff as a function of higher proportions of impermeable surfaces) often result in streambank erosion and the deposition of nutrients, pet waste, and roadway pollutants (oils, metals, chemicals) into the recipient water.

In older cities, primarily in the northeast and the Great Lakes states, stormwater flows into the same pipes as sewage. In non-wet weather events, the stormwater is conveyed to a treatment facility and discharged as cleaner effluent. In order not to overwhelm wastewater treatment facilities, many of these collection systems are designed to overflow ('upstream' of the facility) during wet weather events. This results in untreated stormwater, sewage, and industrial effluent being deposited directly into water bodies. This is known as a combined sewer overflow (CSO).

A 'hard infrastructure' approach to mitigating CSO events is to construct storage capacity whereby stormwater and sewage can be contained until after the wet weather event is over. The material would then be released to the wastewater facility for treatment. A number of cities have constructed deep tunnels to store wet weather capacity. As a result of their very large holding capacity these are long term projects, and are also very expensive. For example, Chicago's tunnel has a project construction lifespan of over 40 years, and is not expected to be completed until 2019. It is expected to cost $3.4 billion.

A 'green infrastructure' approach for stormwater mitigation is premised on the notion that the volume of stormwater should be reduced before entering into stormwater and/or sewage conveyance systems. Green infrastructure approaches for stormwater mitigation provide more opportunities for infiltration to occur in a developed landscape – thereby lessening the amount of runoff. Examples of these technologies include green roofs, permeable pavement, curb cut-outs leading to vegetated areas, rain gardens, increased tree cover, and rain swales[1]. Reducing runoff using these approaches decreases the amount of stormwater and pollution reaching waterways and relieves the strain on stormwater and wastewater infrastructure. The experiences of those cities that have experimented with these approaches have shown that these technologies can be cost-competitive with conventional, 'hard' infrastructure approaches for controlling stormwater. In addition, green infrastructure designed to mitigate stormwater has a number of other benefits. These include improved air quality, mitigation of urban heat island effects, energy savings (with regards to green roofs), and better urban aesthetics (yielding increased property values.)

Sustainable Infrastructure – Energy

Water utilities are significant consumers of energy, and are therefore responsible for large volumes of greenhouse gas emissions. The U.S. Environmental Protection Agency (EPA) and the Electric Power Research Institute estimate that approximately 56 billion kilowatt hours (kWh) are used for supply and treatment of drinking water supplies and POTWs. This is the equivalent of 44.8 million tons of green gas emissions. The Massachusetts Department of Environmental Protection has estimated that wastewater treatment accounts for 1.3% of energy usage across all industrial sectors in Massachusetts.[2] Oregon wastewater utilities use approximately five percent of the state's electricity, and energy accounts for about 15 percent of a typical wastewater treatment plant's budget. The Energy Information Administration estimates that water utility energy consumption is between 30-60% of a city's energy bill. EPA's Energy Star program estimates that approximately $4 billion is spent annually for energy costs (pumping and treatment) to operate water utilities. EPA

[1] Rain swales are shallow depressions that are designed to capture and store rainwater for a period of time, allowing for infiltration or slower water movement.

[2] They also find that drinking water treatment accounts for .74% of industrial emissions. Wastewater treatment, therefore, is nearly twice as energy intensive as drinking water treatment.

notes that a 10% reduction in energy usage could result in $400 million and 5 billion kWh in annual savings.

The majority of energy use at wastewater treatment facilities is a product of treatment processes (including aeration) and pumping. Energy use is affected by the size of the population served, influent loading, level of effluent quality, treatment process type, and the size and age of the treatment facility.

The following are technologies that could be incorporated into wastewater treatment facility systems to realize energy efficiency gains. Depending on the type of system and technologies included, it is possible for wastewater treatment facilities to achieve energy independence. Not only can wastewater treatment facilities become more energy efficient, they can generate energy. For example, biogas emitted from anaerobic digesters can by used to fuel on-site generators to provide electricity and power. An energy audit process can help to determine what technologies should be used to achieve facility energy objectives.

Fuel Cells Using Digester Gas: Traditionally, digester gas has been used in boilers to provide heat back to the digester and for heating of buildings. Often, excess gas is flared off. Digester gas can also be used to produce electricity in addition to heat. The most efficient way to utilize the energy in the digester gas is through a cogeneration system. Cogeneration is the simultaneous production of electricity and heat – both used in wastewater treatment facilities.

Fuel cells run on hydrogen or methane and generate electricity through a chemical reaction. Digester gas is used as the source of the methane. Methane molecules are broken down to allow the hydrogen to be used for the creation of electricity through the fuel cell.

Internal Combustion Engines Using Digester Gas: Instead of being flared, digester gas produced from anaerobic digestion can be used as the fuel for internal combustion engines. These engines are used for both electricity and heat (cogeneration) at wastewater treatment facilities.

Micro-hydro Turbines: Wastewater treatment facilities have an available renewable resource in the flow of water through the plant. Any energy from flow not required for plant operation and the energy from flow obtained from small turbines at the outfall of the plant can be used to produce renewable power.

Microturbines Using Digester Gas: Instead of being flared, digester gas produced from anaerobic digestion can be used to power microturbines. Microturbines are similar to larger traditional combustion turbines, or small jet engines, but spin at much faster speeds. Pressurized fuel (digester gas) is supplied to the combustor, mixed with fuel, and burned. The heated combusted gases expand, powering the turbine that operates the generator and therefore producing electricity.

Solar Photovoltaic Systems: Solar energy refers to a wide array of renewable energy technologies that derive their energy from the sun. Photovoltaic (PV) systems convert sunlight directly into electricity. Electrons in certain types of crystals (contained in PV systems) are freed by solar energy and are induced to travel through an electrical circuit. This process produces electrical energy. Most PV systems include batteries that allow them to continue providing power during the nighttime when there is no sun to provide energy.

The municipal wastewater treatment plant in Charlemont, Massachusetts installed a 15 kilowatt (kW) photovoltaic solar array that has reduced its energy costs by 54% since the project was completed in May of 2005. The project, which includes 96 solar panels mounted on 8 poles connected to 3 inverters, was designed to provide 50% of the plant's electric needs and has been performing above its design capacity. In the three years since the panels went online, the average June energy use has dropped to only 950 kWh, a 62% reduction. The plant used a grant program offered by the Massachusetts Renewable Energy Trust to offset 50% of the $142,000 cost of the project. The original payback time of 17 years has shrunk as energy prices have risen since the panels were installed. In addition to the financial savings the solar panels generate for the plant, the environmentally-friendly panels reduced the facility's CO_2 footprint by nearly 17 tons in the first 2 years of operation.

On-site Small Wind Turbines: Small wind electric systems are defined as wind turbines with no more than 100 kilowatts capacity. They are usually used for home, telecommunications dishes, or water pumping. The wind turbine collects energy from the wind and converts it to electricity that is compatible with a building's electrical system. At 100 feet or more aboveground, they can take advantage of faster and less turbulent wind. Usually small wind turbines consist of two or three blades that are 25 feet in diameter. The small wind turbine will not produce power at wind speeds below 7-10 miles per hour. Grid-connected small wind turbines do not include batteries. Off-grid small wind turbines do have batteries that are charged when the wind is blowing – providing for power when there is no wind.

Fats-Oils-Grease and Green Waste: Fats, oils and grease (FOG) are a significant and problematic component of domestic wastewater. While some FOG is produced from residences, the main sources are commercial and industrial waste streams. In a typical community, restaurants are generally the largest source of FOG. Green waste is food scrap waste that is biodegradable. FOG is also a significant source of sanitary sewer overflows. The greasy waste can cause blockages and eventual breakages in sewer lines – causing leaks and overflows.

FOG and green waste can create additional quantities of digester gas that can be used as a fuel to create electricity. Facility grease trap waste and food scrap waste is considered ideal for anaerobic digestion at wastewater treatment facilities – as an alternative to landfill disposal. The challenge to FOG and green waste is related to successfully receiving, conditioning, and feeding the waste into the anaerobic digester.

Advanced Motors, Engines, and Pumps: Some wastewater treatment facilities still use equipment that was designed decades ago. In the intervening years, newer, more advanced products have become available that are more energy efficient.

For example, the Bath Water District in Bath, Maine, is saving more than $30,000 a year as a result of new variable frequency drives on two pumps. The drives adjust the speed of the pumps according to the volume of water they need to pump to meet demand. Before the upgrade, the pumps operated only at their maximum speed when in use. The $60,000 project was subsidized by a $15,000 incentive from Efficiency Maine, giving it a payback of only 18 months. The facility has saved about 376,000 kWh annually since the upgrades in 2003, the same amount of energy used by 35 homes in a year. The project also have a tangible climate-related impact: the energy savings translate into a reduction of more than 208 tons of carbon dioxide a year.

Aerators are another type of wastewater treatment technology that can be replaced with more efficient systems. Aerators mix oxygen into wastewater ponds to facilitate the breaking down of waste by the natural organisms contained in the ponds, and used in the wastewater treatment process. The City of Astoria, Oregon replaced its 25-year old aerator with a more efficient system in 2003. The older, mechanical system ran constantly and consumed approximately 920,000 kWh per year. The new system is a compressed air wastewater system that operates only when needed, and which uses 375,000 kWh per year. This has resulted in estimated savings of nearly $23,000 a year. The new system cost Astoria $341,000. Given the energy savings of the new aerator, Astoria expects to pay off the loan used for the purchase in approximately 10 years.

Energy Audits: EPA, through its Energy Star program, encourages facilities to engage in energy audit processes to make improvements in energy efficiency. Based on the general Energy Star process for structures, an energy audit process should consist of: a) establishing overall energy objectives; b) performing the energy audit; c) setting baselines; d) establishing an energy plan and setting performance goals; e) tracking performance over time; and f) periodically evaluating energy use.

The initial energy audit, itself, should be conducted with broad-based energy use objectives in mind. For example, does a facility want to increase energy efficiency? Or, does a facility want to achieve energy independence? The audit can assess energy consumption at each of the primary operational areas that significantly affect energy use. These include: plant engineering; purchasing; operations and maintenance; building and facility management; environmental health and safety; corporate real estate and leasing; construction management; contractors and suppliers; and utilities. Data and information from the initial energy audit can be used to establish a baseline against which progress can be measured. The facility's energy plan will include performance goals, facility policies, and technical upgrades aimed at achieving facility energy objectives. Over time, subsequent energy audits should be periodically conducted to track performance and allow for evaluation of the energy plan. This process will help facility managers to determine whether energy efficiency goals have been achieved, will identify facility best practices, and will inform decisions about how to achieve future energy efficiency or independence goals.

Sustainable Infrastructure – Planning, Design, and Construction

Sustainable planning, design, and construction encompass a wide range of activities that can result in lower impacts on watersheds, as well as increases in energy efficiency. For example, decentralized wastewater treatment systems obviate the need for a large, centralized wastewater treatment facility. Similarly, the size of the collection system infrastructure can be made significantly smaller. Decentralized wastewater treatment systems consist of small-scale sewage treatment systems that treat wastewater on the neighborhood scale.

Sustainable building approaches can result in the increased re-use of materials, decreased runoff, and increased energy efficiency. These approaches can be applied to the construction and retrofitting of elements of a wastewater treatment facility. According to the Green Building Council, buildings in the United States account for 72% of electricity consumption, 39% of energy use, 38% of all carbon dioxide (CO_2) emissions, 40% of raw material use, 30% of waste output, and 14% of potable water consumption. Green building approaches seek to decrease many of these factors through the use of energy efficient materials, non-toxic construction materials, natural lighting, and the capture of stormwater, among others. These design, planning, and construction approaches can result in numerous economic, environmental, and health and community benefits. Economic benefits include reduced operating costs, enhanced asset value and profits, and improved employee productivity and satisfaction. Environmental benefits include improved air and water quality, reduced solid waste, conservation of natural resources, and enhanced habitat protection and sustained biodiversity. Health and community benefits include improved air, thermal, and acoustic environments, minimized strain on local infrastructure, and enhanced occupant health and comfort.

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HEARING ON SUSTAINABLE WASTEWATER INFRASTRUCTURE

Wednesday, February 4, 2009

House of Representatives,
Committee on Transportation and Infrastructure,
Subcommittee on Water Resources and Environment,
Washington, DC.

The Subcommittee met, pursuant to call, at 10:00 a.m., in Room 2167, Rayburn House Office Building, the Honorable Eddie Bernice Johnson [Chairwoman of the Subcommittee] presiding.

Ms. Johnson. I call the Subcommittee to order and welcome everyone to the first meeting of the Subcommittee on Water Resources and Environment for the 111th Congress.

Today, the Subcommittee meets to explore water-efficient and energy-efficient technologies that can be incorporated into the Nation's system of wastewater infrastructure to improve the overall cost-effectiveness of modern wastewater treatment as well as promote sustainability.

However, as this is the first meeting of the Subcommittee this Congress, I believe this is a good opportunity to outline our near-term agenda as well as our efforts to address many of the water resource challenges of the Country.

First, let me say how pleased I am to return as the Chairwoman of the Subcommittee on Water Resources and Environment, and I look forward to serving on this Subcommittee with each and every colleague—and before the meeting is over most of them will probably be here—learning of their individual water resource needs and working together to address many of their concerns.

I am also very pleased to be rejoined by my colleague, Congressman John Boozman of Arkansas, the Ranking Republican Member of the Subcommittee on Water Resources and Environment.

The Subcommittee has the broadest agenda of any transportation Subcommittee. Generally speaking, the Subcommittee is responsible for the Corps of Engineers' projects and authorities, EPA's Clean Water and Superfund programs, brownfields, the Tennessee Valley Authority, the St. Lawrence Seaway and programs carried out by the National Oceanic and Atmospheric Administration and the Natural Resources Conservation Service.

Similar to last Congress, the Subcommittee will continue to have an active agenda and explore many of the water resources and environmental challenges faced by our Nation. In addition, the Subcommittee will explore how the infrastructure authorities under its jurisdiction are critical in restoring both the economic and environmental health of the nation.

Starting with today's hearing, the Subcommittee will return to some of the unfinished work of the previous Congress. My plan is to expeditiously move legislation on the Clean Water State Revolving Fund and to report a bill similar to the Water Quality Financing Act of the 110th Congress to the House floor before the Spring district work period.

In addition, the Subcommittee will quickly reconsider other bipartisan legislative proposals from the previous Congress that were not enacted into law, such as the Beach Protection Act, the Sewer Overflow Community Right to Know Act and legislation to reauthorize appropriations to address combined sewer overflows and alternative sources of water.

This year, the Subcommittee will also start the process for drafting a new Water Resources Development Act for the Corps of Engineers, and, to that end, I encourage my colleagues to consider their individual water resources challenges and whether these could be addressed by the Nation's leading water resource agency, the Army Corps of Engineers.

And finally, the Subcommittee will continue its oversight responsibility and should soon announce hearings on the forthcoming Report of the National Committee on Levee Safety as well as recent events surrounding and future prospects for the Tennessee Valley Authority.

In his inaugural address, President Obama challenged us all, and he asked us, both citizens and policy makers, to seek opportunities in the trying times before us. And they are trying.

Over the past year, it has been very clear that there is a heightened need for government action. Nowhere is this more clear than with regards to infrastructure spending. Against a backdrop of huge gaps in water infrastructure spending, investment in the Nation's wastewater systems provides jobs and results in cleaner rivers and a healthier public.

But to paraphrase the President, to say that government is the only answer is to be as wrong as saying that government is the problem. These positions miss the point entirely. Instead, we must ask how we can make government work to efficiently and effectively address our Nation's problems.

And so, it is on this point that we should seize the opportunity to solve our multifaceted problems by enabling the Federal Government to be an agent of change. Economic recovery resources should not just be used to simply provide jobs. Instead, these resources can and should also be vehicles for long-term economic growth and environmental sustainability.

It is in our national interest to incentivize wastewater treatment facilities so that their operators make them more sustainable, more energy-efficient, more water-efficient, to encourage stormwater mitigation and to use green planning, design and construction.

In today's hearing we will hear testimony from our witnesses on sustainable technologies and approaches in the wastewater treatment sector. Much of this technology and many of these approaches are not yet utilized or even widely considered across the wastewater system. But promoting a sustainable wastewater infrastructure not only yields desired environmental results but promotes a market for advanced energy-and water-efficient technologies.

Members of the Subcommittee, when it comes to this issue, we can all do it all. We can reclaim our responsibility for building our wastewater infrastructure while at the same time spending our resources more wisely. We can achieve cleaner water while expending less energy, releasing fewer greenhouse gases, conserving water and encouraging the development of technology and a resurgence of our manufacturing sector.

And all of this means that localities across this country, across the long term, have lower costs, critical in this economic crisis.

These approaches make environmental sense, and they make sense to our bottom lines. This is a way forward that I think we would all want to take.

I thank you, and I yield now to the Ranking Member, Mr. Boozman of Arkansas.

Mr. BOOZMAN. Thank you, Madam Chair, and it really is an honor to serve with you again in this Congress, and I very much appreciate your leadership.

Today, the Subcommittee begins to explore a new and important topic: sustainable wastewater infrastructure.

Ignored in the past, more public attention is slowly being paid to our deteriorating water infrastructure. Our Nation's health and quality of life and economic well-being rely on adequate wastewater treatment. Industries that rely on clean water—like farmers, fisherman, manufacturers—contribute over $300 billion a year to our gross domestic product.

To provide clean water, our Nation already has invested over $250 billion in wastewater infrastructure, but this infrastructure is now aging and as our population continues to grow increasing the burden on our existing infrastructure. If communities do not repair, replace and upgrade their infrastructure, we could lose the environmental health and economic benefits of this investment.

The Congressional Budget Office, EPA, and Water Infrastructure Network have estimated that it could take between 300 and 400 billion dollars to address our Nation's clean water infrastructure needs over the next 20 years to keep our drinking water and waterways safe and clean. This is twice the current level of investment by all levels of our government. These needs have been well documented in our Subcommittee's prior hearings.

We can reduce the overall cost of wastewater infrastructure with good asset management, innovative technologies, water conservation and reuse and regional approaches to water pollution problems. One of the methods to reduce the cost of wastewater infrastructure and, ultimately, wastewater treatment, is to explore alternatives to traditional designs and technologies.

Efforts to contribute to a long-term sustainability of water infrastructure by reducing operating cost, making facilities more energy-efficient and more water-efficient could result in a greater environmental improvement and reduce costs to ratepayers.

According to the Department of Energy, water utility energy consumption accounts for 30 to 60 percent of an average city's energy costs. The EPA notes that approximately $4 billion is spent annually for energy costs to upgrade water supply and wastewater treatment facilities. A 10 percent in energy usage could save these utilities $400 million annually.

Other industries have already begun either retrofitting current operations or constructing new facilities using alternatives technologies. It is not unreasonable to expect the wastewater treatment industry to follow suit.

Water efficiency, permeable membranes, reforestation, fuel cells, hydroturbines and photovoltaic cells are the types of proposals many of our witnesses will discuss today. Green roofs and rain gardens are other approaches that may help us reduce stormwater runoff, and these methods are being introduced to urban areas where runoff is especially prevalent.

However, in our efforts to be energy-efficient, we must not lose sight of the cost of implementing new designs and technologies. The costs are not limited to just purchasing new equipment. There must be adequately trained personnel to install and operate new technologies. Another consideration is the cost of source material and the inflationary impact of the supply and demand of the source materials.

In the past three decades, this Nation has made significant progress in cleaning up our rivers and lakes, but there is still much to be done.

We must be sure that with the limited funds we have we are getting the most clean water for our dollar. These new types of proposals and technologies could result in numerous economic and environmental benefits. However, communities need to do a rigorous analysis of the cost and benefits of installing these technologies and decide for themselves the most appropriate course of action.

I hope to learn more from the hearing today, from this panel of expert witnesses, and we really do appreciate your being here, and I look forward to your testimony.

I yield back, Madam Chair.

Ms. JOHNSON. Thank you very much.

We will now go to the Members of the Committee for comments.

Ms. Edwards is recognized.

Ms. EDWARDS. Thank you, Madam Chairwoman and to the Ranking Member.

I appreciate all of you being here today.

I think it goes without saying, and certainly we have learned this over the last several years, that it is really important to reinvest in the Nation's water and wastewater infrastructure.

In my congressional district, which is just outside of Washington, D.C., you have only to read the headlines to know the impact on our wastewater systems when a water main breaks, a pipe breaks, there is a problem from transmission forward resulting in boiled water advisories, pollutants in the water such as lead and other particulates that are impacting our children and our communities, that we can no longer afford the nearly decades long of disinvestment in the Nation's wastewater infrastructure. And the costs are huge.

And so, the opportunity that we have now is to look at the kinds of technologies that, with the right kind of investment, the right kind of science and research into those investments, can both bring costs down, make them affordable for communities and for taxpayers and, at the same time, propel us into a national 21st Century water infrastructure instead of I don't know in some cases. I know when the water main broke outside of my house, they said it was a young one, and it was 30 years old.

So we have tremendous opportunity in front of us, and I look forward to your testimony and to hearing ways in which we can make investments that aren't just where we live.

I mean the investments that we make in the Washington Metropolitan Area in water and sewer infrastructure deeply impact the Chesapeake Bay and the entire Bay watershed. And so, it is no longer the case, that as taxpayers and community members, that we can believe that it is only important to do what you need to do at home because the impact is so much greater for so many more communities.

And again, thank you for being here, and I look forward to your testimony.

Ms. JOHNSON. Thank you very much.

Mr. Baird.

Mr. BAIRD. I thank the gentlelady.

I thank our witnesses.

In the area of energy conservation or meeting our energy challenges, we have seen a great deal of evidence that oftentimes behavioral changes and conservation measures are the most economical way to proceed in meeting those challenges.

I would be very interested in the panel's observations in terms of what we can do behaviorally rather than just building new plants. What can we do in terms of changing how we consume water, how we produce wastewater, simple measures like composting versus sending things down the garbage disposal?

I would especially welcome your insights into how we can save money and improve environmental outcomes by changing the way we conduct ourselves.

I thank the Chairperson.

Ms. JOHNSON. Thank you very much.

Mr. Cao.

Mr. CAO. Thank you, Madam Chairwoman.

After Katrina, the New Orleans Metropolitan Area was pretty much devastated by the flooding, and much of the sewage and wastewater system was severely damaged. We have estimated that it would cost approximately $800 million in order to upgrade and to repair many of the problems in the system of the Second Congressional District.

So I am very much interested in hearing what technologies are out there, what we can do to improve the system down there, especially in areas that may be affected by the floodwaters especially saltwater from the Gulf of Mexico.

So thank you very much. I look forward to hearing from you all.

Ms. JOHNSON. Thank you very much.

Mr. Perriello.

Mr. PERRIELLO. Thank you, Madam Chairwoman and Ranking Member.

Thank you so much to all of our witnesses here today testifying.

Joining the Subcommittee was my first choice of all of them in Congress because it is such a big priority for my area, and it is also a place that is very real for the people in my district whether that is the county administrator, the farmer, the business leader.

I come from a district, central and south side Virginia, where we have hit 15.5 percent unemployment in several of our small towns. We have been wiped out on manufacturing, on tobacco, on textiles, and we have started to reach a point where the water infrastructure is not only a barrier to bringing new business in, but we have also had to have work stoppages based on crumbling infrastructure.

And the few companies that have stuck with us can't keep that up if we can't keep basic water and other needs getting to them. This is a huge issue for job creation in my district as well as the environment and agriculture and other areas.

I was also excited to work on this Committee because I know it is a bipartisan Subcommittee and I know it is a hardworking Subcommittee. So we are very, very eager to get to work.

When we are losing 16,500 jobs every day in this Country, we know we have to do things that get people to work right away, like rebuilding infrastructure but also doing it on things that are going to be an investment in our future.

And I believe this is a great area for us to show leadership—you as experts, us as representatives—and I look forward to working with you to see what we can do to turn it around.

Thank you very much.

Ms. JOHNSON. Thank you very much.

Mr. Carnahan.

Mr. CARNAHAN. Thank you, Madam Chairman and Ranking Member Boozman.

I represent a district in St. Louis where the metropolitan sewer district has 208 locations where combined sewer overflows can occur, discharging into the Mississippi River and River des Peres and their tributaries. This overflow often, too often, contains impurities that have the potential of adversely affecting the water quality in the area.

But I am especially interested today to hear from the witnesses about how green infrastructure can help reduce the volume of stormwater before it enters the sewage and stormwater system and preventing the occurrence of combined sewer overflows: technologies like green roofs, pervious paving for roads, alleys and parking lots and how that can really make an impact.

I just want to close by thanking our entire panel, but especially I want to welcome Tracy Mehan, the former director of our Department of Natural Resources in Missouri. I look forward to hearing from all of you and welcome Mr. Mehan.

Ms. JOHNSON. Thank you very much.

Mr. Bishop.

Mr. BISHOP. Thank you, Madam Chair, for holding this hearing, and I thank today's panelists for appearing before us.

As those of us on this Committee know, water infrastructure is absolutely necessary for sustainable economic development, and yet it is given little praise and oftentimes little thought by the public and many elected officials. Perhaps this is due to the fact that, unlike roads or bridges, we cannot point to sewer pipes and treatment facilities as easily as we can marvel at our bridges or our highways. However, each is equally important to ensuring that commerce can flourish.

Even some in Congress do not fully appreciate the necessity of water infrastructure. The Congressional Budget Office estimates that there is an annual, I repeat, annual investment need of between $11.6 billion and $20.1 billion to ensure a safe, clean supply of drinking water and an additional need for annual investment of between $13 billion and $20.9 billion in wastewater treatment.

This Committee understands the critical need for increased funding and supported levels of $12 billion for the Clean Water State Revolving Fund in the economic recovery package. Unfortunately the House-passed bill including only $6 billion for water infrastructure.

I offered an amendment to increase funding for the Clean Water SRF by $6 billion to the Committee-proposed levels. However, this amendment was not accepted.

Our Nation is facing perilous economic times. We cannot afford to shy away from investments that will have lasting effects on our communities and our economy simply because we can't see them.

I look forward to working with my colleagues to promote increased awareness of the importance of water infrastructure and to ensure that our adequate funding is available to States and to municipalities to strengthen and expand our economy.

I thank the Chairwoman, and I yield back.

Ms. JOHNSON. Thank you very much.

Mr. Hare.

Mr. HARE. Thank you, Madam Chair, and thank you very much for holding the hearing and my appreciation also to the Ranking Member.

I worked very hard to get on this Committee and on this Subcommittee. I have a district that has 250 miles on the Mississippi River that runs north-south and 23 counties, many of them rural with a number of communities that have serious problems with water and sewer, including my home town of Rock Island, Illinois.

So I am looking forward to the panel today. I am looking forward to working on this Committee.

As my colleague had said, I wish we could have spent a little bit more money on the infrastructure end of it, but we will come back, I am sure.

But, again, I look forward to hearing you all today, and I appreciate your being here.

We have a great Committee, and I am just honored to be on it.

So thank you very much, Madam Chair.

Ms. JOHNSON. Thank you very much.

Any other opening statements?

We will now go to the panel.

The morning's panel of witnesses consists of Mr. Tracy Mehan from the Cadmus Group. Mr. Mehan is a former EPA Assistant Administrator for Water. And we welcome you back.

We will then hear from Mr. Brian McLean. Mr. McLean is Director of EPA's Office of Atmospheric Programs in the Office of Air and Radiation, and he is accompanied today by Ms. Caterina Hatcher, the National Manager of the Public Sector ENERGY STAR program at EPA.

And next, Mr. Rich Brown from the Lawrence Berkeley National Laboratory in California will testify.

And following Mr. Brown is Ms. Jeanette Brown, the Executive Director of the Stamford Water Pollution Control Agency in Stamford, Connecticut, and Ms. Brown is testifying on behalf of the Water Environment Federation.

We will then hear from Mr. Alan Zelenka from Kennedy Jenks Consulting in Eugene, Oregon. Mr. Zelenka is testifying on behalf of the Oregon Association of Clean Water Agencies.

And our final witness this morning is Mr. Andrew Fahlund. He is the Vice President for Conservation at American Rivers.

Your full statements will be placed in the record, and we ask that you try to limit your oral statements and your testimony to five minutes as a courtesy to other witnesses.

Again, we will proceed in the order in which the witnesses are listed. So, Mr. Mehan.

TESTIMONY OF G. TRACY MEHAN, III, PRINCIPAL, THE CADMUS GROUP, INC.; BRIAN MCLEAN, DIRECTOR, OFFICE OF ATMOSPHERIC PROGRAMS, OFFICE OF AIR AND RADIATION, U.S. ENVIRONMENTAL PROTECTION AGENCY ACCOMPANIED BY CATERINA HATCHER, NATIONAL MANAGER, ENERGY STAR, PUBLIC SECTOR, OFFICE OF AIR AND RADIATION, U.S. ENVIRONMENTAL PROTECTION AGENCY; RICH BROWN, ENVIRONMENTAL SCIENTIST, ENVIRONMENTAL ENERGY TECHNOLOGIES DIVISION, LAWRENCE BERKELEY NATIONAL LABORATORY; JEANETTE A. BROWN, P.E., BCEE, D.WRE, EXECUTIVE DIRECTOR, STAMFORD WATER POLLUTION CONTROL AUTHORITY; ALAN ZELENKA, CONSULTANT, KENNEDY/JENKS CONSULTANTS; AND ANDREW FAHLUND, VICE PRESIDENT FOR CONSERVATION, AMERICAN RIVERS

Mr. MEHAN. Thank you, Madam Chair and Members of the Committee.

It is an honor to be part of this very distinguished panel, and I know many of these people personally and professionally. I think it is going to be a great discussion this morning.

The topic of sustainable wastewater or water management generally is indeed a broad subject and can get into everything from asset management, environmental management systems, pricing, rate structure, workforce, replacement.

But I am going to focus on two issues that relate, I think, or interrelate to each other: generally, the idea of managing not just technology, not just gray infrastructure but managing the landscape, the natural infrastructure—sometimes this goes under the term of green infrastructure or low impact development—as well as, in tandem, address the nexus between water, energy use and carbon footprints.

Basically, I think these present tremendous opportunities both for dealing with environmental problems effectively, at the same time, being cost-effective and saving money.

I think the best way to illustrate this is give you a concrete case that I set out in my written testimony from a study of 27 water suppliers by the American Water Works Association and the Trust for Public Lands. They found that the more forest cover in a watershed results in lower treatment costs. That is probably pretty self-evident.

But when you look at it in detail, for every 10 percent increase in forest cover in the source area, treatment and chemical costs and, presumably, energy costs decrease approximately 20 percent. Almost 50 to 55 percent of the variation in treatment costs can be explained by the percentage of forest cover in the source area.

Now take that into the urban context, the kind of situation that Congressman Carnahan mentioned where you are dealing with major urban wet weather issues, which is that constellation of issues that includes combined sewer overflows, stormwater, traditional point source or end-of-the-pipe discharges, maybe, sanitary sewer overflows, et cetera.

All these things could be addressed in a more holistic and more comprehensive and integrated fashion involving not just resort to traditional hard or gray infrastructure—deep tunnels, tanks, et cetera—but also, again, green infrastructure, nonstructural approaches, low impact development, greening the landscape.

The reason why it is true that all of these urban wet weather issues essentially come back to the amount of imperviousness, that is hard surface, in your watershed: roofs, roads, sidewalks, parking lots that basically harden the landscape and disrupt the natural flow regime.

All of these impervious surfaces basically prevent water from seeping into the ground or being retained onsite where it is filtered out, where it is slowed down, where it is cooled and where it evaporates.

Cities such as Philadelphia, Chicago, Portland, Oregon and Milwaukee are all on the cutting edge pursuing these kinds of opportunities, whether it is green roofs, vegetative swales, urban reforestation, pervious surfaces even in alleyways as in the case of Chicago.

So, again, I think these are approaches which, if scaled up sufficiently in a given urban watershed, will reduce cost, will deliver multiple environmental benefits and achieve the objectives under a Clean Water Act NPDS permit.

Briefly, since we have many experts dealing here with energy issues at the facility level, I think it is important to point out that, again, energy management now is at the heart of sustainable water and wastewater management. There is no question that in the last four or five years this has moved to the forefront not just because of cost issues and the cost of energy but also because of concerns with a carbon-constrained world.

Again, I think don't forget that these low impact, nonstructural approaches also interact with these more traditional energy savings opportunities. And, basically I think as we point towards more sustainable programs any funding, whether it is from the ratepayers, from the State or the Federal government, needs to give more credence or provide a level playing field for energy management techniques as well as low impact or nonstructural approaches.

Essentially, with my limited time, I would like to mention I happen to be honored to serve on the board of a new foundation called the Clean Water America Alliance, and I just want to conclude with a statement from the web site of the Alliance that sort of summarizes my view of this matter:

"Imagine a world where water is viewed, managed and valued as one resource, a world where the silo thinking that has kept clean water, drinking water, stormwater and water reuse interests segregated erodes away and a movement toward meeting future challenges on a watershed basis, with a focus on sustainability and green cities, emerges in its place."

That is a world that we can imagine. I think that is a world that we can bring about.

And I thank you for your time.

Ms. JOHNSON. Thank you very much.

Mr. McLean.

Mr. MCLEAN. Thank you, Madam Chairwoman.

As Director of the office at EPA responsible for clean energy programs, I am pleased to testify today on the opportunities to pursue clean energy investments in this Nation's water and wastewater infrastructure. I am also pleased to be accompanied by Caterina Hatcher of my staff who is available to answer your technical questions.

Fostering sustainable wastewater management is a priority at EPA. Our Office of Water is actively addressing the many issues with sustainable wastewater infrastructure including asset management, green infrastructure and water efficiency. My office works with the Water Office on clean energy issues which include energy efficiency and renewable energy.

Clean energy is fundamental to sustainable wastewater management as well as a number of energy and environmental issues including global climate change.

EPA can provide critical assistance based on more than 15 years of experience in this area. A leading example is the ENERGY STAR program which is delivering tremendous results. As of 2007, EPA in partnership with thousands of organizations across the Country is helping Americans avoid the greenhouse gas emissions equivalent to those of 27 million vehicles while saving $16 billion in annual energy bills.

Also, EPA's Combined Heat and Power Partnership program has provided significant technical assistance to help industries adopt this highly efficient technology.

Based on this experience, I wanted to make four points this morning.

First, wastewater treatment plants are large energy consumers, as has been mentioned, and the potential for cost-effective savings is also large.

Water and wastewater treatment facilities require significant energy to power pumps, aeration systems and other operations. They account for an estimated 3 percent of national energy consumption and about $4 billion annually in energy costs and substantial emissions of greenhouse gases. Further, they are typically the largest energy consumers within local governments, accounting for 30 to 40 percent of the energy consumed

Clean energy can significantly reduce the energy use, energy costs and greenhouse gas emissions. Audits show that 10 to 20 percent savings are available through process optimization and equipment modifications at good rates of return. This suggests savings on the order of half a billion dollars or more per year available to local governments.

My second point is capturing these savings requires new energy management tools. The pursuit of clean energy faces many barriers such as lack of information, technical expertise and funding.

To address these barriers, EPA has developed tools and resources to help decision-makers assess the benefits of clean energy, act on available opportunities and measure results. The keystone of EPA's efforts is better management-level information on the energy used in buildings and facilities. We all know that you cannot manage what you do not measure.

EPA has created a National Energy Performance Rating System for wastewater treatment facilities as we have for other building and facility types. Working for the past 3 years with leading industry partners, we devised a ranking system on a scale of 1 to 100, similar to a miles per gallon rating on a vehicle, where 1 means very inefficient and 100 means most efficient. This rating requires minimal data inputs but alerts a facility operator to the opportunities for improved energy efficiency and encourages more thorough analysis of a facility's operations.

My third point is that wastewater treatment plants can benefit from adoption of what we call Combined Heat and Power or CHP.

By capturing the waste heat from combustion and putting it to work, CHP helps a facility reduce its energy costs by improving its fuel efficiencies to levels of 60 to 80 percent, double that of most power plants. Many wastewater treatment facilities are good candidates for CHP due to their onsite source of free fuel, the biogas, and their onsite needs for heat.

The best time to consider CHP is when significant investment in infrastructure occurs. EPA stands ready to assist facilities through this CHP partnership program.

And the fourth and final point I wanted to make was government-industry partnerships such as ENERGY STAR and the CHP partnership, can deliver results.

For example, through EPA's Energy Performance Rating for schools, we estimate that nearly 25 percent of the Nation's schools have been assessed and more than 40 school districts have reduced their energy bills by 10 to 20 percent or more using this rating system.

Recently, the Lieutenant Governor of Wisconsin challenged its school system to achieve 10 percent savings in a year's time, using this EPA system.

With regard to wastewater treatment facilities, more than 100 have already been rated using EPA's system. We expect our strong partnerships with utilities, States and local governments to expand this in the future.

In conclusion, as more attention is focused on improving the Nation's water and wastewater infrastructure, EPA is prepared to help achieve clean energy goals at the same time.

Thank you.

Ms. JOHNSON. Thank you very much.

Mr. Rich Brown.

Mr. BROWN. Thank you, Madam Chairwoman and Members of the Subcommittee. I really appreciate the opportunity to testify today.

My name is Rich Brown, and I am a research scientist at the Lawrence Berkeley National Laboratory in Berkeley, California, and my research investigates the potential for energy efficiency and renewable energy to reduce energy use in buildings and industry. And I am very honored to be here today to talk about my research.

I just want to be clear. My testimony today is just my own personal opinion as a professional in the field and doesn't represent my employer or the sponsors of my research.

I am here today to focus on energy use within the U.S. wastewater system and the opportunities to reduce that energy use through energy efficiency and renewable energy technologies, and based on my research I would like to make four points.

First, our wastewater sector is energy-intensive, and it is growing more so over time.

Second, this energy consumption could be reduced 10 percent to 30 percent using proven technologies, energy efficiency technologies.

Third, our plants, our wastewater treatment plants can actually approach zero net energy use through the use of onsite renewable energy resources.

And, finally, the most important thing I would like to emphasize is that the key to widespread adoption of these technologies is implementation of a comprehensive energy management system by our wastewater utilities.

Most of the municipal wastewater in the U.S. is treated in very large treatment plants that closely resemble industrial facilities. These large plants are very energy-intensive and account for most of the energy consumed in the sector. Nationwide, it is estimated that the sector consumes about 1 percent of the electricity sold in the U.S.

Most of this energy is used in the treatment process itself mainly to aerate the wastewater which provides oxygen to the bacterial treatment processes. The energy needed to treat a gallon of wastewater has increased over time, and it will likely increase in the future to address emerging contaminants and provide water for reuse.

A variety of proven commercially-available technologies are available to reduce this energy consumption. These technologies are of several types including improved equipment such as pumps and blowers that operate more efficiently, improved controls to operate those pumps and blowers only as much as needed and improved system designs to ensure the plant's components operate well together.

In my written testimony, I identify a whole list of efficiency technologies, but I wanted to identify and call out here a set of measures that can be relatively quickly and easily installed during a plant renovation. These upgrades include replacing pump motors and pumps with high-efficiency models, installing variable frequency drives to let the pump's energy to scale with the required pump flows, installing dissolved oxygen sensors to closely monitor the aeration process and installing a data acquisition system for overall plant monitoring and control.

And it is estimated that energy savings from this package of upgrades is typically on the order of 10 to 30 percent of baseline consumption.

I call that particular set out because that is a good candidate for the type of short-term stimulus funding that is being talked about in the Congress now.

Besides energy savings, wastewater plants offer several opportunities for generating energy from renewable resources. The most common and cost-effective renewable resource is biogas from anaerobic digesters used to generate combined heat and power.

And, as Mr. McLean mentioned, the EPA has estimated that if all the current digesters added Combined Heat and Power systems, we could generate on the order of 340 megawatts of electricity in the U.S. which is similar in size to a base load power plant. So the potential is significant.

Treatment plants are also a good site for solar and wind generation systems because they often have significant land area and tend to be sited away from populated areas. In States with generous renewable energy incentives, water and wastewater utilities have been among the leaders in installing these renewable energy systems.

But despite the potential of efficiency in renewables, they still have not been widely adopted in the wastewater industry. There are many factors to explain this, but mainly it is due to the plant operator's attention tending to be mostly focused on meeting wastewater or water discharge permits and not on efficient energy use.

Also, many wastewater plant operators are unaware of their plant's energy use. They don't actually see the bills, typically.

The solution to these problems is an organization-wide energy management program to continuously improve its performance. Such a program begins with collecting energy data and benchmarking against the plants' peers.

This helps managers set energy goals and develop a plan to achieve those goals. Ultimately, an energy management program contributes to overall plant quality and can help improve non-energy factors such as permit compliance.

And I would just like to finish with an example, actually, my home wastewater treatment utility in Oakland, California at East Bay Municipal Utility District.

Over the last five or so years, they have implemented a very aggressive energy management program, and the energy management team at their main wastewater treatment plant implemented a whole series of energy efficiency improvements that reduced the energy consumption of the plant by about 20 percent.

And then they upgraded the biogas production from their digesters so that their Combined Heat and Power plant now meets 80 percent of the plant's energy needs. Just yesterday, I got an email from the plant energy manager saying that they have improved that even, and it is now 90 percent of their energy needs are met by the Combined Heat and Power system.

So I think this is the best proof that the potential is there to realize dramatic savings through efficiency and renewable technologies, but it takes an ongoing commitment to monitor energy use and implement the right technologies.

So I would like to thank you for the opportunity, and I hope this information is useful in your deliberations. Thank you.

Ms. JOHNSON. Thank you very much.

Ms. Jeanette Brown.

Ms. BROWN. Good morning, Madam Chairman and Subcommittee Members.

My name is Jeanette Brown, and I am the Vice President of the Water Environment Federation. I am also the Director of the Stamford Water Pollution Control Authority.

I am honored to be here today to discuss the opportunity within the wastewater sector to ensure protection of water quality and public health in a more energy-efficient and economical manner through conservation, new technology and innovation.

The 35,000 members of the Water Environment Federation, also called WEF, include scientists, engineers, regulators, academics, plant operators and other professionals working in the United States and around the world. Our goal is a sustainable water infrastructure.

My utility provides advanced treatment for a community of 100,000 people. I am very proud of the job we do, providing an essential community service and protecting the water quality of Long Island Sound.

WEF supports the concept of sustainable water infrastructure in a variety of ways including green infrastructure, water efficiency and energy conservation.

To collect and treat wastewater at the more than 16,000 wastewater plants in the United States, we use over 1 percent of electricity generated. Energy costs represent 30 percent of a utility's operating budget, second only to labor. Water utilities can be the largest municipal energy consumer.

Energy is used to pump wastewater to the plant and treat it once it gets there.

To reduce energy, water conservation has to be our first line of attack. Necessity is the mother of invention. The need for new approaches is apparent, given present economic conditions and pressures on limited resources and our environment. The landscape is changing as technologies and concepts are developed.

An evolution in thinking is moving treatment plants from being viewed as major energy consumers to net energy producers. There are several reasons for this paradigm shift: cost of energy and need for energy independence, climate change and the need for a sustainable infrastructure.

In Stamford, we are using an old technology called gasification in a new way, using the product of wastewater treatment known as biosolids which have a relatively high energy value.

Think about this: A 1-pound package of Stamford biosolids can light 3 60-watt light bulbs for an entire day. Since the United States produces 14 trillion pounds of biosolids every year, just imagine how many bulbs we can light from this renewable energy source which is currently considered by many a waste product.

My written statement includes two other examples, one from Rifle, Colorado and one from East Bay Municipal Utility District that Mr. Brown just mentioned.

There are several opportunities for Federal government to provide leadership and assistance as we move forward:

First, the State Revolving Fund should be used more aggressively to promote energy efficiency, conservation and innovation. We hope the Committee will make this a priority when you take up SRF reauthorization later this year.

Second, we urge you to work with your colleagues to ensure any new energy legislation encourages collaboration between energy and water.

Third, expand programs to educate water professionals, the electric power industry and regulators and ensure these programs reflect the latest technologies and practices.

Fourth, support funding for research that allows the testing of innovative ideas. Please refer to the written testimony submitted by the Water Environment Research Foundation for more information on this.

We need to remember three concepts: energy savings through water conservation, energy savings through energy conservation, energy savings through innovation and research.

The water sector needs a new mindset, and we as Americans need a new mindset.

Wastewater utilities are big players in using energy, but we desire to be big players in conserving and even supplying energy. Keep in mind, wastewater is not waste. Our collective interests in a sustainable planet requires that we utilize this resource. Water should be reused, and solids should also be reused, and one way to reuse the solids is to create energy.

This requires a shared vision, leadership and funding. We at the Water Environment Federation stand ready to work with you on a shared vision for turning waste into watts and ensuring energy efficiency and energy independence for sustainable wastewater treatment.

Madam Chair and Subcommittee Members, thank you for giving me the opportunity to discuss this important topic.

Ms. JOHNSON. Thank you very much.

Mr. Alan Zelenka.

Mr. ZELENKA. Thank you, Chairwoman Johnson and Members of the Committee. It is an honor to be testifying here today.

I was a project manager for the Energy Independence Project for the Oregon Association of Clean Water Agencies which was funded by the Energy Trust of Oregon. The project was a groundbreaking project that was recently awarded the American Council of Engineering Companies, ACEC's, 2008 Project of the Year Award in Oregon. This is a hot topic.

The goal of the project was to see what it would take for wastewater treatment plants to become energy independent using energy efficiency and renewable resources.

The study evaluated two wastewater treatment plants in the Cities of Gresham and Corvallis, Oregon. Both have anaerobic digesters and advanced secondary treatment. The study showed that both Gresham and Corvallis could achieve energy independence by using energy efficiency, maximizing the use of their digester gas, installing micro-hydro and solar photovoltaic or PV systems.

Kennedy/Jenks developed a broadly applicable, systematic methodology to evaluate and recommend which energy efficiency measures are cost-effective and determine which renewable resource would work best to make these plants become energy independent.

We created a six-step program that is laid out in the materials that are provided you. But the first step was identify all the energy efficiency measures possible that are cost-effective, determine the plant's energy profile and then assess the renewable resources that make sense for the local community, evaluate those resources and then rank them.

I provided in the testimony a project sheet. On the second page is a ranking of these renewable resources. And I provided color copies. I have them with me.

A ranking of the renewable resources, and the first one, tier one of these was a fats, oils and grease and green waste program followed by internal combustion engines and microturbines. Two was fuel cells and micro-hydropower inside the plant. And then tier three was small wind turbines, solar PVs and really small micro-hydro.

And then the final step was to make recommendations for the plants to become energy independent.

The study provides a path toward energy efficiency and energy independence that any wastewater treatment plant in the country could follow.

First is to install all the cost-effective energy efficiency measures. They are the most cost-effective way to reduce energy needs, save money and protect the environment.

If the plant has unused capacity in their digesters, it should investigate a fat, oils and grease, or FOG, program and a green waste program to create more digester gas. This additional biogas can then power IC engines or microturbines or fuel cells to create more renewable electricity.

And the substantial tipping fees that the treatment plants would get could offset the capital costs in a very relatively short period of time, making FOG and green waste programs a very cost-effective option.

Then finally, internal combustion engines or IC engines using digester gas are the most cost-effective and best overall generation option and should be the first generation source considered.

And after using all the available digester gas, plants should consider micro-hydro, small wind and, finally, solar PVs to become energy independent.

Finally, because all of these resources have high capital costs—Corvallis' plan would cost $12 million and Gresham's would cost $10 million—these high capital costs lead us to need to have public waste treatment plants consider third party leases to avoid the up-front capital costs, to stabilize their O&M costs and take advantage of the available tax credits.

The wastewater treatment plants do indeed use a great deal of energy. Many have already done a great deal of energy efficiency but by no means have the majority implemented all the cost-effective energy efficiency measures. Yet, there is enormous untapped potential across the country to mine much of this energy efficiency out of waste treatment plants with long-term benefits for everyone.

Our study included a checklist of potential energy efficiency measures that each and every waste treatment plant across the country could use to make their plants more energy efficient and energy efficiency measures should be the first thing they do because they are the most cost-effective and best for the environment.

We often see energy efficiency measures that have very small, short paybacks—short as a third of a year or as little as three years. What is needed to capture this potential is targeted programs, adequate funds available to do energy audits, and loans and incentives to get waste treatment plants to act.

Energy efficiency has multiple benefits such as lower operating costs which means lower bills for ratepayers, new equipment that increases reliability, job creation, lower environmental impacts and reduced greenhouse gas emissions, a multi-win proposition.

Digester gas occurs naturally in waste treatment plants, and that could be used to generate low cost renewable electricity. One recent survey showed that only 15 percent of waste treatment plants across the country generate electricity if they have the capability to do so. What is needed is programs directed at waste treatment plants to get access to capital at favorable rates and incentives to lower the costs.

Other renewable resources like wind and micro-hydro and especially solar PV are feasible and can contribute greatly to making wastewater treatment plants energy independent and creating jobs, but it will take targeted programs, access to capital, financial incentives and incentives such as investment tax credits, accelerated depreciation and production incentives.

However, we need to create mechanisms that public agencies can access more readily and take advantage of these tax incentives. For example, in Oregon, we have a Business Energy Tax Credit which pays up to 50 percent of energy efficiency and renewable measures for a particular project, but tax-exempt entities can't take advantage of that.

We did a pass-through of the Business Energy Tax Credit or BETC in Oregon and allowed the public agencies to take 35 percent of that 50 percent tax credit in an up-front payment and transfer the other 15 percent to eligible tax credit agencies.

In conclusion, being creative and putting the right programs and incentives in place can allow wastewater treatment plants to maximize their energy efficiency, optimize their use of renewables, lower costs, enhance the environment and create jobs.

Thank you for the opportunity to testify today.

Ms. JOHNSON. Thank you very much.

Mr. Fahlund.

Mr. FAHLUND. Good morning, Chairwoman Johnson, Mr. Boozman and Members of the Committee.

My name is Andrew Fahlund, and I am Vice President for Conservation Programs for American Rivers, the leading national voice for healthy rivers and the communities they depend upon. Thank you for the opportunity to testify.

This moment in time offers a unique opportunity, as you have heard from some of the panelists already, for Congress to put forth a new vision for sustainable water management. In the same way that we must transform our Nation's energy strategy by embracing efficiency and renewable technologies, we need to transform our water infrastructure and embrace efficiency and green approaches that integrate our built and natural assets and tackle a variety of problems all at the same time. With the impacts of climate change promising more volatile patterns of precipitation, there is simply no time to waste.

My testimony will cover three main areas: first, a definition of what we call green infrastructure; second, some examples of how green infrastructure is cleaning our waters, enhancing our communities and saving money; and, third, a set of recommendations for the Committee on how to further that success.

Green infrastructure means that rather than relying solely upon pipes and treatment plants, we protect and restore those elements of the natural landscape that provide these same services for free, such as wetlands, small streams and forested landscapes.

It means that we replace parts of the built landscape such as placing gardens on rooftops and parking lots or replacing asphalt with materials that allow water to seep into the ground rather than run into the sewer.

These green approaches are gaining favor in cities and counties across America because they are effective, they are inexpensive and because their benefits go well beyond water quality to include enhanced water supply, better flood management, reduced energy and more livable communities.

We can no longer to afford to invest in large single-purpose infrastructure nor can we consider our built infrastructure separate from our natural assets. Both are important elements of a clean water system. We should proceed by maximizing the contribution of green infrastructure as a cost-effective first line of defense that enhances the effectiveness and extends the life span of engineered technologies.

The current economic crisis emphasizes the importance of investing in cost-effective solutions and avoiding investments in sewer lines to nowhere.

Green infrastructure creates jobs in many sectors including plumbing, landscaping, engineering, building and design, and green infrastructure also supports supply chains in the jobs connected with manufacturing of materials. A recent study showed that covering even 1 percent of large buildings with green roofs in medium to large size cities would create over 190,000 domestic jobs.

The following are three examples of where green infrastructure provided community benefits at a fraction of the cost of traditional approaches. My written testimony contains several other examples.

By investing $600 million to protect and restore watershed lands, New York City saved $6 billion in capital costs otherwise needed to construct a water filtration plant as well as 200 to 300 million dollars in additional savings in O&M.

Recently, the City of Indianapolis announced a plan to use wetlands, trees and residential modifications to solve their combined sewer overflow problem. As a result, the city will be able to reduce the size of its new sewer pipe, saving over $300 million and at the same time making the city more beautiful.

Smaller cities and communities are also applying these techniques. The University of Arkansas is designing and implementing a Habitat for Humanity neighborhood including green infrastructure to address water quality and minimize local flooding, using natural areas to absorb runoff. The project has cut infrastructure costs by half over traditional approaches.

American Rivers urges the Committee to promote and implement green infrastructure by primarily focusing in two areas:

First is to integrate green infrastructure into broader water infrastructure spending and programs rather than treating it as separate. Mandatory set-asides are critical in the short run, but we need to require comprehensive integration of green and traditional approaches in our investment decisions.

Second, through your oversight role, ensure that EPA and other agencies facilitate and foster green infrastructure in their policies, practices and spending decisions and support legislation that would further these goals.

In conclusion, today, we have reached a crossroads in how we manage our Nation's water. We should use this moment to move from a 19th Century strategy of overcoming nature to a 21st Century strategy of working along with it. With the provisions that this Committee championed in the economic recovery package, we are off to a great start.

Thank you for the opportunity to testify, and I would be happy to answer any questions you might have.

Ms. JOHNSON. Thank you very much.

I am going to defer the first questioning round to Ms. Edwards.

Ms. EDWARDS. Thank you, Madam Chairwoman, and thank you all for your testimony.

I have a couple of questions if I could direct them to Ms. Hatcher because, one, you carry out the program. I am curious about what you think.

EPA has basically said that the cost-effective clean energy technologies haven't routinely been considered as part of wastewater infrastructure improvements, and I wonder if you can expand on that and particularly pointing out some of the barriers that have to be overcome to incorporate energy-efficient technologies and approaches to be the norm.

And I was especially tuned in to both Mr. Brown and Ms. Brown and your testimony that essentially says we can actually do this. It may not be rocket science in terms of some of the technologies, but we can actually do it.

But I wonder about the intentionality of the strategies that we have within the government to encourage development of energy-efficient technologies and strategies in wastewater treatment systems and what we can do to further that intentionality.

Ms. HATCHER. Thank you for asking me that question. I am happy to answer that question.

In terms of the barriers, to address the first part of your question that had to do with the barriers to energy efficiency and renewable energy in wastewater treatment plants, in our written testimony, what we submitted was it is basically a very simple concept that you can't manage what you don't measure. The state of affairs out with POTWs in the United States is that many plant operators don't necessarily even have access to their energy bill information.

So a simple first step to understand what your energy use picture really is, is to benchmark your wastewater treatment plant, and EPA has developed a system to help with that. There are other approaches that can be taken out there.

Of course, there are a small number of wastewater treatment plants that are actively pursuing energy efficiency opportunities and renewable energy opportunities. But when you move out further, we run benchmarking trainings through the ENERGY STAR program where we train plant managers to benchmark their facilities, and often what the first step that they need to do is actually go gather their energy use information so they can understand how they are using their energy.

Ms. EDWARDS. So what does a benchmark of 58 really mean and, if operators are not required to measure, then why would they?

Ms. HATCHER. Well, there is an energy-saving opportunity, and as you heard that energy costs are second only to salaries, and from a municipality's perspective, which is actually what led us through the ENERGY STAR program into creating a benchmarking system for wastewater treatment plants, it is because how much of an energy consumer wastewater treatment plants are relative to a municipal government's energy use picture.

So the opportunity to save money through cost-effective energy efficiency opportunities and things like Combined Heat and Power, it makes sense to do it.

Ms. EDWARDS. So what do the scores really mean, though, say from 1 to 100, and a goal? I don't know if some median goal is 58. What does that really mean?

Ms. HATCHER. What that means is a benchmarking score is created when a plant operator puts in 12 months of energy use information into our tool called Portfolio Manager which is accessible online, and they also put in a few other parameters about the facility, which I can share with you very quickly.

Those variables are the zip code so we can get the location of the facility to do our weather normalization, average influent flow, average influent biological oxygen demand, average effluent biological demand, facility design and flow rate, and the presence of something called Fixed Film Trickle Filtration Process and presence of nutrient removal.

Ms. EDWARDS. But does EPA have or is there a target that a treatment plant, if they wanted to pursue efficiency, is there a target?

Ms. HATCHER. Well, the range goes from 1 to 100. In other, in our buildings categories, we establish ENERGY STAR rating at a 75 or higher on that scale meaning that that building or plant, if it is operating at a 75 or higher, it is within the top 25 percent of energy performers nationwide. They are more energy efficient than 75 percent of their peers across the Nation.

Does that make sense?

Ms. EDWARDS. It makes sense. It is just that if it is in the top 25 percent, it means that within the plants that are shooting for the goal it is in the 25 percent, but it is not necessarily the most efficient that it could be.

Ms. HATCHER. It is a comparison to your peers.

Ms. EDWARDS. Right. Thank you.

Ms. JOHNSON. Thank you very much.

Mr. Duncan.

Mr. DUNCAN. Well, thank you very much, Madam Chairwoman. I want to thank the witnesses for giving very interesting testimony.

A few months ago, I was talking to our colleague, Congressman Marion Berry from Arkansas. I asked him how many counties he represented, and he told me he represented 26 counties. He said that his area had been depopulated since World War II and that he had to drive 50 miles to the nearest large grocery store and 100 miles to the nearest multi-screen movie theater.

I mention that because about that same time I read in the National Journal that two-thirds of the counties in the U.S. are losing population. That really surprises people in my area. I represent the Knoxville area, and it has been one of the fastest growing areas in the Country for several years.

In fact, a year and a half ago, I chaired a conference in Knoxville on growth with a little over 700 experts and planners and so forth, trying to figure out how we handle the growth and not get overwhelmed by it.

The reason I mention all that now is it seems to me that that is a factor that needs to be recognized, particularly in regard to water and has policy implications in regard to what we do about our drinking water, our wastewater and so forth because what we need to do in some places we may not need to do in other places.

And it is going to be very difficult to come up with a one size fits all. In fact, we probably should do everything possible to avoid a one size fits all solution when we come up with national legislation or national rules and regulations in regard to water.

Mr. Mehan, you mentioned that there are funds for land purchases that can be obtained from the State Revolving Loan funds for drinking water. Do you know how much is being done on that at this point, how much money is being spent in that way?

Mr. MEHAN. I don't have those figures, Congressman. But it is the case that with the Safe Drinking Water SRF you can do that, and I know it has. There have been big purchases in California and other places.

Essentially, whether it is the Safe Drinking Water or the Clean Water Act State Revolving Fund, there are tremendous flexibilities there that the States can utilize if they so choose, whether it is for best management practices for nonpoint sources, whether it is land protection or whether it is for green infrastructure or low impact development. Not all States want to do that.

But you are seeing, it is a small number, States begin to provide in their rating system certain incentives for energy efficiency or for low impact development or allow BMPs, let's say, for agriculture in the appropriate watershed.

But it is true that land purchases can be accessed. Money for that can be accessed through the Safe Drinking Water State Revolving Loan Fund.

Mr. DUNCAN. Just after that, you say in your testimony that a study of 27 water suppliers conducted by the Trust for Public Land

and the American Water Works Association found that more forest cover in a watershed results in lower treatment costs.

Another thing that surprises people, I read several years ago in Bill Bryson's book, A Walk in the Woods about hiking the Appalachian Trail, that New England in 1850 was 30 percent in forest land. Today, it is almost 70 percent in forest land.

And a few years ago, I read that Tennessee, my home State of Tennessee, in 1950 was 36 percent in forest land. Today, it is 55 percent in forest land. That really amazes people.

And so, once again, a lot of places have almost more forest cover than they really need, and many places don't because the growth in Tennessee is in a circle around Nashville and a circle around Knoxville and that is true in almost every State. The growth is in the counties that touch on the urban counties.

When we consider things like green infrastructure and low impact development and all of that, we have to look at that more closely. And some of that may be good, and some of it may be just almost wasteful because I am glad that several witnesses said things like cost-effective and savings and so forth because that is what we are going to have to look at.

My time is almost running out, but I will give you an example. I have no coal in my district, but I have noticed that some people want to do away with almost all coal production in this Country even though we are sometimes called the Saudi Arabia of coal and one of the reasons is because people say it has a bad impact on the streams and the rivers and so forth.

Yet, if you do that, you are going to double or triple or quadruple the utility bills, and you are going to hurt a lot of poor and lower income people in the process. So you have to take that into consideration.

I read that H.L. Mencken said there is a simple solution to every human problem, one that is neat, plausible and wrong. And so, what works one place may not work in another.

Green infrastructure may be good one place and not necessary in another place. That is my point.

I am sorry I didn't get to more questions. I got a little wound up there, Solomon.

But thank you very much. Your testimony has been very helpful.

Ms. JOHNSON. Thank you very much.

Mr. Hare.

Mr. HARE. Thank you, Madam Chair.

Mr. Fahlund, just a couple questions for you. In your opinion, what is the one factor that is most responsible for American towns and cities for not adopting sustainable wastewater infrastructure practices that you have talked about this morning?

Mr. FAHLUND. You know I think it is a little bit difficult to pin it down, but in some respects I almost would describe it as inertia. I think that we have sort of gone along a path that is predictable and one that people are comfortable with, and so breaking out of that kind of a paradigm can be challenging.

But we are starting to see innovators, and we are starting to be able to point to places, a great diversity places. I am sorry Mr. Duncan left because I actually would argue that I think green infrastructure is in fact universally beneficial because it is based on very simple principles, and those principles are quite universal.

But I would say inertia is the biggest challenge.

Mr. HARE. You also recommended that the Committee ensure that Federal agencies such as EPA facilitate and foster sustainable infrastructure policies and practices and spending decisions.

In your opinion, what would be the first step you would like to see this Committee take to see that these practices are undertaken by the EPA and other agencies? Would that be oversight, legislation or a combination or just basically anything here?

Mr. FAHLUND. Well, I would certainly say a combination of oversight and legislation.

I think supporting EPA's green infrastructure initiative, perhaps helping to create an Office of Green Infrastructure within the Office of Water would be an important step for EPA to take.

I think supporting implementation of a performance-based standard for stormwater that focuses on predevelopment hydrology is sort of the optimal goal for a watershed. So, essentially trying to at least hold constant what we had before and not have to worry about the impacts of impervious surfaces as much as we currently do.

Mr. HARE. This is maybe for the rest of the panel. I only have a couple minutes here but for all of you.

Much has been made of the potential economic stimulation effect of the economic recovery package that we passed and its potential for job creation from Federal expenditures on infrastructure. What I would like to know is there a similar potential effect for job creation within the innovative energy and water efficiency technology sectors from encouraging Federal investment in these technologies?

Ms. BROWN. Yes, I believe so. The technology that we are using, for example, that we are working with in Stamford, this gasification is a technology that really needs a lot more development. It could be made so that individual treatment plants can use this technology.

You know most of the treatment plants in the United States are very small. If we had monies to develop a gasifier that would work for a one million gallon a day plant or a two million gallon a day plant, these plants could become energy independent in my opinion.

And that creates jobs. You have manufacturing jobs. You have construction jobs. And you end up with Combined Heat and Power and energy independence.

So I think an investment in innovative technologies is money very well spent. It will not only help with energy use, but it will also create jobs.

Mr. HARE. Mr. Zelenka, you had something?

Mr. ZELENKA. Yes. Both energy efficiency and use of the digester gas create jobs. Energy efficiency creates an infrastructure that can be used in basically any industrial setting.

So using those and promoting those incentives to get those types of energy efficiency measures in the plants will create jobs, and, as well, using the digester gas will create a long-term permanent job at that plant. It takes two people, basically, to run a plant if you generate electricity from methane.

Mr. HARE. Thank you very much.

Thank you, Madam Chair.

Ms. JOHNSON. Thank you very much.

Mr. Ehlers.

Mr. EHLERS. Thank you, Madam Chair.

I apologize for being late, but things kept popping up all morning. It is just one of those days.

And one of the problems is I am co-chairing tomorrow the National Prayer Breakfast, which I assume everyone here will go to and, if not, we will pray for you in the meantime.

[Laughter.]

Mr. EHLERS. But it has taken more than my share of time.

Thank you all for being here.

I especially want to comment and welcome Mr. Mehan who I worked with in Michigan some years ago and was at death's door for a few years. I am glad you have recovered, Marty, and welcome back. Good to see you again.

I am extremely interested in energy conservation and have been for about 30, 40 years now, and I am interested in hearing the discussion here about energy conservation in connection with wastewater infrastructure.

I am sorry I missed the earlier discussion, so if I ask a question that is not appropriate. But to start with, what order of magnitude of energy savings do you think we can achieve by readjusting our wastewater systems? Are we talking a 5 percent savings in energy, 20 percent, 50 percent? What we can achieve?

And my real question is: Is it worth going after?

Anyone wish to comment on that?

Mr. BROWN. I can. I am Rich Brown from the Lawrence Berkeley National Laboratory.

In my testimony, for energy efficiency technologies, I cited a range of 10 to 30 percent savings using commercially-available proven technologies. In using more aggressive strategies, process optimization, it is possible to get 40, 50 percent savings.

It is obviously depends on the starting point, how efficient the plant was to begin with, but just on the energy efficiency, energy conservation side you can do that.

And then with renewable energy generation, either from biogas or other renewable sources, it is possible to get energy independence, as Mr. Zelenka testified.

Mr. EHLERS. Okay. Thank you.

And you are at Lawrence Berkeley Lab?

Mr. BROWN. Yes. Correct.

Mr. EHLERS. I spent 11 years there myself, a good friend of Art Rosenfeld. Is he still playing around with energy issues?

Mr. BROWN. Oh, very much so, yes.

Mr. EHLERS. I assumed he would be.

Mr. BROWN. I was one of Art's students.

Mr. EHLERS. Oh. Well, good.

Ms. Brown?

Ms. BROWN. Yes, I can give you an example.

At my wastewater treatment plant, we have a treatment plant that is designed for 24 million gallons a day. When we were putting in some new equipment, we put in high-efficiency motors, variable frequency drives, control systems for dissolved oxygen to control blowers. We have put in a computer-controlled management system, and our power consumption decreased by 18 percent.

And that was without anything else, just things that were currently on the market that you could use and any treatment plant can install without a huge capital expenditure.

Mr. EHLERS. That is good. I am very pleased to hear that solid number.

People tend not to realize how easy it is to save energy. I know in one of our buildings here we replaced the elevator motors and got a tremendous increase in efficiency.

Ms. BROWN. Just lighting, we went to a different kind of lighting within our buildings, and that had a significant impact too. So people overlook lighting, but it also has a great benefit.

Mr. EHLERS. Well, as someone who put florescent lights in his house about 30 years ago, I can appreciate how much money I have saved by now.

Mr. Zelenka?

Mr. ZELENKA. Yes, a couple things, Mr. Ehlers.

In our proposal, we had a list of energy efficiency measures that any waste treatment plant can go down and check off, that they can look at to make sure that they are doing all the energy efficiency measures that they possibly can, including lighting.

My experience is 10 to 30 percent savings, but in my 20 plus years in working in energy efficiency every time I have said that higher number I have been wrong and been underestimating it. It might be as high as 50 percent.

And energy conservation is the most cost-effective option for any waste treatment plant, and they should do that first. The other advantage is that it reduces their operating costs, which means that they can help stabilize rates over the long term which everybody in the community benefits from.

Mr. EHLERS. Good.

Mr. Fahlund?

Mr. FAHLUND. Yes. I just wanted to mention two things.

One is that consumer end use efficiency is actually something that is an approach that really offers great opportunity for actual savings at the back end. At the plant, if you have less going into the plant, it requires, obviously, less energy to treat and move around.

But it is also I think important to recognize that things like green infrastructure will reduce the amount of water also going into the plant through either leaks and other kinds of stormwater entering into systems that then don't have to be treated as well. So, again, reducing some of the volumes can make a big difference.

Mr. EHLERS. Yes. My home town of Grand Rapids, Michigan has done a great job in that.

Mr. FAHLUND. Yes, they have. We have worked with Grand Rapids quite a bit.

Mr. EHLERS. And they paid for most of it themselves.

Yes, Ms. Hatcher.

Ms. HATCHER. Hi. I would like to add that a good, strong energy management program overall is what will then ultimately help you with continuous energy management and continuous energy efficiency. One can purchase various technologies and if people aren't trained how to operate them and are not optimizing how those technologies work within the plant, they may not get the energy savings that they intended.

So a strong continuous energy management program where you set a baseline for your energy use and then you work toward your energy efficiency reduction goals relative to that baseline and then measure and verify your savings over time is what will help make sure that you really meet your energy reduction goals and are using resources wisely.

Mr. EHLERS. Well, thank you very much. That is very encouraging and very heartening.

As I said earlier, it is not that hard to conserve energy. You just have to think about it and do it.

I just got an idea while sitting here. One of the major corporations in my district is Steelcase Furniture, and they have developed a new system because people who sit at a desk all day get out of shape, they gain weight, et cetera. So they have developed a treadmill which keeps moving, and they can stand on the treadmill while they are working.

And I just thought of another idea. Why not just tilt the treadmill, have them climbing and they can generate electricity which can power their computer? So I will have to pass that on to them too.

[Laughter.]

Mr. EHLERS. Thank you very much.

Thank you, Madam Chair.

Ms. JOHNSON. Thank you very much.

Mrs. Napolitano.

Mrs. NAPOLITANO. Sorry. I am trying to look at my questions.

I have a great interest in the ability to be able to look at new and innovative systems that are being utilized throughout the United States in the different areas that might be applicable. I am chair of the Subcommittee on Water and Power, so water is a very, very hot issue with my Subcommittee.

But I have another question that might be a little different from what we are talking about. What do you know is being done in any area to address the emerging contaminants: pharmaceuticals, personal care products, chemicals in clothing and insecticides?

That may benefit, as you are developing new technology or being able to utilize solar power or other power, to be able to do that. How are we dealing with that, as regards to anyone of you, as regards what we are talking about?

Ms. Brown.

Ms. BROWN. The Water Environment Federation is very active in looking at these micro-constituents or emerging contaminants. We have developed a community of practice which is people that are really interested in the field of contaminants and experts that understand wastewater treatment.

One of the things we need to do is be able to test for them within a wastewater treatment plant and have equipment that can identify what they are before we know how to treat them. So part of it is really in identifying what is in there and then how we can treat it. Is it really treated in a typical treatment plant or do we have to look at advanced treatment?

But the Water Environment Federation and the Water Environment Research Foundation are putting a huge amount of effort into this subject right now, including specialty conferences that we have been running to really get the body of knowledge out there for people to explore it in more detail.

But it is a very complex issue, and it is an issue that is going to take considerable study and then hopefully develop ways of treating it.

Mrs. NAPOLITANO. Anybody else?

Yes, sir.

Mr. ZELENKA. As part of my spare time, I am a city councilor for the City of Eugene as well and one of the things that we are looking at is a take-back program for pharmaceuticals. Almost all of those drugs end up in the water stream, and they don't get filtered out through our waste treatment plants. Having a take-back program will keep those drugs from getting into the waste stream as well as deal with the problem of drug abuse from prescription drugs which is huge among teens as well. So there is added benefit to that program.

Mrs. NAPOLITANO. But it is also something that has not been filtered out of the urine.

Mr. ZELENKA. Right. It is difficult.

Mrs. NAPOLITANO. And so, you have an additional way of adding to or exacerbating the problem.

The concern is what has being done because we know this is a problem nationwide? It isn't just in certain areas.

How we deal with it or how we are developing the filter system to be able to do the job that would not affect those that don't have the immune system to protect themselves.

Then the other question is the water treatment facilities generate a lot of space that could be good areas to place solar paneling. Are water treatment plants able to take advantage of their size to install photovoltaic systems that can support their energy needs and do you have any ideas for our government to assist in that effort?

Ms. Brown.

Ms. BROWN. Yes and, in fact, at my utility, we have two very large buildings that have southern exposures. We are in the process now of sizing solar panels for it, and we are hoping to be able to generate quite a bit of power from those solar panels.

One of the things that was very interesting when I started doing, looking in this a couple of months ago is that the incentives that were available for installing solar panels, at least in Connecticut, no longer exist because too many people were taking advantage of it.

So what we need is we do need some funding, and we do need encouragement from the Federal Government. Funding would be great, whether it is in the form of a loan which is always good for us or an outright grant. The value that we are getting back from solar power would be great.

In addition, wastewater treatment plants should be able to generate electricity from the water that flows through the treatment plant in the effluent pipes, and we need to do some more studying and have some incentives in that area also.

Mrs. NAPOLITANO. But is there an organization that puts these together so they know that they can work together with the Federal Government and request assistance in being able to establish the systems in smaller cities and towns?

Ms. BROWN. Certainly, organizations like the Water Environment Federation have. A lot of the people that are members of the Water Environment Federation are operators and plant people, and the education that comes out of the Water Environment Federation certainly can assist as a clearinghouse for people in learning about energy savings and things like solar panels or hydroelectric.

Mrs. NAPOLITANO. He has an answer.

Mr. ZELENKA. The project that we did for energy independence had both the Gresham and the Corvallis plants using solar PVs to become energy independent, and what they need is access to capital at low rates and incentives and access to the tax credits. The tax credits go to folks that pay taxes, but most municipal and county governments don't pay taxes.

In Oregon, what we did was take the tax credit and create a pass-through that allows the municipal governments to be able to take that and get about 35 percent of the 50 percent tax credit in an up-front payment by transferring that tax credit to someone who has an appetite for that tax credit.

So creative uses of tax credits, I think, is a better way to go than creating appropriation programs that we have had before that haven't really worked. So getting municipal access to those tax credits is real key to do the funding for PV programs and other renewables.

Mrs. NAPOLITANO. Thank you, Madam Chair. I have some other questions that I will submit in writing.

Ms. JOHNSON. Thank you very much.

Mr. Boozman.

Mr. BOOZMAN. Thank you, Madam Chair.

I appreciate the testimony. Your knowledge on things is really very commendable.

We face a lot of challenges in the Country right now, but, long-term, I think this is one of the biggest challenges that we face and probably one of the most important.

Today, the economy is pretty tough with our communities, with our ratepayers and things like that.

Mr. Brown, I think the consensus among a lot of the testimony is 10 to 30 percent depending on whatever. I guess the question I would have is what is the payoff on that? I mean we are reducing energy, but what is the low-hanging fruit?

What can I look for when I go through a wastewater plant to see if they are doing the right thing?

Mr. BROWN. I cited some numbers in my written testimony. There was a list of energy efficiency upgrades with some typical paybacks.

Unfortunately, the answer is it depends usually, and that is one of the reasons why an energy management program such as the ENERGY STAR, a portfolio manager program is so important because the specific upgrades and technologies that are appropriate for a given plant. It is going to vary depending on the plant. Essentially, every treatment plant is different.

Mr. BOOZMAN. What do you see, though, if you grabbed 100 treatment plants? I know that they are all different.

Mr. BROWN. Right.

Mr. BOOZMAN. But what do you see or what are a couple of things that you see that most of them are lacking that they could do fairly inexpensively, that there would be a good cost return because the reality is it doesn't matter what we do? If it is not cost-effective in the environment that we are in now, it is just not going to happen.

Mr. BROWN. Yes. I mention in my testimony there is a group of maybe four or five relatively straightforward measures: improve pumps and motors and variable speed drives. Those typically would have a payback of less than five years, and a lot of times they are going to be one year or less even. I think Mr. Zelenka pointed out that oftentimes these things will pay back in an few months.

And so, I think it is safe to say they definitely pay back within the lifetime of the upgrade, and often within two, three, four years they are generating a positive return to energy savings. You have paid off the additional capital cost, and the energy saving are just accruing to the organization.

Mr. BOOZMAN. Right.

I am sorry, mister. We will get back to you in a second.

One of the things you said, the thing that most operators are chasing are the water discharge permits.

Mr. BROWN. Correct.

Mr. BOOZMAN. That is the number thing.

Mr. BROWN. Right.

Mr. BOOZMAN. Ms. Hatcher, in going down, when we are looking at, especially as we get into getting more and more nutrients out, getting more and more aggressive, do we look?

When we are doing those permits, do we look?

Say, and again these are just numbers, but if you are going as far as phosphorus from one part down to a half a part to a tenth, do we consider the value to the stream versus the energy requirement and the fossil fuels and all that stuff that it takes to go from a half to a tenth?

And then as we go into these, really being very, very aggressive, strategies, when you do your permitting, and I think the ENERGY STAR program is a wonderful program. I commend you on that. But when we do our permitting, do you all have an ENERGY STAR program of your own in considering the permitting process?

I would challenge you, that I think you need to do that.

Ms. HATCHER. Thank you for the question.

As an employee of the Office of Air and Radiation, I am not part of the EPA's Office of Water permitting process.

Mr. BOOZMAN. Well, standing from the side and just looking in.

[Laughter.]

Ms. HATCHER. I still can't answer that question, actually. I don't know the answer to that.

Mr. BOOZMAN. Yes, sir.

Mr. MEHAN. No.

Mr. BOOZMAN. But that would make sense, wouldn't it?

Mr. MEHAN. No. Basically, when you go for your Clean Water Act permit, the NPDES permit, you either have to comply with the technology-based standard for any given pollutant or parameter or for a water quality-based standard if you have already achieved or reached the technology, implemented the technology required, previously.

In fact, this is a hot issue, as you are obviously aware, with the whole idea of nutrients, nitrogen and phosphorus, because that is a huge issue in this Country.

And we really don't have, with an exception of, say, the Chesapeake Bay or maybe phosphorus in some freshwater systems. We are just beginning to get into the development of good technical criteria for nutrient water quality standards, and that will drive up costs.

Hence, that is why I am a big fan of nonstructural best management practices. It is easier to fence animals out of streams, reforest a riparian corridor, change management practices for the use of fertilizer on the land at a fraction of the cost, even if you are paying farmers to do this, than to build a gigantic black box at the end of the pipe and run up your energy costs.

So, definitely, ideally, we are going to have to move to a situation where we sort of have a comprehensive evaluation of all the ramifications of a permitting number.

Mr. BOOZMAN. Mr. Zelenka?

Mr. ZELENKA. Yes. Again, in our report, we had a checklist of 16 simple things that you can look at.

Let me give you three examples that we did at Gresham where we changed their medium bubble diffusers to fine bubble diffusers, a three-year payback. We put in premium efficiency motors, 0.7 years payback. And the best one was we reduced the operating pressure within the system and it had a 0.1 year payback. They actually implemented that before we finalized the report because it was such a simple thing to do, just operationally, and so easily done.

So there are quite a few things that can be done that are very cost-effective.

Mr. BOOZMAN. Thank you very much.

Thank you, Madam Chair.

Think ENERGY STAR for EPA.

Ms. JOHNSON. Thank you very much.

Ms. Hirono.

Ms. HIRONO. Thank you, Madam Chair.

I would like to thank the testifiers for providing some information on our wastewater issues that I wasn't particularly aware of, especially the fact that our wastewater treatment facilities use so much energy.

In particular, Mr. Brown, you noted in your testimony that the trend is for the EPA basically to require more and higher treatment levels in our municipal wastewater treatment facilities. And to the extent that those are really energy users, it seems to go against what we are trying to do today or what we are trying to address today.

I particularly noted this because the City and County of Honolulu without getting into specifics, has been the subject of a lawsuit involving our treatment facility, and because the EPA has required that they go to a higher level of treatment it is going to cost us hundreds of millions of dollars. And there is a question as to whether or not if we had put in place the kinds of thinking, that kind of analysis that we are trying to promote here, that perhaps the outcome would have been different.

And so, that is just sort of an introduction to my interest in this subject.

Mr. Mehan, you noted that you would hope that the EPA, specifically the Office of Water and Enforcement and Compliance Assistance, would incorporate more of these kinds of analysis in their enforcement activities. Is this the entity that regulates wastewater treatment facilities also?

Mr. MEHAN. Basically, this issue of trying to allow a permitted wastewater system to use low impact development or green infrastructure type approaches does get involved with permitting and enforcement issues.

The Office of Water at EPA is sort of the main supervisor of all the permitting systems, both at the Federal and State level where States have delegated authority, but at the enforcement side that is in the Office of Enforcement and Compliance Assistance. So their office is at the same place in the organizational chart, side by side.

The point I tried to make in the written testimony was that we have one case that I am aware of, Portland, Oregon, where they have actually incorporated low impact development and green infrastructure in their long-term control plan, which is essential for combined sewer overflow compliance.

We need to see that become more regular. It ought to be in more long-term control plans, but it shouldn't be in consent decrees which are enforcement tools.

We need to develop a way to evaluate these things with some assurance that we could incorporate them into a permit. So we don't necessarily have to make it an enforcement matter but a permitting matter.

The good news is there is an agreement signed between the Office of Water and the Office of Enforcement and Compliance Assistance to begin to pursue this whole issue of green infrastructure and low impact development in a more sustained fashion, and I am hopeful over time.

I am aware of a few municipalities that are trying to work through regional offices to do this as a permitting matter rather than as an enforcement or consent decree matter. So I am hopeful that over time we are going to see low impact development and green infrastructure become more routine at the permitting level, not just at the enforcement level.

Ms. HIRONO. Thank you for that, but I wasn't clear on whether this particular office within EPA is the entity that enforces, for example, the Clean Water Act.

Mr. MEHAN. The Office of Water is in charge of implementing the Clean Water Act and the Safe Drinking Water Act, but the Office of Enforcement does the enforcement. Several years back, what, a decade and a half ago, the enforcement functions were broken out of the Air Office, the Water Office, the Superfund Office, and that is a separate office of equal weight or equal standing, independent of those line programs.

Ms. HIRONO. I think that raises the point that in the Transportation and Infrastructure Committee we are spending a lot more time now trying to get people to talk to each other so that we are all going in the same direction on the same page.

EPA is a very large organization, and I hope that these kinds of approaches. And, as Mr. Fahlund said, inertia is a huge element going through not just our administrative agencies, but a lot of people don't like to make changes in their individual lives either.

But whatever we can do to promote interagency discussions and moving us toward in our enforcement, in our permitting, to incorporate these kinds of energy-saving and holistic analyses to decision-making.

I hope that in your testimony, which I didn't have a chance to completely read, that you have some specific ideas for how Congress can promote these kinds of approaches through our authorizing legislation.

Thank you, Madam Chair.

Ms. JOHNSON. Thank you.

The Chair recognizes Mr. Baird.

Mr. Baird.

Mr. BAIRD. I thank the Chair, and I thank our witnesses.

I have spent an awful lot of time on the issue of global warming and related phenomena. I just want to share a couple of ideas and then get your input.

First of all, I think our wording has been, unfortunately, wrong in terms of describing climate change and global warming. Warming is something that is nice. I like to be warm. Change is what we elected President Obama on a platform of.

The reality of what we are dealing with is something much more serious. It is lethal overheating of the planet, deoxygenation of the atmosphere and the acidification of the oceans.

If a doctor said to you, you have mildly accelerated cellular growth, you could call that cancer. But cancer gets your attention. Accelerated growth sounds like kind of a good thing.

Then, on the cure side, we have been vastly mild in our response.

If that doctor said you have accelerated cellular growth and, oh, by the way, as soon as we can come up with an international protocol we will try to reduce that growth by 2050, you might just say, you know, Doctor, if I have cancer, I would kind of like to get that treated right quick.

Now the reason I say that is because I am particularly concerned about oceans, and this is relevant to your work and today's testimony. The combination of acidification of our oceans, dead zones, harmful algae blooms, invasive species, et cetera, all of which are related to the water that we put into our system, I think has a real possibility of wiping out the oceans. And we need to talk about that at a much greater level than we have.

I mentioned earlier the issue of behavior change. On energy consumption, many people have in their minds some thoughts of things they can do to reduce energy output or energy consumption and why that might be beneficial. We don't tend to do that in terms of water.

What is the impact, for example, on your ability to clean water when people flush everything down the toilet and the drain and use chemical cleaners to clean it?

What might we do with how we wash our cars, et cetera?

I just want to open that topic up and hear your feedback about what can we do to make a national effort to save our oceans, improve our clean water and save energy in the process. I will just open that up.

Ms. BROWN. You have brought up an extremely complex issue.

My plant is on Long Island Sound. I am concerned about sea level rise inundating my plant down the road. So that is a major concern that I have.

But we are also required to remove nitrogen because of the eutrophication problems in Long Island Sound, and the cost of removing nitrogen is very high.

Now, in Connecticut we have a nitrogen trading program, and this past year I made $943,000 selling nitrogen credits. So I got some of the money back that it costs me, and it is a very good program based on the TMDL of Long Island Sound.

But it is an extremely complex issue where we need to treat water for water quality, but there is a cost associated with that treatment. It is not easy.

We have seen a reduction in our flow coming into our treatment plant because of water conservation out in the city, but it doesn't mean that there is less pollutants coming into the treatment plant too, and that is something to bear in mind.

We may save some money in pumping the water, but there is still a certain amount of waste that has to be treated. You are just making it more and more concentrated as it goes in.

So it is a hugely complex issue where you are trying to balance the good of the environment in so many ways: the good of the environment by energy conservation, the good of the environment by treating the waste to the level that you need to protect the flora and fauna out in the receiving waters.

Mr. FAHLUND. Congressman, my organization obviously cares about how to educate or wants to educate consumers as to what they can do to contribute to ensuring that we have a sustainable supply of water.

And I would add to your list in terms of looking at the climate crisis. I think water is where most Americans are going to feel. Freshwater is where most Americans are going to feel the effects of climate change first and worst, whether too much or too little, probably some of both in any given location.

We put together a report focused in the southeastern United States but that really could be applicable anywhere in the United States that identifies nine policies and practices that citizens and localities can undertake to reduce their water consumption. Again, I do think that that has an added benefit not only on the supply side but also on the wastewater treatment side.

We have also undertaken to educate citizens and municipalities and utilities about how they can implement some of these stormwater measures, these green infrastructure measures right there in their own homes. Whether that is trying to keep as much as that rainwater onsite as they can during storm events, these are things that can be done by individual citizens particularly if they are provided some incentives to do so from utilities or from municipalities. Prince Georges County, in fact, was one of the early adopters of this kind of an approach and led some of the innovation in this arena.

So we are doing what we can to educate the public, but I think what we need to do is work together with industry and others to try to further that kind of outreach and, hopefully, advance the investment in these technologies.

Ms. JOHNSON. Thank you very much.

Mr. Taylor.

Mr. TAYLOR. Thank you, Madam Chairman.

Mr. McLean, I am curious. I am going back a couple of decades now, but it is my understanding that the EPA paid a Dr. Wolverton down at the Stennis Space Center to come up with a system, and the idea was to try to reuse the water on the space shuttle in a closed system. So he had come up and developed an anaerobic stage or aerobic stage and then a plant and gravel filter for the last stage where the bacteria that attach itself to the gravel did the tertiary treatment.

I thought it showed a lot of promise back then. Obviously, with cheap energy, the tendency was at the time to just keep building plants with the aerators and using a lot of energy because energy was cheap.

What, if anything, became of that research because I don't know that anything ever became of it?

Mr. MCLEAN. I am going to deflect and see if Tracy has been listening to your question.

Mr. TAYLOR. There was a guy named Wolverton. His work was done at the Stennis Space Center. He was under an EPA contract, and he worked on that project for several years. And from what I read back then when I was a city councilman and spent time on wastewater matters, it made a lot of sense.

The engineers at the time said energy is cheap. Aerators work. Aerators use less square footage, footprint, and that was the way to go.

Now that we are concerned about energy costs, what, if anything, has become of that research?

Mr. MCLEAN. Okay. I am not familiar with the research or what may have become of it.

Tracy was at EPA, well, after that, but may know how that concept was carried forward.

Mr. MEHAN. Congressman, I am not familiar with the study that you are referencing. I will make a generic comment that the development of membrane technologies.

Mr. TAYLOR. This wasn't membrane. This was just simple gravel and sand. The water had to filter through it much like on your swimming pool.

Mr. MEHAN. That, I can't.

Mr. TAYLOR. And the bacteria that attached to it created the tertiary treatment because, guys, I just did a quick read. If I was a professor, you all would be in trouble for plagiarism. I am seeing the same thing over and over in almost every one of these reports.

And the other thing that I am not hearing any of you talk about is land treatment. Now I realize that is not going to work for the large. It is not going to work for Long Island. That is not going to work for New York City. But for a great many of our cities where there are green spaces nearby, that seems to me again a proven technology that I don't see any of you. I haven't made it to the last one, but that I don't see any of you talking about.

Yes, ma'am, Ms. Brown.

Ms. BROWN. There is land treatment that is used at many small treatment plants. In fact, some treatment plants have actually gone to using various plants like hyacinths and duckweed in order to absorb nutrients.

Mr. TAYLOR. Particularly mercury, if I am not mistaken.

Ms. BROWN. That reduces the cost of treating nutrients. That is great as you mentioned, and you recognize that it is good for small treatment plants.

Unfortunately, the way the biological process works within the treatment plant is you need to give them air through the aeration system. But over the past several years, there has been a lot of improvements in how we deliver that air. I think one of these gentlemen mentioned going to fine bubble diffusers, and that fine bubble has reduced energy costs at treatment plants, along with having computer controls that monitor the level of oxygen.

But as far as treating water in order to make it reusable, I do not think, and I don't know that research, but the level of treatment that you mentioned with just the bacteria attaching to a substrait, a rock or something.

Mr. TAYLOR. Well, it was actually three stages. He had an anaerobic stage, then to an aerobic stage, the last stage was a sand and gravel filter with plants in there to pick up some of the heavy metals.

Ms. BROWN. Sure. You would actually have to go beyond that if you wanted to reuse the water. For example, in New York State——

Mr. TAYLOR. No, no. Again, this was for a closed system on a spaceship. What I am talking about now is wastewater treatment. Using the same system but for wastewater treatment, get it clean enough to go back into the streams.

Mr. BROWN. Right. Yes, and you could do that very definitely through that kind of a system, and we do that already. Many plants have sand filtration. So they go through the same stages that you mentioned, and they go through sand filters, and then that is discharged to the environment in a very clean stage.

Mr. TAYLOR. As a matter of curiosity, I am not trying to bust anybody's chops, but I did not see that mentioned in any of these proposals, and I am just curious why.

Mr. BROWN. That technology was commercialized under the trade name, the Living System, and actually the EPA Water Office has a fact sheet on their web site about it. That was several years ago. I think you mentioned 15, 20 years ago. I don't think it ever reached commercial viability.

But I think, more generally, I would classify that as what I would call a natural treatment system. So there are conventional mechanical treatment systems which is most of what we talked about today, which are these highly capital-intensive engineered systems that look more like once-through industrial processes versus natural systems that use natural processes, plants for oxygen production and things like that.

There are a variety of these concepts that have been developed. There is, for instance, a technology called an Advanced Integrated Wastewater Pond System which was developed at U.C.-Berkeley that uses a series of stages including algae ponds. The algae produces oxygen which is used in the secondary treatment. It is an integrated system that does biogas production, and it produces pretty much reusable quality water at the end, and it mostly runs off of solar energy that the algae collect.

So there are various systems under this general classification of natural systems. Constructive wetlands is another type of system that people use not generally for primary or secondary treatment but for water polishing to remove the final suspended solids.

Mr. TAYLOR. Thank you, Madam Chair.

Ms. JOHNSON. Thank you very much.

The Chair recognizes Ms. Norton and also asks if you will take the Chair for the final question period.

Ms. NORTON. [Presiding.] While I wasn't here, I am familiar with your approach, and I particularly appreciate the complexity with which you view the problem before us.

I have a question that is less complex although I have to say that the integrated approach, the understanding that the planet is of a piece. You can't save one part of it without saving the other seems to me lost on many of us, even those of us who are committed environmentalists.

Just to cite one example where the Congress is embedded and indeed subsidizing, the issue of ethanol, for example, most people call that food. We thought we were making some kind of progressive change to make it fuel, and look what it has done to the price of corn and the price of food around the world.

And not only have we encouraged it, I don't even know how we are going to get out of it because we have subsidized farmers and it is profitable.

The complexity of the problem is what interests me most, and my own sense is that some combination of innovation or technology in greening may lead us to an acceptable answer. I certainly don't see any society, even in our shall we call it growth period, willing to make even the smallest sacrifice on behalf of the environment. So I just think we are a long way from understanding how to grapple it.

I want to ask you about one actor. Of course, I represent the Nation's Capital. We have here the largest wastewater treatment facility in the world. It handles treatment for Maryland, for the District of Columbia. The Federal Government owns 70 percent of our waterfront.

Indeed, the sewer system, which is infamous for stormwater overflow, was built by the Corps of Engineers more than 100 years ago. And I get a little bit of money each year as they try to move toward one of the systems I think you may even have discussed where they gather this water in big bins and the like.

But if you think about the culprit here, it turns out to be the Federal Government. It built the system. Its facilities and runoff are at least as responsible.

The Anacostia is the most polluted river, and it starts in Maryland. So there are other actors as well, believe me.

But when you talk about large actors, they are the Federal buildings that are characteristic of the Federal presence here and in Maryland.

Oh, this question is posed for the EPA representatives, but I would be please to hear any one of you hear any of comment on it.

I am sure the Federal Government has responsibility around the Nation but nothing like it does in this region.

So how does an enforcement agency, and I heard you say perhaps enforcement is not the only approach, hold such a large and important actor, fill in the blanks—it could be a State actor someplace—accountable for stormwater runoff and energy use reductions with a facility that deeply implicates it?

I should let you know that the entire downtown area of Washington, later on, when they built stormwater facilities for much of the city, you don't have the same system but because this is so old. Essentially, what we are talking about, the overflow, comes from places like where we are sitting now, downtown in the Federal buildings. And, of course, the Federal Government is the ratepayer.

If you have a large actor like that, no matter what you convince your smaller actors including residents to do, you have this big elephant there. How do you integrate it into your strategy?

Don't all speak at once. Yes.

Mr. FAHLUND. I would be happy to respond to that.

There was actually a provision in the last Energy Bill that put requirements on all new Federal facilities to maintain sort of a predevelopment hydrology. So, in other words, to not further contribute to the imperviousness within its footprint.

And, unfortunately, the implementation of that provision has not really moved forward, and we are certainly looking forward to the EPA——

Ms. NORTON. I am sorry. The provision does what?

Mr. FAHLUND. What it does is it requires new Federal facilities to maintain water onsite, maintain stormwater onsite, which of course is really the contributing factor to the combined sewer overflow problems you are describing. It is that stormwater that rushes off of the hard surfaces. And it requires them to maintain that onsite.

And so, that is a provision that really hasn't been——

Ms. NORTON. Onsite? I don't understand how that will work.

Mr. FAHLUND. So, essentially, what it would require would be things like green roofs. It would incentivize and require.

Ms. NORTON. And the Federal Government is looking. We have asked the Federal Government to look at green roofs around the region.

Indeed, they tried the notion of one on the Rayburn Building and said it wouldn't take a green roof, something about the way it was built, it wouldn't. So I guess we are going to have to abide runoff that comes from where we are sitting now.

But go ahead.

It would, of course, work, I am sure, in the newer buildings.

Mr. FAHLUND. I don't believe that this provision affects existing facilities, but it is only for new construction.

Ms. NORTON. Yes, in any case.

Mr. FAHLUND. But I do think that there needs to be a more concerted effort, and perhaps the Office of Water at EPA can help lead an effort in this regard to audit the Federal buildings, not just in D.C. but around the Country to really try to get at their contribution to the problem.

Ms. NORTON. Is there an EPA witness here?

Mr. MCLEAN. I think what you have identified, underlying it, is one of the problems we haven't talked about as directly. We talked about all the technology and all the things you can do to solve these problems. I think the underlying problem is people, organizations, relationships that need to be challenged to get things done.

I am from the Air Office. I cover a lot of issues. In the last three months ago, we entered into an MOU with our Water Office specifically to connect our energy efficiency work with the Water Office's work on water and wastewater. That is why I am here today, because we are trying to bring our understanding of how to promote energy efficiency into the water and wastewater treatment area.

And I deal with climate and other issues, but I don't get into water permitting. I don't even do in the air permitting area.

I do know that the challenges within the Federal Government are significant. To be able to get other agencies within the Federal Government to comply with EPA directives that apply to everyone else is a challenge.

And so, you have raised a fundamental sort of institutional challenge in how to get things done, and I recognize that and will take back that concern. But I think it has to be dealt with.

Ms. NORTON. The stovepiping, of course, and I can understand why. It is very complex, and we are all divided into these various units.

But, of course, I am encouraged by what all of you are saying essentially about the need for energy-efficient and water-efficient technologies as well as management practices to get at the roots of this. It is kind of a truism as far as I am concerned.

If it is obviously the way to go, you don't want to create more problems by adopting one form, although sometimes you don't even know until we have adopted. I don't think people understood anything about ethanol except it was a substitute, for example, for gasoline.

But assuming you do know something, do you find that there are any real or even perceived barriers to going straight forward with technologies that are energy-efficient and water-efficient today?

Are there barriers that you see for moving ahead, real or perceived, on the usage of new management practices and new technologies in order to accomplish these ends?

Mr. MCLEAN. Raising that issue, I think, is important. Several of us have identified some of the management tools, and the part that my office has played in here is to recognize that the people who make decisions at wastewater treatment plants in municipal governments and in industry need to have the information in front of them to make wiser decisions.

We all recognize that there are efficiency improvements, 10 to 20 percent or more. They could go 30, 50 percent. But that information has to be presented to people who make the decisions.

What we have tried to do in our energy efficiency work for the last 15 years is to crack that barrier, that information barrier and bring the information to the decision-makers in these organizations so that they can make the wiser choices, and we think there is a fair amount of efficiencies that can be gotten simply through the right people getting the right information.

So we use our rating tools, and we use our management tools to bring that to people's attention. When that is in front of people, we find that there is a considerable amount of efficiency that people can undertake.

Now it can get more and more expensive as you go up the cost curve, but we think there are relatively cheap things that people can do and that was identified.

The other issue that was mentioned is that there are hundreds of facilities out there. They are all different in some way, and so you can't have a one size fits all solution that says everybody must do this or everybody must do that. But if everybody looks at what they need and they analyze it and they measure it and then they measure the results, we feel that that is the path that we need to get people on to address this issue.

Ms. NORTON. Well, the fact that in your testimony you said there were 100 wastewater facilities conducting these energy audits suggest that they heard about it somehow or the other. Now that is where the Federal Government comes in.

I don't understand how we expect people. I accept that there are very different kinds of systems out here. I just talk about mine. I don't accept that they cannot be classified into various groupings and given guidance from somebody who has all that information, and as far as I am concerned it is the Federal Government.

Say, if you have this kind of facility, here is the latest kind of technology you should be using or moving forward. You have another kind. There can't be so many that the Federal Government couldn't do that at the very least.

Yes, Ms. Hatcher.

Ms. HATCHER. One thing that looks like it may change with the stimulus is the dynamic of the traditional barrier of access to capital, and I think that that is one.

When you think about this in terms of the road to energy efficiency for a wastewater treatment plant, we, through voluntary initiatives, have been trying to encourage market transformation. By that what I mean is we try to educate the wastewater treatment plant managers and the local governments about energy efficiency opportunities through a whole host of means, generally ones that are cost-effective for us to employ from the Federal Government.

We are not out there doing walk-through energy audits in wastewater treatment plants in terms of the way we use EPA funds. What we do is we may have a web cast or a local workshop where people can come and learn about those opportunities. We teach people what the opportunities are, and then it is up to them to go to take the initiative, to then make the changes that are necessary.

In terms of financing barriers, one of the perceived barriers is that often people don't believe they have access to capital. They are not sure whether the SRF process is something that they can then use to do energy efficiency projects. Also, they are not necessarily sure they have it in their capital budgets to the do the energy efficiency improvements that are needed.

And then an additional one is that transferring from the buildings market the successful approach of using energy services companies is something that has been a growing thing in the wastewater industry, the use of energy services companies to help reduce the barrier of access to capital.

One of the things that I think is important to think about as you move forward is the timing of which, in terms of you are trying to increase the rate at which energy efficiency and renewable energy happens in wastewater treatment plants. One thing that these organizations need to be ready and able to do is receive and manage the funds and so forth and understand how to use them in the context of good energy management. And so, in terms of the organizations and one of the barriers they may have is lack of staff.

So one would need to be able to, within that organization, use resources wisely and then choose the opportunities that are the right ones to make energy efficiency improvements and then measure those results effectively in a low cost manner and be able to demonstrate that the resources have been used wisely.

So, in terms of the traditional barriers, the picture would be potentially changing if there was increased capital for these projects.

Ms. NORTON. That is the granddaddy of the wastewater treatment problems.

Yes, Ms. Brown.

Ms. BROWN. I just wanted to say and follow up on what Ms. Hatcher said about education in the wastewater industry and just mention that the Water Environment Federation is just about ready to release a manual of practice on energy efficiency and conservation in wastewater treatment plants. That will go a long way in educating, I think, our sector on what we can do.

And then, with the potential of having capital from the stimulus package, we may be able to make great progress in the next couple of years on this subject.

Ms. NORTON. Yes, Mr. Zelenka.

Mr. ZELENKA. I look at it as a continuum. When the water is being used, so at the end use, low flow plant standards can be federally done. Conservation programs, getting people to use less water, so less of it goes through the treatment plant, and then also stormwater management alternatives like bioswales onsite that take the water and clean it before it goes into the systems, naturally and inexpensively. Green roofs are another example of that.

But then when you get to the plant, then there is energy efficiency and renewables, and what is needed in that regard is targeted programs that get people to have access to audits that give them the information, the calculations and money to pay for those audits, so that the operators who don't, typically. They are worried about meeting their permit requirements. They are not worried about meeting their energy requirements. So, having a program specifically targeted towards energy is really important.

And then access to the capital, as has already been mentioned, and access to tax credits that municipals can't take advantage of are really important.

Ms. NORTON. Well, I don't know. The new administration may be right in having a czar, some kind of environmental czar. I don't know how you are going to get all these pieces together. Otherwise, let's see if that works.

Before I ask if there are other Members who might have further comments, I will give you a primitive example. You might have read in the newspaper that they found lead in children here because of a lead pipe problem that developed here.

And talk about information. The authorities not only did not provide information. The authorities, I think it is fair to say, covered up information. It was an infamous notion.

Of course, then when we uncovered it they assured us that, in any case, there were no issues. Well, now, the CDC has found that there are elevated levels of lead in these children.

But this is a very interesting technology example. Immediately, of course, people began to change their lead pipes.

Now consider this: There is the lead pipe that you are responsible for on your premises. Then there is the part that the jurisdiction is responsible for. So, as if on automatic pilot, the treatment plant began to change their part. Well, what good is that if the whole system isn't changed?

And then of course, there are some faucets that would need to be changed. I mean the children were very young children and those are the people for whom that is a real danger.

However, we also discovered that the water treatment plant was using—now I do not recall the substance and it has been used all over the United States—a substance, a chemical that got rid of the lead and therefore may well be doing the job, had it not been for this problem that was uncovered.

So we are confronted now with, since we don't have any adverse effects so far as we know of from this chemical, whether or not we should be doing lead pipe changes at all, hugely expensive. So that if the jurisdiction decides that is where it is putting its environmental or stormwater overflow dollar, it is not going to be putting it somewhere else.

But, again, if the Federal Government. And for all the good that all of you do where you are, it does seem to me that there has to be a central actor here that sorts out the available issues, warns people, for example, as even this jurisdiction, the heart of the Nation's Capital, wasn't about whether or not you should think twice before simply going about changing the lead pipes at one part and not the other.

You have to make sure you ask the owner, of course, whether or not she is willing to change as well. But I don't see how you can expect to get anywhere on these issues as long as each jurisdiction is trying to figure it out for itself.

There is a vote that is going to be coming up.

My good friend, Mrs. Napolitano, has a question, I understand.

Mrs. NAPOLITANO. Thank you, Madam Chair.

Listening to this is really, really good, and you are right on point in regard to the lead issue.

Is there any centralized information dissemination to general public, to agencies, to wastewater treatments, that they can go and be able to get new technology, as was being pointed out by the Chair, where they may be able to tap into and be able to get that information?

Ms. BROWN. The Water Environment Federation, as I mentioned, has 35,000 members, many of which are operators, utility managers and consulting engineers. We continually update the information that is available.

Mrs. NAPOLITANO. Thank you for that answer. The problem is the general public doesn't know that. The constituency doesn't know that. So when somebody has a problem with lead, they don't know where to go.

And there is an issue of educating the general public in regard to the low-flow toilets, for instance. Or, just not a couple of years ago, in my Water Subcommittee, we granted a pilot to catch rainwater on the school district grounds, on parkland. So there are many things that are out there that people are not aware of that are not being shared.

And I agree with the Chair. There has to be somebody that can really look at all these things and be able to not wrap around totally, but be able to capture, to be able to disseminate, inform and educate the public. That is one.

The second one is one of the things you haven't touched on wastewater is in the ports where boats and commercial ships and tourist ships come in, and they dump their wastewater in our oceans.

Now thanks to EPA in the Western Region with the former director, Mr. Wayne Nastri, they are forcing L.A. ports to be able to have those people recycle that wastewater, and that is a large part of it.

What is there that we are not connecting, again, being able to wrap around some of these issues that are out there that we are not dealing with because the general public doesn't know that these issues exist?

Access to capital, we also suggested in a letter to the Committee that the U.S. Territories and Hawaii be given some capital assistance to be able to work on their wastewater treatment plants which they are, sadly, lacking in.

So I mean those are all great big issues that we don't even consider. We are only looking at our local community issues but not at other issues that also affect our own citizens.

We need to have more information. We need to be able to know where to access.

Anybody that wants to address any of it, please, do so.

Yes, sir.

Mr. FAHLUND. In my testimony, I recommended that the Committee really exercise its oversight authority over EPA and really try in a partnership, but also in a bit of a leading manner, really try to get EPA in a position where it is empowered to actually provide that kind of information, to be a central source, a resource for any number of these issues.

And I think that it is really valuable and important for the EPA to start to actually figure out ways to break down some of the silos that they are in. Those silos are there for lots of reasons, and it is quite understandable. Congress has silos. My organization has silos.

Mrs. NAPOLITANO. One of the issues that I find is we may do very well with the organizations that you represent, but sometimes we don't even get this information and go after enforcement with businesses who are actually big polluters, and we do not actually.

I hear this in my district from some of the Federal marshals, that they cannot go in and—how would I say—not heavy-handed, but enforce the rules and regulations in place now. So that also has to do a little bit of changing of mindset, if you will.

Anybody else? No?

Thank you very much, Madam Chair.

Ms. NORTON. Thank you very much.

I am about to close the hearing.

As I listen to you, it seems to me that a lot of the work is already being done. Maybe the Federal Government should go on your web sites—I don't know what to do—and then to just simply distribute the information from there.

It is very frustrating to know that there are ways to do it. Now when you hear it from the Federal Government, it has a kind imprimatur that I think may be necessary.

I am all for enforcement. Indeed, I think one of the most important things we do for the overall environment is we who insist upon strong enforcement.

But I think your testimony has shown that when we are dealing with the entire planet we need to move thought in advance of enforcement.

Yes, you can get a consent decree and look what that means. That means all at one time somebody has come up with a whole lot of money to deal with a problem that has gone so far that we had to, as it were, send the EPA cops after you and, yes, then you will begin to comply.

When we are all in the same boat when it comes to trying to figure out what to do, it does seem to me that, while keeping enforcement as strong and stronger certainly than it has been, there is a great unknown out there that faces every jurisdiction. It seems to me the Federal Government has to consult with those such as yourselves who have been trying to figure this out so that we can be honest with jurisdictions about what we know and don't know, about what they perhaps may want to be cautious about.

And then perhaps get what I do think we need. We do need experiments in real time. We do need to see how some of these things work.

But, that said, we certainly don't need people going off on something that absolutely does not work such as the lead pipe example where the information was right there, for example.

And I am not sure about the ethanol example, whether it was there or not, but it is certainly there now. I tell you if you try to unwind that, unwind that and get it back, you are going to have a very hard time because people are making a lot of money eating fuel.

I appreciate that the Chair of the Subcommittee has looked to you first as the first. I guess this is the first. This is the first session of our Subcommittee, because I think it argues well for how we are going to approach the very important issues that you have left us with.

And I thank you again on behalf of the Chair and on behalf of the entire Subcommittee.

[Whereupon, at 12:28 p.m., the Subcommittee was adjourned.]

OPENING STATEMENT OF
THE HONORABLE RUSS CARNAHAN (MO-03)
HOUSE TRANSPORTATION & INFRASTRUCTURE COMMITTEE
WWATER RESOURCES AND ENVIRONMENT SUBCOMMITTEE

Hearing on
Sustainable Wastewater Management
February 4, 2009
2167 Rayburn House Office Building

Chairwoman Johnson and Ranking Member Boozman, thank you for holding this hearing on sustainable wastewater infrastructure.

The Metropolitan Sewer District in my home of St. Louis, Missouri has two-hundred-eight locations where combined sewer overflows can occur discharging into the Mississippi River, River des Peres and their tributaries. St. Louis has a hard infrastructure approach to mitigating combined sewer overflows to contain stormwater and sewage until after a wet weather event is over. However, in the spring, when there are particularly heavy periods of rain, the stormwater flow increases causing the combined sewer overflow into area waterways. This overflow may contain impurities that have the potential of adversely impacting the water quality of the Mississippi River and River des Peres. I am very interested to hear from our witnesses how a green infrastructure approach can help reduce the volume of stormwater before entering the sewage and stormwater system and preventing the occurrence of combined sewer overflows.

We must work to reduce the energy consumed in wastewater treatment as just over one percent of all electricity generated in the United States is used for the collection and treatment of wastewater. We must work to make wastewater plants net producers of energy rather than solely consumers. The use of innovative green infrastructure, which can reduce stormwater runoff, sewer overflows, and flooding by protecting, restoring, and mimicking the natural habitat of the area.

In closing, I want to thank our witnesses for joining us today and I look forward to hearing their testimony, especially on steps our wastewater treatment facilities could take to achieve energy independence.

**Statement by Congressman Jerry F. Costello
Committee on Transportation and Infrastructure
Subcommittee on Water Resources
Hearing on Sustainable Wastewater Infrastructure
February 3, 2009**

Thank you, Madame Chairwoman for calling this hearing on sustainable wastewater infrastructure.

Ensuring that our country's water infrastructure is adequate to meet the goal of protecting and improving water quality is among the greatest responsibilities of this Subcommittee. We must continue to invest in our wastewater infrastructure so we can make the necessary improvements and do it in an environmentally friendly way.

In my district and across the state of Illinois, I see the effects of under-investing in wastewater infrastructure at the federal, state, and local level. Without a consistent and firm commitment from the federal government, the needs of our communities will go unanswered.

The federal government is working towards implementing new, greener programs for wastewater infrastructure and I am interested in hearing from our witnesses on the federal government's current policies and other ideas on how to address this issue.

I welcome the witnesses and I look forward to their testimony.

Harry E. Mitchell

Statement of Rep. Harry Mitchell
House Transportation and Infrastructure Committee
Subcommittee on Water Resources and Environment
2/4/09

--Thank you Madam Chairwoman.

--And thank you for holding today's hearing on sustainable wastewater infrastructure. As a former mayor, I am especially aware of how important this issue is.

--Before we hear from our witnesses, I want to quickly reiterate my concern about the funding formula that is currently used to allocate federal assistance to State Clean Water Revolving Funds.

--Due to the continued use of 1970 Census data, the formula continues to deprive Arizona of its fair share of federal funds.

--Since 1970 our state's population has more than tripled. Arizona ranks 37th in receipt of federal funding for SRFs, even though we rank 9th in terms of need. On a per capita basis Arizona is 53rd. We are dead last. Even the territories do better than we do.

--In the 110th Congress, the House passed the Water Quality Financing Act, H.R. 720, which included a provision to begin changing the way SRF funds are distributed from a system based on census data, to a system based on need.

--This was a solid step in the right direction, and I hope we can build upon it in the 111th Congress.

-- I yield back.

Water Environment Federation®
Preserving & Enhancing the Global Water Environment

Energy Efficiency and Energy Independence for Sustainable Wastewater Treatment

TESTIMONY OF

JEANETTE A. BROWN, P.E., BCEE, D.WRE

VICE PRESIDENT, WATER ENVIRONMENT FEDERATION

EXECUTIVE DIRECTOR, STAMFORD (CONNECTICUT) WATER POLLUTION CONTROL AUTHORITY

BEFORE THE

WATER RESOURCES AND ENVIRONMENT SUBCOMMITTEE

COMMITTEE ON TRANSPORTATION AND INFRASTRUCTURE

U.S. HOUSE OF REPRESENTATIVES

FEBRUARY 4, 2009

Water Environment Federation
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Good morning, Madam Chair and Subcommittee Members. My name is Jeanette Brown and I am the Vice President of the Water Environment Federation. I am also the director of one of the largest wastewater utilities in Connecticut, the Stamford Water Pollution Control Authority. I am honored to be here today to discuss the opportunity within the wastewater sector to ensure protection of water quality and public health in a more energy efficient and economical manner through conservation, new technology, and innovation.

The Water Environment Federation (WEF) was founded in 1928 and is a not-for-profit technical and educational organization with more than 35,000 members devoted to the preservation and enhancement of the global water environment. WEF members include scientists, engineers, regulators, academics, plant operators and other professionals working in the United States and around the world. Our goal is a sustainable water infrastructure.

As the Executive Director of the Stamford, Connecticut Water Pollution Control Authority with 30 years experience in wastewater treatment I feel that I am most qualified to speak about the sector. The Stamford Water Pollution Control Authority provides advanced wastewater treatment for a community of 100,000 people. As an engineer, and a water professional, I am a steward of the environment and very proud of the job we do providing an essential community service and protecting the water quality of Long Island Sound. Later I will explain the steps that we are taking in both conservation and innovation, specifically utilizing the oldest waste product known to man as a sustainable and renewable energy source. I am referring to the by-product of the wastewater treatment process, technically referred to as wastewater residuals or biosolids. There are more than 16,000 wastewater treatment plants in the United States. Almost all are publicly owned. In the process of collecting and treating wastewater to protect public health and the environment, these plants use over one percent of all the electricity generated in the United States. Energy costs typically represent over 30% of a utility's operating budget second only to labor. In many communities the water and wastewater utilities are the largest municipal energy consumers.

The water professionals who make up the Water Environment Federation are very concerned about the high use and cost of energy as well as the age of our infrastructure. Protection of our waterways requires that systems be expanded to meet the pressures of growing populations, increased treatment requirements to meet water quality needs and that aging systems be upgraded in a way that enables energy efficiency and the capture of energy from the waste products. As a sector, we are very concerned about the detrimental effect that high energy costs and high capital improvement costs can have on the ability of local communities to maintain or upgrade their water infrastructure. This in turn can have a detrimental effect on our ability to protect public health and the environment. Therefore, we need to act now if we hope to continue to protect our environment and ensure sustainable wastewater treatment through energy efficiency and energy independence.

Sustainability Includes Green Infrastructure, Water Efficiency, and Energy Efficiency and Independence

The Water Environment Federation is supporting this concept of sustainable water infrastructure in a variety of ways including the promotion of green infrastructure. We are also advocating sustainable operation of more conventional infrastructure. This includes advocating energy conservation through effective operational practices and through technological advances, and innovation that allows the utilization of renewable energy sources.

WEF's membership understands that energy conservation and renewable energy initiatives in wastewater treatment plants cannot solve the world's energy crisis, but we know that it will certainly make a difference. We are therefore taking a proactive leadership approach; WEF hosts conferences, publishes papers, and convenes forums on the issue for water professionals. Of particular note, WEF is updating our Manual of Practice on *Energy Conservation in Water and Wastewater Treatment Facilities*, to be released later this year. This manual will cover energy efficiency and tools to measure, assess, and conserve energy. It features new information on cogeneration, energy recovery, energy efficient design, use of renewable fuels, and related climate change issues.

In 1989, WEF founded the Water Environment Research Foundation, (WERF). WERF is engaged in research to optimize wastewater operations for energy, cost, and environmental footprint. Additionally, WERF's climate change program is assessing processes and technologies to cost-effectively mitigate the sector's potential impact. One WERF project, *Improving the Wastewater Plant Environmental Footprint: Options for Your Locality*, will help wastewater treatment plants define their current carbon and ecological footprint as they take steps towards reducing their impact.

As stated earlier, over one percent of all the electricity generated in the United States is used for collecting and treating wastewater. Within wastewater treatment systems, energy is used to run pumps and motors, aeration systems, disinfection processes, solids processing equipment, lighting, computers, and other electrical equipment. It is also consumed in pumping wastewater to treatment plants. To reduce energy use, water conservation has to be our first line of attack: conservation through change of habit, conservation through the introduction of new technology, and innovation to open new doors and new approaches to solving old problems. In order to change old habits; we need to educate people about the value of water. We are very supportive of efforts to educate the public about water conservation measures and water-efficient products. Conservation of water will help conserve other vital resources. Our formula is: **Use Less = Treat Less = Reduced Costs and Energy Required**. In addition money has to be used wisely and put toward research and development of new technology and innovation, and prioritized to bring the most good or biggest bang per dollar.

Water professionals over the past few years have worked hard to reduce power consumption by using high efficiency motors, high efficiency lighting, computer controls which can turn equipment on or off based on process needs, and education. Conservation alone is not enough to reduce the need for fossil fuel generated power, but it has to be our first and most pronounced step in our efforts to decrease our use of fossil fuels.

Necessity is said to be the mother of all invention. The need for new approaches is certainly apparent given present economic conditions and pressures on both limited resources and our natural environment. Innovation is indeed blossoming all around us driven by need. The landscape is changing as technologies and concepts are being developed to allow plants to be energy independent or even net energy producers. **This evolution in thinking moves wastewater treatment plants from being major energy *consumers* to net energy *producers* and represents a paradigm shift in the sector.**

Why is this paradigm shift so important?

There are three major reasons:

1. Cost of Energy and Energy Independence

Recent spikes in energy prices highlight the volatility of global energy markets and their impact on a utility's bottom line. Energy efficiency, with a movement toward energy independence for treatment plants, reduces or eliminates a utility's vulnerability to energy prices and saves communities monies through decreased operating costs. Additionally, it can help mitigate the stress that an increasing population and aging electrical infrastructure are creating on our already strained energy grid.

2. Climate Change

The water sector is keenly aware of the impacts of climate change as the tangible effects of these changes are already being manifested in the water cycle. Prolonged droughts, amplified storm intensity, and increased variability in precipitation patterns are forcing water managers to adapt to a new reality. As a result, the sector is taking steps to reduce its carbon footprint by reducing greenhouse gas emissions associated with the energy required for its operations and by capturing greenhouse gas emitted from the treatment process.

3. Sustainability

Sustainable practices and approaches are becoming integrated into utilities' operating principles and capital improvement plans. Water managers view themselves as environmental stewards charged with protecting and enhancing water resources for the immediate and future generations. Sustainable approaches to water management include having a sound fiscal program where costs are scrutinized and revenues account for the true costs of treating water and capital improvements. Additionally, sustainable approaches achieve environmental goals such as minimizing resource consumption and production of waste products. Energy efficiency plays a role in both of these aspects of sustainability in the water sector. Examples of these sustainable approaches include the use of natural, biological processes to remove pollutants rather than using chemicals and the reuse of biosolids to augment or replace chemical fertilizers.

Besides energy conservation, what else can we do to guarantee sustainability in the water sector?

Here are three examples of innovative processes:

Stamford Biogas Turns Waste into Energy

Wastewater treatment generates solid residual material known as biosolids when it is appropriately treated. This material has a relatively high BTU (british thermal unit) or energy value. In other words, it is a good fuel and it is produced by every community. Typically wastewater residuals are trucked out of a community after processing and used on land as a fertilizer or buried in landfills. In some cases, they are burned at on-site incinerators at the treatment plant. Think about this: A one-pound package of the dried biosolids produced in Stamford Connecticut, or most other treatment plants, has a heating value of almost 9000 BTUs! My utility feels that putting this material on land is a waste of a renewable energy source which can help in a small way to reduce dependence on fossil fuels and significantly reduce our carbon footprint. We are using a gasification process to convert biosolids to a synthetic gas which we call Stamford Biogas (you can read more at www.stamfordbiogas.com). Gasification produces no greenhouse gases and any gases produced by the generation equipment can be returned to the gasifier to remove the carbon dioxide. This biogas can be used as fuel to run internal combustion engines or to fire boilers to produce electricity. The gas produced from this one-pound bag of biosolids can light three 60-watt light bulbs for an entire day. In the United States, just over seven million tons of wastewater residuals or biosolids are generated every year. That's over 14 trillion pounds per year. Just think how many bulbs we can light from this renewable energy source which is currently considered by most of the public as a waste product.

We have built a pilot facility in Stamford where we test biosolids from various treatment plants and develop technology to improve gas production. Not only have we used the Stamford Biogas to generate electricity, but also have used it to run a car. Additionally we have tested our biosolids in full-scale equipment supplying energy to the electrical grid. Once funding is available (and we are hoping for stimulus funding), we plan to construct a 15 megawatt facility. This facility will demonstrate the feasibility of this technology for other plants in the United States.

This truly falls within the definition of our conservation and innovation approach to the future. We have taken a waste product which is costly to dispose and by managing the product on site we conserve energy by elimination transportation, we produce a fuel by an innovative process, and we sustain our responsibility to the environment.

Solar Energy Powers Water and Wastewater in Rifle, Colorado

A different approach to energy efficiency is being practiced in the City of Rifle, Colorado, a city of 10,000 residents in Western Colorado. The City has recently built one of the largest renewable energy solar systems used for a combined (potable water and wastewater) municipal system. Ninety percent of the daytime power used to pump drinking water is provided by a 600 kilowatt solar array. Sixty percent of the daytime power to run Rifle's wastewater reclamation facility is provided by a 1.7 megawatt solar array. These two systems will prevent more than 152 million pounds of carbon dioxide from being emitted using traditional fossil fuel electricity over a 20 year period. More electricity could be generated by solar power but the City has approached the limit of power generation set by the Colorado Public Utilities Commission.

East Bay MUD's R2 Program Generates Electricity and Income

Another local agency that has embarked on an innovative approach to utilizing a resource commonly thought of as waste is the East Bay Municipal Utility District (EBMUD) of Oakland, California. About six years ago, EBMUD initiated what they refer to as their "Resource Recovery" or R2 program. The R2 program uses existing wastewater treatment capacity to treat high-strength industrial or commercial wastes from food processors such as dairies and wineries. By adding these high-strength wastes to anaerobic digesters, EBMUD was able to double biogas production and on-site electricity generation from the biogas. Currently EBMUD's on-site generation meets about 90% of its demand and they aim to exceed 100% in the future so that the wastewater plant becomes a net energy producer. The R2 program yields many benefits including cost-effective waste neutralization and minimization for industry, on-site energy generation to alleviate grid congestion, increased system reliability, less reliance on imported fuel sources, increased revenues, and a reduced carbon footprint.

According to EBMUD staff, there were several drivers for an aggressive Renewable Energy program, including: 1) the opportunity for revenue from taking additional organic wastes trucked to the treatment facility coupled with use (and/or sale back to the electrical utility) of the associated green energy from digesting the waste; 2) the District's mission includes a commitment to "Sustainability," and renewable energy helps reduce fossil fuel usage, thereby reducing greenhouse gas emissions; and 3) increased reliability associated with being 100% energy self-sufficient, particularly in the event of major utility power outages during storms and following any moderate or major earthquakes.

These three examples demonstrate the kinds of innovative thinking being practiced within the wastewater sector. Another model is the performance of the Strass wastewater treatment plant located near Innsbruck, Austria, that is actually producing more energy than is needed to operate the facility. The Strass plant accomplishes this through a two-pronged approach of continually exploring options to improve the plant's overall energy efficiency and optimizing methane production from the solids digestion facilities that process its residual solids. WERF has a project that is studying the Strass plant and developing benchmarks for US facilities.

How the Federal Government Can Help Wastewater Managers Achieve Greater Energy Efficiency -- and Energy Independence

Although our sector is currently witnessing renewed interest in activity related to energy efficiency, we see opportunities for the Federal government to provide leadership and assistance as we move toward an eventual goal of energy independence for wastewater treatment facilities.

Federal leadership will accelerate the progress being made in the areas of research, technology transfer, and education so that more communities benefit from the energy efficiency measures and innovative approaches described earlier.

The Water Environment Federation respectfully offers the following suggestions and recommendations for greater Federal leadership:

Funding: The Federal government helps fund wastewater infrastructure improvements through the Clean Water Act's state revolving fund (SRF) program. The SRF does allow funding to be used for energy efficiency projects and some states have moved in this direction. However, the reality is that priority for SRF funding has historically been given to treatment plant expansions to address additional flows and upgrades to meet increasingly stringent water quality standards. The SRF should be used more aggressively to help wastewater managers reduce their greenhouse gas emissions and operate in a more sustainable manner, where projects meet appropriate requirements. We are pleased that the recent economic stimulus package approved by the House of Representatives directs that up to ten percent of the additional $6 billion for the Clean Water State Revolving Fund will be used for energy efficiency, water efficiency and other green technologies. We encourage the Subcommittee to consider making this priority permanent when you take up SRF reauthorization later this year.

Cross-sector collaboration: Although this Subcommittee does not have jurisdiction over the electric power industry, we urge you to work with the appropriate Committees and Subcommittees in Congress to ensure that any new energy legislation includes provisions that encourage collaboration and cooperation between the energy and water sectors. Such provisions should include incentives or requirements for the electric power industry to support the installation of efficiency measures or renewable energy technologies at wastewater treatment facilities, and for the utilization of any excess electricity that is generated back to the grid. We realize that there are challenges associated with decentralized energy production and that this might run counter to the existing centralized power infrastructure. But as noted earlier, we believe that innovation and creativity are essential if we are going to meet our future energy needs in a sustainable manner.

Education: The paradigm shift I referred to earlier--thinking of wastewater treatment plants as net energy producers--will require education of water professionals, utility operators and managers, the electric power industry, regulators, and the public. We can take the examples I cited earlier, demonstrating energy efficiency and even net energy production and educate other utilities across the country about the possibilities of energy independence. In addition, federal leadership and funding are needed to build on and expand worthwhile existing programs such as Energy Star, and to ensure that these programs reflect the latest in technology and best practices.

Research: The wastewater sector needs research funding to allow the testing of the innovative ideas I just discussed. There are many possibilities for using the products or the processes to generate electricity at treatment facilities. But this takes money. Last May, WEF joined with seven other major water organizations in calling on Congress to establish a comprehensive, coordinated and federally-sponsored applied research program to give water managers predictive and decision-support tools to address the effects of climate change. Research is also needed on mitigation and adaptation strategies, such as those I've discussed related to energy efficiency and sustainability in the wastewater sector, focused specifically on mitigating the impacts of climate change on water quality and quantity.

A Basic Triumvirate Thought Premise to Energy Sustainability

I would like to summarize some key concepts in energy efficiency and energy independence for the wastewater sector:

- **Energy savings through water conservation** -- by changing our habits, old ways, and business as usual. The water sector needs a new mind set, and we as Americans need a new mind set;
- **Energy savings through reduced energy use** – by developing and introducing new technology, high efficiency motors, computer-controlled automation, and the capture of wasted power through hydroelectric generation, wind, and solar;
- **Energy savings through innovation and research** -- such as utilizing by-products for the production of power in a way that doesn't pollute our environment.

In conclusion, we ask the Subcommittee to keep in mind that wastewater is NOT waste! Currently wastewater utilities are big players in *using* energy, but we desire to be big players in *conserving* and even *supplying* energy. Every day, 24 hours a day, seven days a week, the public produces wastewater. Our collective interest in a sustainable planet requires that we turn that waste into useful products. The water should be reused, and the solids should also be reused, and one way to reuse the solids is to create energy. This requires a shared vision, leadership and funding. We at the Water Environment Federation stand ready to work with you on a shared vision for turning "waste into watts" and ensuring energy efficiency and energy independence for sustainable wastewater treatment.

Madam Chair and members of the Subcommittee, thank you for giving me the opportunity to discuss this important topic. We at WEF stand ready to assist you in any way as we work on continuing to improve the energy efficiency and promote energy independence for the water sector.

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Energy Efficiency and Renewable Energy Technologies in Wastewater Management

Testimony for a hearing on "Sustainable Wastewater Management"
Before the
Subcommittee On Water Resources And Environment
House Committee On Transportation And Infrastructure
February 4, 2009

Richard Brown
Research Scientist, Lawrence Berkeley National Laboratory

Madame Chairwoman and Members of this Subcommittee, thank you for inviting me to testify today. My name is Richard Brown, and I am a Research Scientist at Lawrence Berkeley National Laboratory (Berkeley Lab). For nearly twenty years, I have conducted energy efficiency and renewable energy research at Berkeley Lab. My research investigates the potential for energy efficiency technologies to reduce energy use in buildings and industry, as well as opportunities for electricity end-users (such as Federal facilities) to purchase renewable power. The unifying theme of my research is better understanding how energy is used and applying appropriate demand- and supply-side technologies at the point of use, in order to reduce the environmental impact of our energy system. I am honored to be able to share with you my views as a researcher and as a private citizen. This testimony represents my own professional opinion and in no way represents the views or positions of Lawrence Berkeley National Laboratory, the U.S. Environmental Protection Agency, or the U.S. Department of Energy.

I am here today to provide an overview of energy use in the U.S. wastewater sector, and the opportunities for reducing the environmental impact of that energy use through energy efficiency and renewable energy technologies. While the topic of sustainability is necessarily very broad, I will focus my discussion today primarily on the application of these clean energy technologies to the Publicly Owned Treatment Works (POTWs) in the U.S. This summary is based on research I have done for the EPA Energy Star program to help them develop an energy management program for water and wastewater utilities.

Based on this work, I'd like to make the following points:

- The U.S. wastewater sector is very energy intensive, consuming about 1% of national retail electricity sales;
- This energy consumption could be reduced 10% to 30% through the application of proven energy efficiency technologies;
- Use of digester biogas for combined heat and power (CHP), along with other on-site renewable energy technologies, can help wastewater plants approach the goal of net-zero purchased energy use;
- The key to widespread adoption of these technologies is implementation of a comprehensive energy management program by wastewater system operators;
- Finally, over the longer term there is a need and an opportunity to improve the available efficiency and renewable energy technologies for the wastewater sector, and integrate these into a more comprehensive strategy of environmental sustainability.

Overview of Energy Use in the Wastewater Sector

Although many of us take it for granted, one of the hallmarks of modern society is a sanitation system that collects and treats sewage to protect both human health and the environment. The main purpose of wastewater treatment is to remove pollutants and other impurities from wastewater so the water can be safely discharged into the environment or reused for non-potable applications such as irrigation or groundwater recharge. In general, energy consumption in wastewater treatment is a function of the quantity of wastewater treated and the required effluent quality of treated wastewater, as dictated by either discharge requirements or reclamation quality and reuse requirements. The most basic treatment objectives may be categorized as follows: separation and removal of solids, oxidation or 'stabilization' of suspended organic solids, disinfection, and detoxification. Traditionally, the primary goal of municipal wastewater treatment has been the removal of settleable solids and the oxidation of suspended organic waste materials. The latter is a process of adding oxygen to wastewater in order to oxidize and reduce its organic content (also known as "aeration"), making it less reactive and less oxygen-consuming when it is discharged into a receiving surface water or groundwater reservoir.

Wastewater treatment is usually defined by the stage or level of treatment. The quality of the treated effluent is improved with each successive stage of treatment:

- Preliminary: removal of grit, course solids, and debris (e.g., plastic, metal, wood),
- Primary: substantial removal of settleable and floatable solids,
- Secondary: substantial removal of organic material and suspended and dissolved solids,
- Tertiary: nearly complete removal of organic matter and suspended solids, along with substantial removal of nutrients, particularly nitrogen and phosphorus.

Stages of treatment beyond secondary are often referred to collectively as 'advanced' treatment. Each treatment stage can be accomplished through a variety of process types and technologies. The large variation in process types, technologies, equipment, site-specific and regulatory design constraints leads to large variations in plant design and the resulting energy use.

In 2004, approximately 16,600 POTWs operated in the United States. The minimum level of municipal wastewater treatment currently required is secondary treatment, which all but a few treatment plants are designed to provide. In addition, about 5,000 plants go beyond this requirement to provide tertiary treatment. Approximately 75% of the U.S. population is served by POTWs (most of the remainder are served by on-site septic systems). Most POTWs (82%) have small capacities (defined as less than 1 million gallons per day – MGD), but together all of these small systems treat only about 8% of total U.S. wastewater flow. These plants tend to be in rural areas with low population densities. The remaining 18% of all U.S. POTWs handle 92% of the total collected wastewater flow. The largest 41 plants have capacities greater than 100 MGD (US EPA 2008). This testimony mainly focuses on these large treatment systems because that is where most of the energy is consumed. These large systems are characterized by highly-engineered, mechanical treatment systems that can handle large waste flows from urban population centers. Designed primarily with the intent of meeting water quality goals, these systems typically involve energy-intensive processes that are essentially industrial facilities in their scope and complexity.

In aggregate, The Alliance to Save Energy (2002) estimates that U.S. municipal water and wastewater systems consume 75 billion kWh each year, which corresponds to an electricity bill of $3.6 billion. Of this amount, water supply systems consume about 60% and wastewater systems consume about 40% (Burton 1996), or about 30 billion kWh/year for the wastewater sector. This is approximately 1% of U.S. retail electricity sales.

In contrast to drinking water supply systems, where pumping accounts for most of the energy use, wastewater system energy use is dominated by the treatment process itself. Figure 1 shows the division of energy consumption for a typical large municipal wastewater treatment facility. Oxidation is the most energy intensive part of wastewater treatment, accounting for approximately 70% of energy use in municipal secondary-stage wastewater treatment facilities. The most common oxidation process is activated sludge treatment, used in secondary treatment of approximately 70% of the collected municipal wastewater flow in the U.S. (Gibbs and Morris 2005). Sludge conditioning and dewatering processes are also significant energy users in conventional wastewater treatment processes, accounting for approximately 10% of national wastewater sector energy use. Preliminary and primary treatment stages are less energy intensive than conventional secondary treatment, while tertiary treatment can be as energy intensive as secondary treatment, depending on the type and quantity of pollutants being removed and the desired or regulated effluent quality.

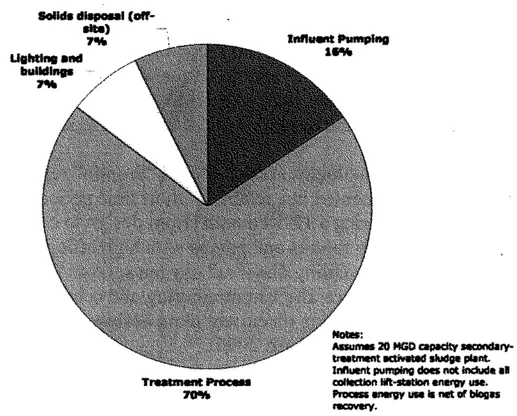

Figure 1: Typical allocation of energy use within a large wastewater treatment plant Source: (Burton 1996), (Owen 1982)

The most common energy uses in wastewater treatment are aeration and pumping. Aeration introduces dissolved oxygen into wastewater to support aerobic oxidation and also for nitrogen removal. Mechanical aeration is also used to promote mixing and to promote the bacterial process of waste oxidation. Pumping is used to move and recirculate water and solids through the sequence of treatment processes. Other common uses of energy during wastewater treatment are mechanical mixing, chemical dosing, media and membrane filtration, dissolved air flotation, sludge handling and disposal, and digester heating.

Over time, the trend in the wastewater sector has been to include more, and more energy-intensive, treatment processes. This has generally been driven by more stringent water quality standards (which increasingly require tertiary treatment for nutrient removal or additional treatment types for removal of toxins). In the future, it is likely that energy use will increase further as a result of new treatment processes that address emerging contaminants (such as endocrine disrupting compounds), and the need to treat wastewater for reuse in order to extend our water supplies.

Energy Efficiency Opportunities in the Wastewater Sector

A variety of technologies exist to reduce energy consumption in the wastewater treatment sector while maintaining or enhancing productivity. These technologies fall into several categories: improved equipment that operates more efficiently compared to standard equipment (i.e., delivers the same service for less energy input), improved controls to ensure that equipment is operated as efficiently as possible and turned down or off when not needed, and improved system designs to minimize losses and ensure that the various components operate well together.

Table 1 lists energy efficiency technologies that are commonly applied in the wastewater sector. These are all mature technologies that are commercially available and widely applied in other industries as well. Due to the wide variation in wastewater treatment plant design and conditions, only a subset of these technologies will be applicable to any given facility, thus it is important for the plant operators and managers to conduct an energy efficiency assessment to determine which technologies are appropriate for their situation.

Many of these technologies address the problem that wastewater treatment systems are designed to meet peak wastewater flows but do not operate energy efficiently for the majority of the time when flows are significantly lower (peak flows usually only occur during certain seasons or times of day). Specifically, variable frequency drives and automated controls allow the many pumps and blowers in a wastewater treatment plant to scale their output—and the energy they consume—to match the requirements of the plant loading conditions.

Many of these technologies are considered "drop-in" replacements for existing equipment and thus can be implemented in a relatively short time period. A common package of measures that can be installed during a 12-18 month (from design to commissioning) plant renovation would consist of: replacing motors and pumps with high efficiency models, installing variable frequency drives, installing dissolved oxygen sensors for the aeration process, and installing a SCADA system for overall plant monitoring and control. Energy savings for such a package of upgrades varies depending on current plant design and conditions, but saving 10-30% of baseline consumption is typical (PG&E 2006).

Table 1: Common energy efficiency technologies applied to the wastewater sector

Energy Efficiency Technology/Strategy	Description	Typical Payback (years)
High Efficiency Motors	Motors with lower internal losses; used for pumps, blowers, mixers, etc.;	variable
Variable Frequency Drives (VFDs)	Electronic controller that matches motor speeds to the required load; avoids running at constant full power	½ to 5
High Efficiency Pumps	Pumps with lower internal friction and head losses	variable
Variable Air Flow Rate Blowers	Variable rate blowers efficiently match air supply to aeration requirements	<3
High Efficiency Blowers	Air blowers with lower internal losses	variable
Dissolved Oxygen Controls	Maintains the dissolved oxygen (DO) level of the aeration tank(s) at a preset control point by varying the air flow rate to the aeration system	2 to 3
SCADA System	Supervisory Control and Data Acquisition system collects facility-wide data and allows control of equipment to more precisely meet required flows	variable
Fine-Bubble Aeration	Fine-pore diffusers generate smaller bubbles for aeration processes; improves oxygen transfer to wastewater	1 to 7
Staging of Treatment Capacity	Treatment systems designed and installed to operate efficiently at multiple "stages" (i.e. across a range of flow conditions)	<2
Recover Excess Heat from Wastewater	Excess heat from wastewater reused in low-temperature heating applications	<2
Efficient Mixing of Aerobic Digesters	Mechanical mixing used rather than aeration where possible; mechanical mixing uses less energy	1 to 3
Efficient sludge handling	Screw presses and gravity belt thickening use less energy for sludge dewatering and thickening	variable
Efficient Ultraviolet (UV) Disinfection Lamps & Controls	High efficiency UV lamps convert more of the power they consume into useful light; controls turn down lights when not needed	variable

Source: Wisconsin Focus on Energy (2006), PG&E (2006)

Renewable Energy Opportunities in the Wastewater Sector

The wastewater sector offers several attractive opportunities for generating energy from renewable resources: combined heat and power using biogas, effluent hydropower, and on-site wind and solar installations.

The solid residuals ("sludge") from primary and secondary treatment are often stabilized in a separate sludge digester – a closed vessel that is often heated and mixed, in which anaerobic bacteria "digest" organic solids resulting in the production of biogas. Biogas so produced consists primarily of methane and carbon dioxide and can be captured and used for power generation, to heat and mix the separate sludge digester, or for some other energy end use. The use of waste heat from power generation is known as combined heat and power (CHP) or cogeneration. The EPA CHP Partnership has analyzed the potential for CHP in the wastewater sector and found that it is a good technical fit for wastewater treatment facilities and there is significant potential for power generation. Their study found that if all 544 POTWs in the United States that operate anaerobic digesters and have influent flow rates greater than 5 MGD were to install CHP, approximately 340 MW of clean electricity could be generated (US EPA 2007).

Another renewable energy option is effluent hydropower. Wastewater treatment plants with a large elevation drop to their effluent outfall can place an in-conduit hydro-generator in the outfall pipe to generate power. This is not commonly done, but has been implemented at a few plants, such as San Diego's Point Loma treatment plant, which has a 90-foot drop from the plant to the ocean outfall.

Finally, because POTWs often have significant land area (in many cases the largest parcel owned by the municipality) and are not located close to other developments, the wastewater treatment plant may be a very good host site for on-site solar or wind generation systems. Many water utilities in California have installed photovoltaic arrays on large, flat structures they own such as reservoir covers. Wastewater plants have similar opportunities. Figure 2 shows the Atlantic City, NJ treatment plant with both wind and solar generation on-site. These renewable resources serve essentially 100% of the facility's electrical load.

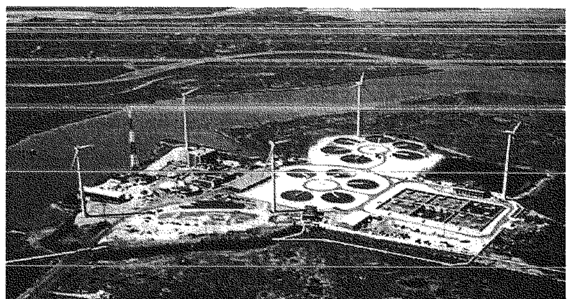

Figure 2: Atlantic County (NJ) Utilities Authority wastewater treatment plant with 7.5 MW wind system and 500 kW solar array

Energy Management Programs

Despite the potential for the energy efficiency and renewable energy improvements described above, they still have not been widely adopted in the wastewater industry. This is due to several barriers that prevent wastewater managers from adopting new technologies, including: a singular focus on meeting discharge permits, lack of knowledge about energy use and bills (often the wastewater plant operator never sees the energy bills), and a perception that energy costs are uncontrollable, fixed costs. The solution to many of these barriers is an energy management program to help improve the energy performance of the wastewater system on an ongoing basis. Changing how energy is managed by implementing an organization-wide energy management program is key to successfully reducing energy use and implementing renewable energy projects.

A strong energy management program creates a foundation for positive change and provides guidance for managing energy throughout an organization. Energy management programs also help to ensure that energy efficiency improvements do not just happen on a one-time basis, but rather are continuously identified and implemented in an ongoing process of continuous improvement. Furthermore, without the backing of a sound energy management program, energy efficiency improvements might not reach their full potential due to lack of a systems perspective and/or proper maintenance and follow-up. Most importantly, energy management programs are most effective as part of an overall process of managing quality within the wastewater utility, and can lead to improvements in non-energy factors such as better permit compliance, odor control, etc.

The major elements in a strategic energy management program, as defined by the Energy Star program, are depicted in Figure 3. The U.S. EPA Office of Wastewater Management has also published a very good guide to implementing an energy management program in water and wastewater utilities.

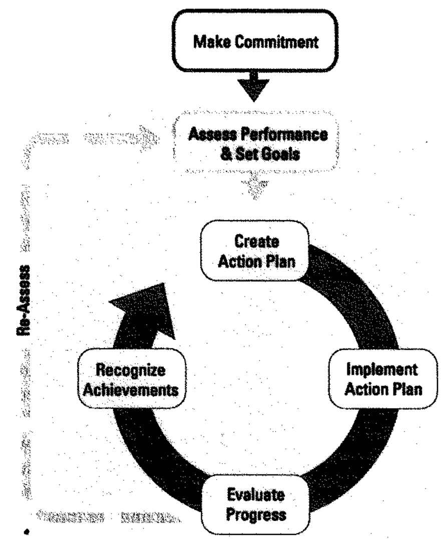

Figure 3: Steps in a strategic energy management program

Source: US EPA (2005)

A successful program in energy management begins with a strong organizational commitment to continuous improvement of energy efficiency. This involves assigning oversight and management duties to an energy director, establishing an energy policy, and creating a cross-functional energy team. Steps and procedures are then put in place to assess performance through regular reviews of energy data, technical assessments, and benchmarking. The Energy Star program has developed an energy benchmarking tool for POTWs that is very useful in this step of the process. From this assessment, an organization is able to develop a baseline of energy use and set goals for improvement. Performance goals help to shape the development and implementation of an action plan.

Progress evaluation involves the regular review of both energy use data and the activities carried out as part of the action plan. Information gathered during the formal review process helps in setting new performance goals and action plans and in revealing best practices. Once best practices are established, the goal of the cross-functional energy team should be to replicate these practices throughout the organization. Establishing a strong communications program and seeking recognition for accomplishments are also critical steps. Strong communication and receiving recognition help to build support and momentum for future activities.

An energy management program should also coordinate with the local electric utility for assistance with energy benchmarking and assessments as well financial incentives for efficiency and renewable investments. More and more electric utilities are offering efficiency programs targeted at industrial facilities, including water and wastewater utilities.

A very good example of an effective energy management program is the East Bay Municipal Utility District, located in Oakland, CA. Over the course of five years, their energy management team pursued a long-term plan of implementing energy efficiency improvements in their wastewater treatment plant, which reduced the plant's energy consumption by 20%. They also increased the production of biogas from the plant's digesters in order to increase the production of electricity from their on-site CHP plant. By the end of the five-year period, the on-site CHP generation was meeting 80% of the treatment plant's energy needs (Cohn et al. 2005).

Broader Sustainability Opportunities in the Wastewater Sector

Ultimately, initiatives taken to improve the energy efficiency of wastewater treatment need to be made in the context of improving the overall environmental sustainability of this sector. To achieve sustainability, systems need to be designed to treat wastewater as a resource (of both water and nutrients), not a waste. Eventually, WW treatment systems need to be more integral to local ecosystems, functioning as part of the local water and nutrient cycles rather than once-through industrial systems. For example, a more sustainable system might treat wastewater in a more distributed way so that treatment can be performed by natural systems. These natural systems tend to use more land area and are thus not well suited to centralized wastewater treatment. A more sustainable system might also involve graywater treatment and beneficial reuse of water on-site. Reducing drinking water use, and the resulting generation of wastewater, also needs to be a component of a more sustainable wastewater management system.

There are many opportunities to improve sustainability, but more research needs to be conducted to make these approaches practical for implementation by water and wastewater utilities. Several states (most notably California, but also New York and Wisconsin) are conducting research on issues related to this topic, including quantifying energy savings in the drinking water and wastewater systems due to avoided water use, the energy requirements for water reuse, and new protocols for energy management in the water and wastewater sector. Additional research is needed, however, and the Federal government can serve a useful role in funding research and integrating the findings into a national program.

Conclusion

Madame Chairwoman and members of the Subcommittee, to conclude I want to re-emphasize that I am not here to advocate for any particular policy outcome from this Committee. Instead, I hope that the information that I have presented today will be helpful as you consider how the Federal government can play a role in improving the sustainability of our wastewater management system.

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Brief Biography – Richard Brown

Richard Brown is a research scientist in the Environmental Energy Technologies Division at Lawrence Berkeley National Laboratory. His research analyzes energy use in buildings and industry, customer adoption of renewable energy systems, and the connection between energy and water use. His current research interests include technical support to the ENERGY STAR program, developing a home energy audit web site (the Home Energy Saver), developing solutions to address the growing energy use of electronics and miscellaneous equipment in buildings, and analyzing the energy use of drinking water and wastewater treatment systems. He was the lead author for the federal government's guidebook to purchasing green power for business and institutional customers. Before joining the LBNL staff, he spent four years in the Air Force analyzing the cost and performance of satellite systems. He holds an M.A. degree from the Energy and Resources Group at the University of California at Berkeley, and a B.S.E. in Engineering and Management Systems from Princeton University.

Testimony before the
Committee on Transportation and Infrastructure
Subcommittee on Water Resources and Environment
U.S. House of Representatives
on

Sustainable Wastewater Management

February 4, 2009

by

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Introduction

Good morning, Chairwoman Johnson, Ranking Member Boozman, and members of the Subcommittee. My name is Andrew Fahlund and I am Vice President for Conservation for American Rivers. American Rivers is the preeminent national advocate for healthy rivers and the communities that depend upon them. We believe that rivers and clean water are vital to our nation's health, safety, and quality of life, and on behalf of American Rivers' 65,000 members and supporters, I thank you for holding this hearing, *Sustainable Wastewater Management,* and for the opportunity to testify.

American Rivers applauds the Committee for spotlighting the need for a sustainable approach to protecting and restoring our water and water infrastructure. This moment in time offers a unique opportunity for Congress to put forth a new vision for sustainable water management. The public has recently come to understand that we must transform our approach to energy by embracing efficiency and renewable technologies that rely upon nature to fuel our economy in the 21st century. We need a similarly transformative model for water infrastructure. To protect our rivers and our communities, we must adopt and apply a definition of infrastructure that integrates our built and natural assets, using "green" infrastructure as an effective way to reduce polluted stormwater runoff and sewer overflows while making our communities more resilient to a changing climate.

We urge the Committee, and Congress as a whole, to adopt policies and funding that promote and require green infrastructure solutions. Green infrastructure solutions are by their nature flexible and cost-effective and will work best and most effectively in a world dominated by climate change and new economic challenges. This testimony will address the following topics:

I. A vision for 21st century water infrastructure;
II. What is "Green infrastructure";
III. Multiple benefits of green infrastructure;
IV. Green infrastructure recommendations.

I. A Vision for 21st Century Water Infrastructure

A new vision for sustainable water infrastructure is one that integrates traditional and green infrastructure in a way that works with nature instead of against it. Green infrastructure works by protecting and restoring streamside buffer zones and wetlands to reduce pollution, by treating stormwater runoff on-site instead of causing sewer overflows and downstream pollution, and by reducing potable outdoor water use to reduce energy use and polluted runoff. Green infrastructure approaches are cost-effective and focus both on protecting existing natural features as well as restoring and integrating natural functions at the site, neighborhood, and watershed scale. Healthy floodplains, small streams and wetlands, and streamside buffer zones are key parts of our water infrastructure and should be considered our first line of defense against floods, droughts and pollution, while in developing areas we must integrate techniques such as green roofs and rain gardens to reduce, reuse and clean our water.

Background

As the Committee is well aware, clean water is at the heart of our communities and we cannot take it for granted. It is our most precious natural resource, essential to the health and well-being of our communities, economy and ecosystems. Since 1972, the Clean Water Act (CWA) has greatly reduced the discharge of raw sewage, chemicals, and other pollutants to our water bodies, and the number of water bodies meeting water quality standards has doubled over that time. Yet in recent years water quality has deteriorated, and year after year, many rivers and streams continue to be too polluted for fishing, swimming, or for other purposes.[1] In 2006, EPA found that only 28% of the nation's stream miles were in good condition.[2] Water and wastewater systems now receive a D-, the lowest grade given by the American Society of Civil Engineers in their evaluation of

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[1] *See e.g.* U.S. EPA, *National Water Quality Inventory: Report to Congress, 2004 Reporting Cycle* (Jan. 2009) http://www.epa.gov/owow/305b/2004report/ reporting that 44% of stream and river miles assessed by states are impaired and do not meet their designated uses.

[2] U.S. EPA, *Wadeable Streams Assessment: A Collaborative Survey of the Nation's Streams*, EPA 841-B-06-002, Dec. 2006 http://www.epa.gov/owow/streamsurvey/.

our nation's entire infrastructure.[3] Aging sewers and treatment plants, growing population, and sprawling development patterns strain our existing clean water systems; and without increased investment and improvement in sustainable infrastructure, the level of sewage pollution in the nation's waterways is predicted to increase to pre-1970 levels by 2025 – the highest ever recorded.[4]

At the same time we continue to lose crucial elements of our natural clean water system such as headwaters streams, wetlands, forests, riparian lands, and natural floodplains from causes including development and reduced protection under the CWA. In a study on the significance of riparian, streamside lands, the National Research Council found that, "loss of natural riparian vegetation is as much as 95 percent, indicating that riparian areas are some of the most severely altered landscapes in the country."[5] In the Chesapeake Bay Watershed, a population increase of eight percent over a ten year period from 1990 to 2000 corresponded with an increase of 40 percent in paved and other impervious surfaces over the same period, destroying the capacity of our natural infrastructure to provide clean water.[6]

Small streams and wetlands comprise over 60% of our stream miles and are critical to providing clean and safe water to downstream communities.[7] More than 7,400 public drinking water supply intakes providing drinking water to over 110 million Americans are located in source water protection areas that contain headwater, intermittent, or ephemeral streams.[8] Yet, protection for these streams is weakening as hundreds of CWA

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[3] American Society of Civil Engineers, Report Card on America's Infrastructure, 2009, accessed online Jan 28, 2009, http://www.asce.org/reportcard/2009/index.html
[4] U.S. EPA, *Progress in Water Quality: An Evaluation of the National Investment in Municipal Wastewater Treatment* (June 2000). http://www.epa.gov/owm/wquality/benefits.htm
[5] National Research Council, *Riparian Areas: Functions and Strategies for Management*, National Academy Press (March 2002). This same study pointed out the tremendous value and importance of these areas in filtering pollutants, lowering water temperatures, maintaining river flows, and providing wildlife habitat.
[6] U.S. EPA, Evaluation Report no. 2007-P-00031: *Development Growth Outpacing Progress in Watershed Efforts to Restore the Chesapeake Bay* (September 2007)
[7] See Judy L. Meyer et al. *Where Rivers Are Born, The Scientific Imperative for Defending Small Streams and Wetlands*, American Rivers and Sierra Club (2007) http://www.americanrivers.org/site/DocServer/WhereRiversAreBorn1.pdf?docID=182.
[8] *Id.* and EPA Assistant Administrator Benjamin H. Grumbles letter to Association of State Wetland Managers (2005), http://www.aswm.org/fwp/letterbg.pdf

enforcement cases have either been dropped completely or lowered in priority due to legal uncertainty.[9] Protecting existing natural infrastructure also reduces the burden on existing hard infrastructure, and should be the first tenet for protecting clean water. The effectiveness of this proactive approach to protecting our natural infrastructure is illustrated by New York City's $600 million investment in Catskills land protection and restoration, which saved $6 billion in capital costs to construct a water filtration plant as well as $200-300 million in annual operation and maintenance costs.[10]

Finally, our most sophisticated climate models predict more frequent and severe droughts and more frequent and intense floods, often in the same place. Both of these extremes will serve to further stress clean water.[11] More extreme rainfall will result in more sewer overflows in some regions,[12] while increased runoff will increase pollutant loads to streams and rivers and algal blooms will become more common in areas with warmer water.[13] Periodic droughts will result in lower streamflows reducing the ability of water bodies to adequately assimilate pollutants and meet water quality standards. Both extremes of global warming will likely increase the frequency of waterborne disease outbreaks.[14]

While it is generally accepted among scientists that under climate change most places will experience more frequent and intense storms and droughts, the closer one applies those models to local conditions, the greater the uncertainty about what to expect. This

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[9] U.S. EPA, Memo from Office of Compliance and Enforcement (Feb 2008) http://oversight.house.gov/documents/20081216113901.pdf.

[10] "Ecosystem Services: A Primer." The Ecological Society of America. August 2000. http://www.actionbioscience.org/environment/esa.html.

[11] Kundzewicz, Z.W et al. "Freshwater Resources and Their Management." Climate Change 2007: Impacts, Adaptation and Vulnerability. Contribution of Working Group II to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change, M.L. Parry et al. Eds., Cambridge: Cambridge University Press, 2007. 173-210.

[12] See e.g. U.S. EPA, *A Screening Assessment of the Potential Impacts of Climate Change on Combined Sewer Overflow (CSO) Mitigation in the Great Lakes and New England Regions*, DRAFT Report, EPA/600/R-07/033A (2006).

[13] Bates, Bryson et al. "Technical Paper on Climate Change and Water." Geneva: Intergovernmental Panel on Climate Change, 2008, p. 53-4.

[14] Kari Lydersen, *Risk of Disease Rises With Water Temperatures*, Washington Post, Oct. 20, 2008, http://www.washingtonpost.com/wp-dyn/content/story/2008/10/19/ST2008101901645.html and Curriero, et al. 2001. *The Association Between Extreme Precipitation and Waterborne Disease Outbreaks in the United States, 1948–1994.*Vol. 91, No. 8, J. Am. Pub. Health Assoc. 1194-1199.

leads to two important and related conclusions about future investment in water infrastructure. First, we should implement the most flexible solutions that will be beneficial whether it is wetter, drier, or stays the same. Second, on the other side of the coin, this need for flexibility argues against significant investment in static, capital-intensive, single purpose investments.[15]

Looking forward

Given this context, we need a new agenda for water in this country that does not rely upon the outmoded approaches of the past two centuries. Because climate change is changing traditional precipitation patterns, the notion that water systems can be designed and managed for a relatively stable range of conditions is no longer true.[16] The Midwest's second "500-year" flood in twenty years is a case in point.

As described below, green infrastructure approaches are just the sort of flexible "no regrets" solutions that provide multiple benefits and work under a wide range of climatic conditions. A green roof will reduce stormwater runoff when it's wet and reduce building temperatures and energy costs when it's hot. Similarly, water efficiency reduces water and energy use and is thousands of times cheaper per gallon than building water supply dams.[17] We can no longer afford to invest in large, single objective infrastructure nor consider our "hard" or built infrastructure separately from our natural or green infrastructure nor do we have to.[18]

[15] Milly, et al., *Stationarity is Dead: Whither Water Management*, Science, Feb. 1, 2008: Vol. 319. no. 5863, pp. 573–574.
[16] *Id.*
[17] American Rivers, *Hidden Reservoir: Why Water Efficiency is the Best Solution for the Southeast*, October, 2008
[18] In their most recent Report Card, the American Society for Civil Engineers writes: "Sustainability and resiliency must be an integral part of improving the nation's infrastructure. Today's transportation systems, water treatment systems, and flood control systems must be able to withstand both current and future challenges. Both structural and non-structural methods must be applied to meet challenges." American Society of Civil Engineers, *Report Card on America's Infrastructure, 2009*, accessed online Jan 28, 2009, http://www.asce.org/reportcard/2009/index.html.

We need not eliminate engineered systems, such as pipes and treatment plants altogether – nor should we. They are important elements of our clean water system, and many are in desperate need of repair or replacement. But relying solely on fixed engineering solutions will not solve our future needs. Instead, we should optimize the mix of green infrastructure as a cost-effective "first line of defense" to enhance the effectiveness and extend the lifespan of state-of-the-art engineered technologies.

II. What is Green Infrastructure

As a working concept, green infrastructure can broadly be defined as an approach to water management that reduces stormwater runoff, sewer overflows, and flooding by protecting, restoring, or mimicking the natural hydrology of an area. This is often accomplished through the use of plants and soils or engineered solutions that recreate natural processes.[19] In other words: planting trees and restoring wetlands, rather than building costly new water treatment plants; replacing parking lots and driveways with permeable pavement to reduce wastewater treatment demand; increasing water efficiency instead of building new water supply dams; and restoring floodplains instead of building taller levees.[20]

Green infrastructure solutions can be applied on different scales, from the house or neighborhood level, to the broader landscape level. On the local level, green infrastructure practices include rain gardens, permeable pavements, green roofs, infiltration planters, trees and tree boxes, and rainwater harvesting systems that maximize the opportunities for stormwater to infiltrate into the ground or transpire back into the atmosphere. At the largest scale, the preservation and restoration of natural landscapes (such as forests, floodplains, streams and wetlands) are critical components of green infrastructure.

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[19] Gary Belan & Katherine Baer, *Green Communities for Clean Water*, River Network, River Voices 18:1 (2008).
[20] See generally, American Rivers, *Greening Water Infrastructure* http://www.americanrivers.org/site/PageServer?pagename=AR7_GreenInfrastructure_Background.

On the municipal scale, where the primary goal is to reduce polluted stormwater runoff and sewer overflows, the characterization provided by the EPA is useful:

> "When used as components of a stormwater management system, Green Infrastructure practices such as green roofs, porous pavement, rain gardens, and vegetated swales can produce a variety of environmental benefits. In addition to effectively retaining and infiltrating rainfall, these technologies can simultaneously help filter air pollutants, reduce energy demands, mitigate urban heat islands, and sequester carbon while also providing communities with aesthetic and natural resource benefits."[21]

Already, green infrastructure is being used successfully by a number of cities around the country.[22] Chicago, Portland, Seattle, Milwaukee, Philadelphia, San Francisco and others are recognized as leaders in this area. Interest continues to grow as communities recognize the multiple benefits of using cost-effective techniques such as rain gardens, green roofs, and permeable pavement to manage stormwater on-site, reducing the need for expensive, hard infrastructure projects and stretching scarce dollars further. Just recently, the City of Indianapolis announced that by using wetlands, trees, and downspout disconnection to reduce stormwater flows into their combined sewer system, the City will be able to reduce the diameter of the planned new sewer pipe from 33' to 26', saving over $300 million and also beautifying the city.[23]

Chicago is one example of a city that has emerged as a leader in using an integrated approach to incorporate green infrastructure into planning and retrofits for clean water, cooler temperatures, and more attractive neighborhoods.[24] The city has promoted a wide range of techniques including green roofs, urban forestry, rain gardens, and downspout disconnection. Prompted by the need to reduce combined sewer overflows and Mayor Daley's personal commitment to a greener city, the City has modeled techniques such as the green roof on City Hall as well as subsidies for certain materials and an expedited

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[21] U.S. EPA, *Managing Wet Weather with Green Infrastructure, Glossary of Terms* http://cfpub.epa.gov/npdes/greeninfrastructure/information.cfm#glossary.

[22] See generally, NRDC, *From Rooftops to Rivers: Green Strategies for Controlling Stormwater and Sewer Overflows* (2006) and Water Environment Research Foundation, *Using Rainwater to Grow Livable Communities* (2008) http://www.werf.org/livablecommunities/.

[23] *Sewer Overhaul Mean More Green*, Indystar.com Oct. 14, 2008, http://www.indystar.com/apps/pbcs.dll/article?AID=/20081014/LOCAL18/810140384.

[24] See NRDC, *From Rooftops to Rivers* and City of Chicago, *Chicago Green Roofs* http://www.artic.edu/webspaces/greeninitiatives/greenroofs/main.htm.

green permitting program. One city program provided rain barrels to 400 families at a subsidized cost of $15 each, which are projected to divert 760,000 gallons of runoff from the combined sewer system, reduce localized sewage backups into basements, and cut down on water demand for landscape irrigation. Under the Green Alleys program, Chicago is retrofitting its 2,000 miles of alleyways with permeable pavement to reduce polluted runoff.

Smaller cities and communities are also applying these techniques for clean water at lower costs. In Washington County, Arkansas, the University of Arkansas is designing and implementing a Habitat for Humanity neighborhood using low impact development techniques and forgoing curbs and gutters to minimize flooding by using natural areas to absorb stormwater.[25] By combining measures to slow traffic with stormwater controls, the project is cutting infrastructure costs by half. In Burnsville, Minnesota, a program to replace existing development and impervious surfaces with rain gardens successfully reduced stormwater runoff in an older neighborhood that lacked the space for more conventional and larger stormwater detention ponds.[26] In comparison to the control neighborhood, the raingardens reduced runoff by 90 percent.

In Clayton County, Georgia a constructed wetland system that receives treated wastewater and recharges reservoirs had a consistent supply of water throughout the drought. While surrounding communities had severe water use restrictions and saw reservoirs drop below 50% capacity, Clayton County never dipped below 77% of reservoir capacity.[27] Additionally, the constructed wetland system has saved roughly

[25] University of Arkansas School of Architecture, *'Green' Habitat Neighborhood Wins National Award*, http://architecture.uark.edu/443.php (last accessed Jan. 28, 2009).
[26] Water Environment Research Foundation, Retrofitting a Suburban Neighborhood with Raingardens http://www.werf.org/livablecommunities/studies_burns_mn.htm (July 2008).
[27] Saporta, M. August 24, 2008. Praise flows freely for Clayton County's water system. Atlanta Journal-Constitution; Associated Press. October 19, 2007. No backup plan in place for drought-stricken Atlanta. Fox News.

$50,000 in annual electricity costs from reduced treatment needs[28] and has eliminated the need for 300 miles of pipes and 20,000 sprinklers.[29]

This surge in interest from cities, towns and counties across America has been enhanced by the EPA's Green Infrastructure Initiative, which has broad support from industry, local government, and conservation groups.[30] Formal recognition by EPA of the validity of using green infrastructure techniques to meet regulatory requirements for combined sewer overflows (CSOs) and stormwater under the Clean Water Act further illustrates the value of these approaches.[31]

III. Multiple Benefits of Green Infrastructure

Green infrastructure should be at the forefront of our infrastructure solutions, in part because of the multiple benefits it provides for communities.

Improving water quality – As mentioned above, many communities use a variety of green infrastructure techniques to reduce stormwater and sewer overflows.[32] Portland, Oregon's natural stormwater management program demonstrates the effectiveness of green infrastructure for controlling stormwater runoff. Portland's program to disconnect downspouts from roofs to prevent them from pouring directly into storm drains keeps more than 1.2 billion gallons of stormwater out of the sewer system every year.[33] Green Street projects, which reduce impervious surfaces and increase tree planting, have been

[28] Clingan, C. June 2, 2008. Green infrastructure highlights American Wetlands Month. National Association of Counties, County News. Washington, D.C.

[29] Clayton County Water Authority. 2005. 50 years of insight: the story of Clayton County Water Authority (1955-2005). Morrow, GA.

[30] U.S. EPA, *Green Infrastructure Partnership* http://cfpub.epa.gov/npdes/greeninfrastructure/gisupport.cfm. Partners include the Association of Interstate Water Pollution Control Administrators, the American Public Works Association, the National Association of Clean Water Agencies, and the National Association of Environmental Local Government Professionals.

[31] U.S. EPA, *Use of Green Infrastructure in NPDES Permits and Enforcement*, EPA Memo to Regional Water Division Directors State NPDES Coordinators, Aug. 2007. http://www.epa.gov/npdes/pubs/gi_memo_enforce.pdf.

[32] U.S. EPA, Green Infrastructure Types, Applications and Design Approaches to Manage Wet Weather http://cfpub.epa.gov/npdes/greeninfrastructure/technology.cfm (last updated Jan 6, 2009).

[33] Portland Bureau of Environmental Services, Downspout Disconnection Program Brochure, http://www.portlandonline.com/bes/index.cfm?c=43081 (accessed November 11, 2008).

shown to retain up to 94% of rainfall and to reduce pollutants by 90%.[34] Citywide, Green Street projects currently retain and infiltrate 36.9 million gallons of stormwater per year and have the potential to manage 7.9 billion gallons, or 80% of Portland's runoff annually.[35] Green roofs in Portland have shown similarly impressive results, reducing peak storm flows 81-100% and retaining an average of 60% of total runoff.[36]

Milwaukee, Wisconsin is another city that is proactively using green infrastructure to complement hard infrastructure to reduce stormwater and combined sewer overflows. The city has installed rain gardens and helped install or fund green roof installation and actively promotes downspout disconnection for homeowners as well as purchasing and protecting land in the watershed.[37] Modeling by Milwaukee showed that a combination of these techniques would reduce combined sewer overflow volumes by 14% to 38% in each neighborhood.[38]

Green jobs and the economy – Green solutions create good jobs in many sectors, including plumbing, landscaping, engineering, building, and design. Green infrastructure also supports supply chains and the jobs connected with manufacturing of materials including roof membranes, rainwater harvesting systems, and permeable pavement. Covering even one percent of large buildings in medium to large sized cities in the U.S would create over 190,000 jobs while a $10 billion investment in water efficiency would create 150,000-220,000 jobs.[39]

[34] Portland Bureau of Environmental Services, Stormwater Management Facility Monitoring Report (2006).
[35] Portland Bureau of Environmental Services, About Green Streets Video. http://www.portlandonline.com/BES/index.cfm?c=47429& (accessed December 9, 2008).
[36] Portland Bureau of Environmental Services, Ecoroof Incentive Program, http://www.portlandonline.com/bes/index.cfm?c=48724 (accessed December 3, 2008).
[37] NRDC, *From Rooftops to Rivers* (2006) at 20-22.
[38] *Id.*
[39] Will Hewes, *Creating Jobs and Stimulating the Economy Through Investing in Green Infrastructure*, American Rivers and the Alliance for Water Efficiency (2008) and see, Alliance for Water Efficiency, *Transforming Water: Water Efficiency as Economic Stimulus and Long-Term Investment*, Position Paper (Dec. 2008) available at: http://www.allianceforwaterefficiency.org/AWE_Advises_Obama_Transition_Team.aspx.

Cost savings – The current economic crisis emphasizes the importance of investing in cost effective solutions and avoiding infrastructure investments such as "sewer lines to nowhere" that only serve to compound existing problems by fueling sprawl and causing more water pollution. Several studies have concluded that green infrastructure and conservation approaches to development and stormwater management are environmentally beneficial and more cost effective for communities and developers than conventional stormwater control systems. Those approaches are cost effective in two ways: by providing ecosystem services, such as pollutant removal, groundwater recharge, increased air quality, and flood management, and by reducing costs for construction materials, operations and maintenance, or hard infrastructure.[40] For instance, the California Department of Transportation found that comprehensive use of green infrastructure and low impact development to control stormwater would cost $2.8 – 7.4 billion compared to $44 billion for conventional controls.[41] A New York study showed that green streets, street trees, and rain barrels managed stormwater three to six times more effectively than conventional storage tanks per $1000 invested.[42]

Costs for reducing sewer overflows can also be lowered using these methods – the City of Portland spent $8 million to subsidize downspout disconnections for homeowners keeping one billion gallons of water from entering the city's combined sewer system thus saving $250 million in hard infrastructure fixes that otherwise would have been necessary to reduce sewer overflows.[43] Similarly, downspout disconnections near Flint, Michigan cost approximately $15,000 but provided over $8,000 in savings a month from reduced costs associated with stormwater facility fees and managing combined sewer overflows.[44] Developers using green infrastructure also benefit economically as replacing hard

[40] See Ed MacMullan and Sarah Reich, *The Economics of Low Impact Development: A Literature Review*, ECONorthwest (Nov 2007) http://www.econw.com/reports/ECONorthwest_Low-Impact-Development-Economics-Literature-Review.pdf.
[41] *Id.* at 21.
[42] *Id.* at 17.
[43] Alexandra Dapolito Dunn and Nancy Stoner, *Green Light for Green Infrastructure*, Environmental Law Institute, Environmental Forum (May/June 2007).
[44] MacMullan and Reich at 16.

infrastructure including curbs, gutters, and stormwater pipes with low impact development techniques can reduce construction costs and increase lot value.[45]

Green infrastructure can also be used to cost effectively reduce localized flooding. In the Towar Garden community in Meridian Township, Michigan, flooding was a recurring problem during even small rain events. Residents regularly experienced drainage problems, basement flooding and sanitary sewer backups.[46] The Drain Commissioner chose to retrofit the neighborhood drainage system with almost six acres of rain gardens to filter and absorb most of the flood water. Construction costs were half of the traditional, structural alternative due to reduced pipe size, excavation and other factors, which more than offset the higher maintenance costs associated with the project.

Water efficiency provides perhaps the best illustration of cost effective alternatives to conventional infrastructure. If the Atlanta metro area undertook a set of common water efficiency practices and policies, it could save as much as one-third of its current water use, twice the amount of water provided by four proposed dams, saving $700 million.[47] Public savings for all of these examples, in turn, can be used to meet other municipal needs.

Other environmental benefits – Green infrastructure can increase ground water recharge, critical in times of drought. It can also minimize localized flooding and soil erosion that can threaten downstream properties and severely damage wildlife habitat and ecological health.[48] More broadly, green infrastructure has been found to improve air quality in

[45] *Id.* at 24-29, and see U.S. EPA, *Reducing Development Costs through Low Impact Development Strategies and Practices*, EPA 841-F-07-006 (Dec. 2007) http://www.epa.gov/owow/nps/lid/costs07/documents/reducingstormwatercosts.pdf reporting that in 11 of 12 cases, installation of low impact development stormwater was cheaper than that of conventional controls with savings ranging from 15% to 80%.

[46] Towar Rain Garden Drains, MACDC 2008 Innovation and Excellence Award Winner, Ingham County Drain Commissioner, Mason, MI. http://www.towardrains.org/Towar%20Rain%20Garden%20Drains.htm (last accessed Jan. 29, 2009).

[47] American Rivers, *Hidden Reservoir: Why Water Efficiency is the Best Solution for the Southeast*, October, 2008, at 6, http://www.americanrivers.org/site/DocServer/SE_Water_Efficiency_Oct_2008_opt.pdf?docID=8421

[48] Braden, J.B. and D.M. Johnston. 2004. "Downstream Economic Benefits from Storm-Water Management." *Journal of Water Resources Planning and Management* 130 (6): 498-505.

neighborhoods,[49] reduce heat island effect in suburban and urban areas, reduce energy use,[50] increase green space and wildlife habitat as well as improve neighborhood aesthetics.[51] Additionally, implementing green infrastructure is a visible and tangible way for people to become engaged in environmental protection at the neighborhood level.

Climate change adaptation – Managing stormwater may increasingly be synonymous with managing for climate change adaptation.[52] Already, cities are experiencing changes in precipitation patterns that require changes in stormwater planning and management and integrating decentralized green infrastructure approaches will likely be a vital part of any adaptation strategy.[53] Seattle, New York City and San Francisco are evaluating or implementing green infrastructure practices as part of a plan to prepare for climate change impacts. In efforts to prepare and protect communities from the unpredictable changes that lie ahead, stormwater management occupies a central role in proactively adapting infrastructure to climate change. With proper incorporation of green infrastructure, stormwater management systems can have the capacity and flexibility to efficiently handle vulnerabilities associated with climate change, including water quality degradation and increased flood risk.[54]

Human health – Recent studies have shown an association between greener neighborhoods and a lower body mass index for children, suggesting another benefit of green infrastructure at the community scale.[55]

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[49] American Forests. 2000-2006. *Urban Ecosystem Analysis.* Retrieved August 2, 2007, from http://www.americanforests.org/resources/urbanforests/analysis.php

[50] Plumb, M. and B. Seggos. 2007. *Sustainable Raindrops: Cleaning New York Harbor by Greening the Urban Landscape.* Riverkeeper. Retrieved May 3, 2007, from http://riverkeeper.org/special/Sustainable_Raindrops_FINAL_2007-03-15.pdf

[51] U.S. Department of Defense. 2004. *Unified Facilities Criteria - Design: Low Impact Development Manual.* Unified Facilities Criteria No. 3-210-10. U.S. Army Corps of Engineers, Naval Facilities Engineering Command, and Air Force Civil Engineering Support Agency. October 25. Retrieved May 4, 2007, from http://www.wbdg.org/ccb/DOD/UFC/ufc_3_210_10.pdf

[52] Laure Funkhouser, *Stormwater Management as Adaptation to Climate Change*, Stormwater 8(5):17-36 http://www.stormh2o.com/july-august-2007/adaption-climate-change.aspx.

[53] S. Moddemeyer, Decentralized Approaches to Adapt to Climate Change.

[54] Funkhouser, L. supra note 55.

[55] J.F. Bell, J.S. Wilson & G. C. Liu, *Neighborhood Greenness and 2-Year Changes in Body Mass Index of Children and Youth*, Am. J. of Preventative Medicine 35(6) 547-553 (2008).

Energy savings – The energy cost of cleaning and delivering water is often overlooked and must be better integrated into our energy and water decisions.[56] It is estimated that between three and nineteen percent of electricity is used to clean, treat, and convey water, providing an important opportunity to save energy by saving water.[57] Green infrastructure and water efficiency measures reduce energy costs by diverting stormwater from municipal waste treatment facilities, requiring less energy for total treatment costs. It also reduces the demand for highly treated and energy intensive potable water. Investing in efficiency before building new dams and desalinization plants, or pumping water from far away sources represents the most cost effective source of clean and reliable water in addition to saving energy. By replacing 1.3 million old toilets with low-flow models rather than building a new wastewater treatment plant, New York City saved water, energy, and $200 million in taxpayer money.[58]

IV. Green Infrastructure Recommendations

With its responsibility for the oversight and authorization for clean water, the House Transportation and Infrastructure Committee has many opportunities to robustly promote and implement green infrastructure. American Rivers respectfully urges the Committee to adopt the following recommendations:

1. Integrate green infrastructure into broader water infrastructure spending and programs rather than treating it as separate. Mandatory set-asides are critical in advancing these new approaches. Future solutions must fully integrate green and traditional approaches.
2. Hold federal agencies such as the Environmental Protection Agency accountable for facilitating and fostering green infrastructure in their policies, practices, and spending decisions, and support legislation that would further these goals.

[56] For an overview of this issue, see Michael E. Webber, *Catch-22; Water vs. Energy*, Scientific American Earth 3.0, Vol 18., No. 4 (2-9) (2008).
[57] Don Elder, *Water, Energy and Climate Change*, River Network, River Voice, vol. 16, no. 4 (2006). Numbers differ according to region with California leading the nation at approximately 19%.
[58] New York City Department of Environmental Protection. "Water Conservation Program" Flushing, NY, 2006.

3. Protect and restore existing natural infrastructure critical for clean water by passing legislation to affirm the historic protections of small streams and wetlands afforded by the federal Clean Water Act.
4. Require consideration of the climate and energy impacts of all decisions regarding water infrastructure.
5. Support research and development for innovative integrated green infrastructure but do not postpone investing in "no regrets" strategies today.

Conclusion

Today we have reached a crossroads in how we manage our nation's water. Traditional water infrastructure will continue to play a role, but is designed to solve only a single problem and requires a huge capital investment. We must use this transformational moment to move from 19th Century infrastructure to a wiser combination of green and traditional infrastructure that will meet the needs of the 21st Century. Thank you for the opportunity to testify on sustainable water management and green infrastructure

Testimony of Brian McLean
Director, Office of Atmospheric Programs,
Environmental Protection Agency,
before the House Committee on Transportation and Infrastructure, Subcommittee on Water Resources and Environment

February 4, 2009

Thank you for the opportunity to testify on behalf of the Environmental Protection Agency concerning clean energy and wastewater treatment. My name is Brian McLean and I am Director for the Office of Atmospheric Programs within EPA's Office of Air and Radiation, the office that oversees EPA's clean energy programs. With me today, is Caterina Hatcher, ENERGY STAR National Manager for the Public Sector, who manages our energy efficiency work with local governments and wastewater utilities and can answer the technical questions relating to this work.

Overview

Fostering sustainable wastewater management is a priority at EPA and is all the more important given the increased investments in water infrastructure expected from an economic stimulus package. Many factors contribute to sustainable wastewater management. EPA's Office of Water is actively promoting asset management, green infrastructure, water efficiency, and energy efficiency at these facilities. My office works in partnership with the water office on clean energy issues. To help expand understanding of these important opportunities, the Office of Water and the Office of Air and Radiation recently signed a Memorandum of Understanding providing for close cooperation between the two offices on this critical topic.[1]

Today, I have been asked to speak about clean energy, which I define as energy efficiency and renewable energy. Both of these areas are fundamental to sustainable wastewater management and are extremely timely as our nation is poised to invest billions of dollars in infrastructure that will benefit many generations over the coming years. I will share with you how EPA's ENERGY STAR and Combined Heat and Power (CHP) programs, working with EPA's Office of Water, have been helping to promote clean energy in the wastewater industry

I would like to start by outlining some facts about energy use in the water and wastewater industry.

- Water and wastewater treatment facilities require significant energy to power pumps, aeration systems, and other operations.
- Combined, drinking water and wastewater services account for an estimated 3% of national energy consumption, equivalent to between 56 and 75 billion kilowatt hours

[1] http://www.epa.gov/water/climatechange/docs/ccow-oarmou/pdf

(kWh) and about $4 billion in annual energy costs.[2]

- Wastewater treatment plants are typically the largest energy consumers within local governments, accounting for 30 to 40% of the total energy consumed.[3]
- These facilities are significant sources of greenhouse gas emissions, contributing approximately 45 million tons of greenhouse gases to the atmosphere annually[4]
- Many facilities are facing operating deficits and these deficits are expected to increase as operations and maintenance costs increase due to aging infrastructure, population shifts, and increased need for treatment[5]

Clean energy, including biogas, can reduce energy use, energy costs, and greenhouse gas emissions at wastewater treatment facilities and offers cost-effective opportunities to do so. Numerous audits have identified that 10 to 20 percent savings are available through process optimization and equipment modifications.[6] They also include clean energy options such as methane capture and utilization, combined heat and power, as well as solar and wind energy.[7,8] Many energy efficiency improvements at water and wastewater treatment facilities can have good rates of return

The Office of Water recently published a strategy addressing climate change and water issues, and identified opportunities for reducing greenhouse gas releases from wastewater treatment plants through improved energy efficiency and water efficiency as well as power production using methane and other resources.[9]

Energy Efficiency

The significant potential in this industry for cost-effective clean energy technologies and practices has not routinely been considered as part of infrastructural improvements. In order to help overcome the traditional barriers to clean energy, such as lack of information, expertise and funding, EPA has been developing tools and resources to help local government and wastewater utility managers learn about the benefits of clean energy, act on those opportunities, and measure results.

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[2] EPA, GETF, Jan. 2008, p. 4. *Ensuring a Sustainable Future: An Energy Management Guidebook for Wastewater and Water Utilities.*
http://www.epa.gov/waterinfrastructure/pdfs/guidebook_si_energymanagement.pdf

[3] EPA,OPPD, Mar 2008. "Water and Energy: Leveraging Voluntary Programs to Save Both Water and Energy," viii.

[4] Based on an average mix of energy sources providing the energy for water and wastewater facilities. Methane (CH4) and nitrous oxide (N2O) are also emitted from wastewater treatment facilities but are not included in these estimates The source for the emissions estimate is EPA, 2008.
http://www.epa.gov/waterinfrastructure/bettermanagement_energy.html

[5] EPA,OPPD, Mar 2008. "Water and Energy: Leveraging Voluntary Programs to Save Both Water and Energy," 3-4.

[6] Based on audits of over 200 facilities through EPRI's Water and Wastewater program

[7] EPA. http://www.epa.gov/chp/markets/wastewater.html

[8] Santa Clara Valley Water District, June 2007. *From Watts to Water: Climate Change Response through Saving Water, Saving Energy, and Reducing Air Pollution,* p. 33.
http://www.valleywater.org/conservation/media/Documents/WUE%20Water%20Energy%20Report.pdf

[9] http://www.epa.gov/water/climatechange/index.html

EPA's energy efficiency efforts build on our successful ENERGY STAR program. In 2007, this program identified energy savings of 180 billion kilowatt-hours (kWh) -- estimated to be associated with savings $16 billion on consumers' and business' utility bills.[10]

As part of the ENERGY STAR program, EPA has worked to provide important energy management tools to many decision-makers to help them assess the efficiency of their facilities, target investments, and track the results for their efforts. Providing key energy and environmental information to the right audiences has been an important part of EPA's ENERGY STAR program for commercial buildings since the late 1990s.

Better information on the energy used by buildings and facilities and how they compare to one another is critical to fulfilling the energy efficiency potential. Energy use information is often not available. Moreover, even when energy information is available, it can be hard to understand and compare to other similar facilities. Since you can't manage what you don't measure, EPA created a national energy performance rating system. This may not seem to be a major innovation, but for the first time it is possible for buildings and facilities to receive a ranking on a scale of 1-100, similar to a miles per gallon rating on vehicles, and for decision-makers to develop investment strategies based on this standardized, objective information.[11]

A good example is provided by EPA's recent work with school districts across the country. Since 2000, EPA has provided an energy performance rating for school buildings. Since then, we estimate that nearly 25% of the nation's schools have been assessed using this rating.[12] And many school districts are using this information to improve operations, make upgrades and measure results. Through our ENERGY STAR partnerships with hundreds of school districts we have seen dramatic reductions in the energy used in their school buildings. For example, more than 40 school districts have reduced their energy bills by 10 to 20 percent or more. Leaders, such as the Lieutenant Governor of Wisconsin, are challenging their school systems to achieve and track energy savings using EPA's tools.[13]

The EPA energy performance rating system is bringing similar management information and performance tracking to other building areas as well, such as hospitals, office buildings, retail stores and more.

With wastewater treatment, we have developed a facility-level energy performance rating system by working with many leading industry parties over the last 3 years.

A study of 54 wastewater facilities that helped test the ENERGY STAR benchmark indicated that the EPA performance scores ranged from 1 through 99, with an average score of 58. In fact, one facility in the study provided data from both before and after a

[10] EPA, CPPD, "ENERGY STAR® and Other Climate Protection Partnerships 2007 Annual Report," 2008
[11] http://www.energystar.gov/index.cfm?c=evaluate_performance.bus_portfoliomanager
[12] Ibid, p. 26.
[13] http://www.energystar.gov/index.cfm?c=leaders.bus_leaders

series of facility renovations designed to improved energy efficiency. These improvements included the installation of premium efficiency motors, the addition of variable frequency drives to pumps, and an upgrade to the aeration system. There was considerable improvement in the rating of this facility; it started at a 69 in 2004 and moved to a 99 in 2007. These improvements resulted in source energy savings of about 2.3 kBtu/gallons per day.[14] This demonstrates the utility of the tool in tracking wastewater energy performance.

More than 100 wastewater facilities have already used EPA's rating system and this is growing. We expect that our strong partnerships with the utilities and local governments will bring important tools and information to help achieve significant energy savings. To help them find specific savings, an energy management guidebook and opportunities to network with other wastewater utilities have provided concrete examples of how to make cost-effective improvements.

Combined Heat and Power

EPA also has a CHP Partnership program to work closely with energy users, the CHP industry, state and local governments and other clean energy stakeholders to facilitate the development of new projects and to promote their environmental and economic benefits. Highly efficient combined heat and power systems provide multiple benefits in terms of improving energy performance and reducing greenhouse gas emissions.

EPA estimates that if the over 500 wastewater treatment plants where CHP would be feasible would install it, 340 MW of clean electricity would be generated and 2.3 million metric tons of CO_2 would be offset annually, which is equivalent to cutting CO_2 emissions from 430,000 cars.[15] This assessment is based on technical feasibility. Treatment plant managers would need to perform a site-specific cost-effectiveness analysis to determine the economic feasibility of investing in a CHP system at their particular facility with site-specific digester, heating, and electric loads. Working with the Office of Water, we have targeted analysis, technical resources (e.g., case studies) and outreach efforts to increase awareness and adoption of CHP in wastewater treatment facilities.

Next Steps

In 2009, EPA will continue to promote the benefits of clean energy. We will also enhance and expand EPA's energy performance ratings to meet the needs of water and wastewater utilities. Through our network of states and local governments, we have a ready avenue to make this information available to commercial and industrial energy users.

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[14] WEFTEC, October 2008. "Benchmarking Wastewater Facility Energy Performance Using ENERGY STAR Portfolio Manager", http://www.cee1.org/files/WEFTEC2008Session981130Manuscript.pdf

[15] "Opportunities for and Benefits of Combined Heat and Power at Wastewater Treatment Facilities," http://www.epa.gov/chp/documents/wwtf_opportunities.pdf.

As more attention is focused on improving the nation's water and wastewater infrastructure, I thank you for the opportunity to discuss how EPA can help achieve clean energy goals at the same time. This concludes my testimony. Caterina and I would be pleased to answer any questions the Members of the Subcommittee may have.

TESTIMONY OF THE HONORABLE G. TRACY MEHAN, III[1] BEFORE THE SUBCOMMITTEE ON WATER RESOURCES AND ENVIRONMENT OF THE HOUSE COMMITTEE ON TRANSPORTATION AND INFRASTRUCTURE ON SUSTAINABLE WASTEWATER MANAGEMENT

FEBRUARY 4, 2009

Madame Chairwoman and Members of this Subcommittee, I am G. Tracy Mehan, III, formerly Assistant Administrator for Water at the United States Environmental Protection Agency. Prior to that, I served as Director of the Missouri Department of Natural Resources and the Michigan Office of the Great Lakes. I am presently employed as an environmental consultant at The Cadmus Group, Inc. I am testifying today in my individual capacity. My testimony and the views expressed herein are entirely mine and not those of my company or its clients.

Good morning and thank you for this opportunity to discuss the opportunities and challenges of "Sustainable Wastewater Management" which, in my understanding, tries to address, in a comprehensive way, point and nonpoint source pollution; surface and groundwater protection; the nexus between water, energy and Greenhouse Gas (GHG) emissions; and cost-effectively restore the chemical, physical and biological integrity of the nation's waters.

This is an exciting, albeit daunting topic. So let me start by describing the results from a study done in the area of source water protection (SWP), a concept derived from the 1996 amendments to the Safe Drinking Water Act but analogous to the concept of watershed protection under the Clean Water Act.

The idea behind SWP is to prevent contamination of drinking water supplies as part of a multi-barrier approach which includes treatment. Increasingly, land conservation is seen as a fundamental part of source water protection. In fact, funds for land purchases can be obtained from the State Revolving Loan Funds for drinking water.

A study of 27 water suppliers conducted by the Trust for Public Land (TPL) and the American Water Works Association (AWWA)[2] in 2002 found that more forest cover in a watershed results in lower treatment costs. For every 10 percent increase in forest cover

[1] Contact information: c/o The Cadmus Group, Inc., 1600 Wilson Boulevard, Suite 500, Arlington, VA 22209. Phone: 703-247-6106. E-mail: gmehan@cadmusgroup.com.

[2] This study is described in *Protecting The Source: Land Conservation and the Future of America's Drinking Water* (2004) published by TPL and AWWA. This is a follow-up study to the original one completed in 1997.

in the source area, treatment and chemical costs decreased approximately 20 percent. Almost 50 to 55 percent of the variation in treatment costs can be explained by the percentage of forest cover in the source area.

In other words, the natural infrastructure, if you will, is a least-cost approach to protecting water quality which can generate multiple benefits such as habitat, carbon sequestration and aesthetics. Utilizing such green or natural infrastructure means less hard or gray infrastructure and reduced energy intensity, too.

We are seeing a similar trend in the realm of waste and stormwater management in more and more utilities and communities across the country. This is especially true with respect to "urban wet weather" issues, a constellation of problems including Combined Sewer Overflows (CSOs), stormwater runoff, and conventional point-source or end-of-the-pipe discharges. More and more, they are addressing these challenges through a watershed approach which employs green or nonstructural approaches in tandem with traditional hard or gray infrastructure.

At the heart of these urban wet weather problems is the degree of imperviousness or hardening of the landscape throughout the watershed with a concomitant disruption to the natural flow regime. Roads, sidewalks, parking lots, roofs and tightly compacted building sites allow water to run off, carrying with it pollution into nearby streams and rivers while also elevating water temperatures and increasing the velocity of the flow which scours stream and destroys biological diversity. The resulting condition is sometimes called the "urban stream syndrome."

In cities such as Philadelphia, Chicago, Portland (OR) and Milwaukee, water managers are trying to implement green infrastructure solutions or low-impact development (LID) practices. A number of these techniques are well known to this Committee such as green roofs, rain barrels, rain gardens, vegetated curb extensions, porous pavement, urban reforestation, and even constructed or restored wetlands or wet meadows. The aim of these practices is to retain water on site, allowing for infiltration and evapotranspiration, thereby reducing runoff and allowing for removal of unwanted pollutants.

In fact, Portland has actually incorporated LID solutions into its long-term control plan for addressing its CSO issues. Unfortunately, this may be the only instance where LID practices have been incorporated into the formal regulatory structure. EPA, specifically the Offices of Water (OW) and Enforcement and Compliance Assistance (OECA) should continue to facilitate the incorporation of the green solutions into CSO permits, not just consent decrees. Our understanding and knowledge of these techniques are getting better every day. It is time to incorporate them into the fabric our regulatory programs.

The Milwaukee Metropolitan Sewerage District is working with the Conservation Foundation, a national land conservancy, to purchase and restore 1800 acres of floodplain area to date. This is both to meet the District's flood plain management responsibilities, but also to ameliorate its CSO and stormwater problems.

Recently, the National Research Council of the National Academies released a landmark study on the nation's stormwater program in which it recommended managing stormwater on a watershed basis and using water flow as the common metric of regulation, as opposed to a pollutant by pollutant scheme. Such an approach could include multiple agencies or jurisdictions with stormwater responsibilities in a given basin. Indeed, EPA has already promulgated guidance on watershed-based permitting which allows for a comprehensive, watershed approach which could fold in all urban wet weather issues if the permitted entities wanted to do so, and the federal and state regulators gave their approval.

Both federal and state regulators need to encourage and facilitate such holistic and cost-effective steps to managing urban wet weather issues so as to reduce reliance on grey solutions and encourage greener ones which are less costly and generate multiple environmental benefits.

State Clean Water Revolving Loan Funds should also begin to recognize-and reward-the efficacy of green or LID techniques in dealing with urban wet weather issues. A few states are starting to recognize the cost-effectiveness and multiple benefits of these approaches, but the number is not large.

The goal of sustainable wastewater management also requires that we begin to pay greater attention to the nexus or inter-relationship between water, energy and GHG emissions. Clearly, a shift to green infrastructure or LID is in line with this goal. It is cheaper, less energy intensive and has the potential even to promote biological sequestration of carbon and mitigate urban heat island effects.

Global pressures on energy prices and environmental concerns have moved the issue of energy management to the top of the agenda for all utilities, especially wastewater and water systems. The water sector is estimated to consume 3 percent of the total electricity generated by the U.S. electric power industry. Energy is also used in individual homes to access water and wastewater services. And in some areas of the country, where water must be transported over large distances with daunting topography, the percentage is certainly higher. Finally, some experts are predicting that energy consumption at water and wastewater utilities will grow by more than 20 percent in the next 15 years.

Whether it be capturing and reusing methane from a wastewater system or adopting various renewable energy sources, the water industry continues to embrace energy management as a key pillar of sustainable water and wastewater management.

Recently, the Oregon Association of Clean Water Agencies (ACWA) issued a new report documenting how two wastewater treatment plants can become energy independent. Funded by the Energy Trust of Oregon, Gresham and Corvallis, Oregon were able to take steps to optimize energy efficiency and use renewable resources. Again, this report shows that many treatment plants can generate a substantial portion of their power by using methane gas.

Gresham's use of methane gas to generate clean power cut costs by $240,000 annually. It also purchases 17 percent of its electricity from wind farms.

Given the rise of carbon cap-and-trade programs on the West Coast and in the Northeast, as well as the possibility of a similar federal program coming on line, there may be opportunities for water and wastewater utilities to participate in emerging carbon markets.

Imagine a wastewater system selling carbon credits generated by its methane capture program.

What if a number of drinking water utilities in any given watershed might pool resources to reforest a groundwater recharge area. In the process they may be able to demonstrate substantial biological sequestration of carbon to participate in these new markets.

If water and wastewater utilities are able to generate an income stream from their participation in a new carbon or GHG market, that would enhance their economic and environmental sustainability simultaneously.

This is not your parents' water or wastewater sector! Green infrastructure now supplements gray infrastructure. The land and water interface requires that it be managed on a watershed scale. Finally, the nexus between energy, water and carbon necessitates new approaches which recognize the importance of this interrelationship.

Policy, regulation and financing should support these shifts in water management and allow for the implementation of those practices which deliver the most cost-effective solutions to the broad array of environmental challenges facing us now, some 36 years after passage of the Clean Water Act.

Thank you for your attention.

Testimony to the House Subcommittee on Water Resources and Environment
February 4, 2009
By Alan Zelenka
Energy Services Leader for Kennedy/Jenks Consultants
On the Oregon ACWA Energy Independence Project

My name is Alan Zelenka and I am the Energy Services Leader for Kennedy/Jenks Consultants. Kennedy/Jenks is an engineering and science consulting company for water and wastewater agencies; as well as ports, railroads, airports and other industries.

The Oregon Association of Clean Water Agencies (ACWA) is trade association for all the wastewater treatment plants in Oregon, and the Energy Trust of Oregon (ETO) uses the public purposes money collected from Oregon electric utility ratepayers to do energy efficiency and renewable resource projects.

I was the project manager for the Energy Independence Project for ACWA which was funded predominantly by ETO.

This project is a ground-breaking project that was recently awarded the American Council of Engineering Companies (ACEC) 2008 Project of the Year Award for Oregon. The goal of the project was to see what it would take for waste treatment plants (WTP) to become energy independent using energy efficiency and renewable resources. In essence, how would they end their addiction to grid electricity.

The 2008 study evaluated two wastewater treatment facilities, in the cities of Gresham and Corvallis, Oregon both using anaerobic digesters and advanced secondary treatment. The study showed that the Gresham and Corvallis plants could achieve energy independence by using energy efficiency, maximizing the use of digester gas, and installing micro-hydropower and solar photovoltaic systems (solar PV).

Kennedy/Jenks developed a broadly applicable systematic methodology to evaluate and recommend which energy efficiency measures (EEMs) and which renewable resources would work best to have these plants become energy independent. We created a six step program to end their addiction to grid electricity.

Step 1 – Identify energy-efficiency measures. In the study's first step, Kennedy/Jenks performed an energy audit with plant personnel and reviewed previous energy audits. Then we identified already-implemented EEMs and recommended others, considering installation cost, energy and financial savings, incentives, net cost, and simple payback. We also created a list of EEMs that treatment plants should consider to become more energy-efficient.

Step 2 – Determine plant energy profile. Next, we analyzed the two plants' utility bills, determining purchased energy, deducting the energy saved by new EEMs, and yielding their net energy requirements, which is the amount of energy each plant must offset to become energy-independent.

Step 3 – Assess renewable resources to use. The study's Technical Advisory Committee (TAC) had approved seven renewable resources to be assessed:

1. Fuel cells using digester gas
2. Internal combustion (IC) engines using digester gas
3. Microturbines using digester gas
4. Micro-hydropower turbines with plant outfall to a river
5. Solar PV
6. On-site small wind turbines
7. Fats, oil, and grease (FOG) and green waste to increase digester gas production

The Kennedy/Jenks team assessed and profiled each resource's history, technical description, vendors, size and kWh production, project examples, funding sources, and cost, along with political, community, environmental, greenhouse gas, and operational impacts. The cost of each resource was analyzed using levelized cost that puts them on equal financial footings. The lowest-cost resource was found to be FOG, followed by IC engines.

Step 4 – Evaluate renewable resources. To evaluate the data, the Kennedy/Jenks team created criteria that were approved by the TAC: levelized cost, environmental impacts, technical maturity and reliability, greenhouse gas impacts, political and community impacts, operational impacts, and adequate size. The criteria were weighted by the TAC and, using a point scoring system, the resources were ranked.

Step 5 – Rank the resources. The resources were ranked as follows:
1. FOG and green waste – 88 points
2. IC engines (385 kW) – 82 points
3. Microturbines (65 kW) – 81 points
4. Fuel cells (400 kW) – 70 points
5. Micro-hydropower turbines (35 kW) – 68 points
6. Small wind turbines (100 kW) – 60 points
7. Small wind turbines (10 kW) – 55 points
8. Solar PV (100 kW) – 52 points
9. Micro-hydropower turbines (5 kW) – 46 points

Step 6 – Develop recommendations to become energy-independent.

Gresham Plant: The Gresham plant already uses nearly all its available digester gas in a Caterpillar IC engine and has no significant wind resource. Hence, Gresham will need to rely on a combination of energy efficiency, micro-hydropower, and solar PV. The Kennedy/Jenks team recommended three EEMs (replace four motors with premium efficiency motors; reduce non-potable-water pressure; and replace the aeration diffusers with newer, more efficient fine-bubble diffusers) and recommended installation of a micro-hydropower 35-kW unit. Finally, the plant should meet the balance of its net energy requirement with 22 solar PV units of 100 kW each if sufficient land is available. The estimated total net capital cost (including incentives) to become energy-independent: approximately $9.6 million.

Corvallis plant: The Corvallis plant had already implemented all the cost-effective EEMs available to them and also lacks a significant wind resource. The Kennedy/Jenks team recommended a combination of two microturbines to use the plant's existing digester gas supply (the plant has insufficient digester gas to operate an IC engine), plus solar PV. The plant should consider a lease option for the microturbines and the solar PV. The plant should install 28 solar PV units of 100 kW each if sufficient land is available. The estimated total net capital cost (including incentives) for the Corvallis plant to become energy-independent: about $12.1 million.

Highly recommended: FOG and green waste program. The study found that both plants have excess digester capacity, which they could access to generate more digester gas using FOG and green waste. The additional digester gas in turn would power other renewable resource options. The upfront capital cost would be $1.1 million to process 3,000 gallons of grease and 20 tons of food scrap per day, which would create approximately 107,000 cubic feet/day of digester gas, which could run three microturbines (1.6 million kWh/year), one fuel cell at 80 percent capacity (1.4 million kWh/year), or one Caterpillar IC engine at approximately two-thirds capacity (0.9 million kWh/year). The substantial tipping fees could cover the capital cost in a relatively low number of years, making a FOG and Green Waste program a very cost-effective option.

Recommended path toward energy independence:

- Apply energy-efficiency measures (EEMs) first! They are the most cost-effective way to reduce energy needs and to save money. To accomplish this, a plant must have an energy audit conducted to identify EEMs, then seek incentives, and then install the EEMs.
- The evaluation methodologies developed in this study are broadly applicable to any WTP across the nation.
- IC engines are the most cost-effective and overall best generation option, and should be the first generation resource considered.
- Investigate a FOG and Green Waste program to create more digester gas if excess digester gas is available. This additional biogas can then power IC engines, microturbines, and fuel cells.
- After using all available digester gas, consider micro-hydro, small wind, and finally solar PV systems to become energy independent.
- Because these resources have high capital costs, public WTPs should consider third-party lease options to avoid upfront capital costs, to stabilize O&M costs, and to take advantage of tax credits.

Conclusions

WTPs use a great deal of energy. Many have already done a great deal of energy efficiency, but by no means have all of them implemented all cost-effective EEMs. There is an enormous potential across the country to mine much more energy efficiency out of WTPs.

Our study included a check-list of potential EEMs that each and every WTP across the country could use to make their plants more energy efficient. EEMs should be the first thing that they do because they are the most cost-effective option. We often see EEMs that have very short simple paybacks; as short as 0.3 to 3 years. What is needed is targeted programs, adequate funds available to do energy audits, and incentives to get the WTPs to act. Energy efficiency has multiple benefits such as lower operating costs which means lower rates for rate-payers, new equipment that increases reliability, lower environmental impacts, and reduced GHG emissions.

Excess digester gas at WTPs can use generators to cost-effectively create electricity and is considered a renewable resource. One recent survey showed that only about 15 percent of WTPs with the potential to generate electricity are actually doing so. What is needed is programs directed at WTPs, access to capital at favorable rates, and incentives to lower the cost. The benefits of generating electricity from digester gas are: lower environmental impacts, reduced GHGs, WTPs gaining control over their energy future, and in some cases depending on the existing cost of electricity, plants can lower their operating costs which means lower bills for rate-payers.

Other renewable resources like wind, micro-hydro, and especially solar photovoltaics (PV) are feasible and can contribute greatly to making WTPs energy independent. But it will take targeted programs, access to capital, and financial incentives to entice WTP to act. Incentives such as: investment tax credits, accelerated depreciation and production incentives. However, we need to create mechanisms so that public agencies can also take advantage of these tax incentives. For example, in Oregon, the Business Energy Tax Credit (BETC) has a pass-through provision that allows public agencies to transfer these tax credits to approved private entities and reap 35 percent of the 50 percent tax credit in an up-front payment.

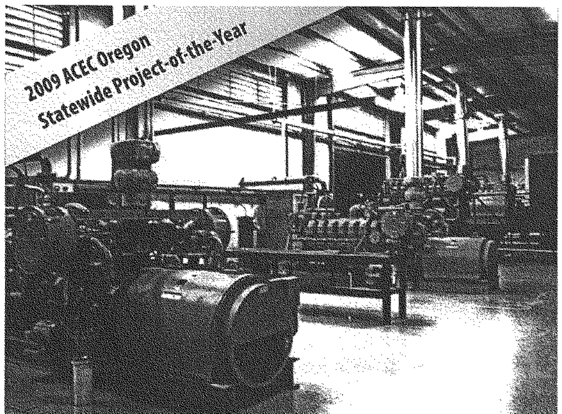
Being creative and putting the right programs and incentives in-place can allow WTPs to maximize their energy efficiency and optimize their use of renewables.

Attached are the Project Summary Sheet for the ACWA Energy Independence Project, and the executive summary of the full report.

Thank you for your time, and I very much appreciate the opportunity to testify today.

Energy Independence Project

Oregon Association of Clean Water Agencies,
in partnership with Energy Trust of Oregon



The 2008 energy independence study showed that IC engines are the most cost-effective and overall best generation option.

Achieving energy independence. For the Oregon Association of Clean Water Agencies and Energy Trust of Oregon, Kennedy/Jenks Consultants investigated how domestic wastewater treatment plants could most effectively eliminate the purchase of electricity, using energy-efficiency measures (EEMs) and renewable resources to become energy-independent.

The 2008 study evaluated two wastewater treatment facilities, in Gresham and Corvallis, both using anaerobic digesters and advanced secondary treatment. The study showed that the Gresham and Corvallis plants could achieve energy independence by using energy efficiency, maximizing the use of digester gas, and installing micro-hydropower and solar photovoltaic systems (solar PV).

Step 1 – Identify energy-efficiency measures. In the study's first step, Kennedy/Jenks performed an energy audit with plant personnel and reviewed previous energy audits. Then we identified already-implemented EEMs and recommended others, considering installation cost, energy and financial savings, incentives, net cost, and simple payback. We also created a list of EEMs that treatment plants should consider to become more energy-efficient (see box).

Step 2 – Determine plant energy profile. Next, we analyzed the two plants' utility bills, determining purchased energy, deducting the energy saved by new EEMs, and yielding their net energy requirements, which is the amount of energy each plant must offset to become energy-independent.

Step 3 – Assess renewable resources to use. The study Technical Advisory Committee (TAC) had approved seven renewable resources to be assessed:

1. Fuel cells using digester gas
2. Internal combustion (IC) engines using digester gas
3. Microturbines using digester gas
4. Micro-hydropower turbines with plant outfall to a river
5. Solar PV
6. On-site small wind turbines
7. Fats, oil, and grease (FOG) and green waste to increase digester gas production

The Kennedy/Jenks team assessed and profiled each resource's history, technical description, vendors, size and kWh production, project examples, funding sources, and cost, along with political, community, environmental, greenhouse gas, and operational impacts. The cost of each resource was analyzed using levelized cost that

Energy-efficiency measures for WWTPs >>

- Optimize pump station wet-well set points to decrease pumping head
- Add variable-frequency drives to motors of pumps and blowers
- Install premium-efficiency motors on pumps, blowers, and process equipment
- Automate aeration blower operation to maintain dissolved oxygen level and sequence blower operation
- Upgrade aeration systems with fine-bubble diffusers
- Replace aeration mechanical mixers with submersible mixers
- Maximize cogeneration operating time
- Reduce odor control fan operating time to minimum required
- Upgrade digester gas mixing to hydraulic mixing
- Reduce digester mixing time
- Reduce non-potable water pressure
- Recover exhaust heat to supplement supply heat
- Upgrade to more energy-efficient lighting

Levelized Costs of Assessed Renewable Resources	
Resource Option	Levelized Cost (cents/kWh)
FOG & Green Waste	-9.5*
IC Engines (385 kW)	2.9
Utility Power – Pacific Power	4.4
Microturbines (65 kW)	4.9
Utility Power – Portland General Electric	6.8
Fuel Cells (400 kW)	7.9
Micro-Hydropower #1 (35 kW)	15.4
Small Wind Turbine #2 (100 kW)	16.5
Small Wind Turbine #1 (10 kW)	19.0
Solar PV (100 kW)	36.5
Micro-Hydropower #2 (5 kW)	111.8

The negative cost is due to the revenue from tipping fees, which, over time, outweighs the capital cost.

puts them on equal financial footings. (The lowest-cost resource was found to be FOG, followed by IC engines.)

Step 4 – Evaluate renewable resources. To evaluate the data, the Kennedy/Jenks team created criteria that were approved by the TAC: levelized cost, environmental impacts, technical maturity and reliability, greenhouse gas impacts, political and community impacts, operational impacts, and adequate size. The criteria were weighted by the TAC and, using a point scoring system, the resources were ranked.

Step 5 – Rank the resources. The resources were ranked as follows:

1. FOG and green waste – 88 points
2. IC engines (385 kW) – 82 points
3. Microturbines (65 kW) – 81 points
4. Fuel cells (400 kW) – 70 points
5. Micro-hydropower turbines (35 kW) – 68 points
6. Small wind turbines (100 kW) – 60 points
7. Small wind turbines (10 kW) – 55 points
8. Solar PV (100 kW) – 52 points
9. Micro-hydropower turbines (5 kW) – 46 points

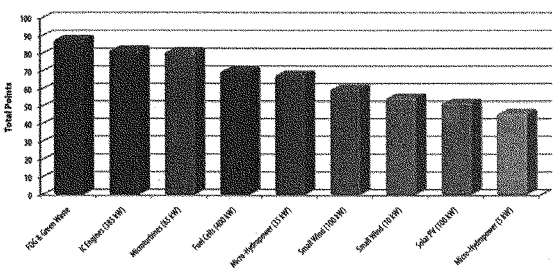
Step 6 – Develop recommendations to become energy-independent.

Gresham Plant: The Gresham plant already uses nearly all its available digester gas in a Caterpillar IC engine and has no significant wind resource. Hence, Gresham will need to rely on a combination of energy efficiency, micro-hydropower, and solar PV. The Kennedy/Jenks team recommended three EEMs (replace four motors with premium-efficiency motors; reduce non-potable-water pressure; and replace the aeration diffusers with newer, more efficient fine-bubble diffusers) and recommended installation of a micro-hydropower 35-kW unit. Finally, the plant should meet the balance of its net energy requirement with 22 solar PV units of 100 kW each if sufficient land is available. The estimated total net capital cost (including incentives) to become energy-independent: approximately $9.6 million.

Corvallis plant: The Corvallis plant had already implemented all the cost-effective EEMs available to them and also lacks a significant wind resource. The Kennedy/Jenks team recommended a combination of two microturbines to use the plant's existing digester gas supply (the plant has insufficient digester gas to operate an IC engine), plus solar PV. The plant should consider a lease option for the microturbines and the solar PV. The plant should install 28 solar PV units of 100 kW each if sufficient land is available. The estimated total net capital cost (including incentives) for the Corvallis plant to become energy-independent: about $12.1 million.

Highly recommended: FOG and Green Waste program. The study found that both plants have excess digester capacity, which they could access to generate more digester gas using FOG and green waste. The additional digester gas in turn would power other renewable resource options. The upfront capital cost would be $1.1 million to process 3,000 gallons of grease and 20 tons of food scrap per day, which would create approximately 107,000 cubic feet/day of digester gas, which could run three microturbines (1.6 million kWh/year), one fuel cell at 80 percent capacity (1.4 million kWh/year), or one Caterpillar IC engine at approximately two-thirds capacity (0.9 million kWh/year). The substantial tipping fees could cover the capital cost in a relatively low number of years, making a FOG and Green Waste program a very cost-effective option.

Ranking of Renewable Resources



Kennedy/Jenks' recommended path toward energy independence >>

- Apply energy-efficiency measures (EEMs) first – the most cost-effective way to reduce energy needs and save money. Conduct energy audits to identify EEMs, then seek incentives.
- IC engines are the most cost-effective and overall best generation option.
- Investigate a FOG and Green Waste program to create more digester gas, which can then power microturbines, fuel cells, and IC engines.
- After using all available digester gas, consider solar PV systems.
- Because these resources have high capital costs, consider third-party lease options to avoid upfront capital costs, fix O&M costs, and take advantage of tax credits.

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Final Energy Independence Project

03 July 2008
Revised

Prepared for

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K/J Project No. 0876003

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Executive Summary

Oregon's domestic wastewater treatment facilities are leaders in the protection of public health and the environment by providing water quality services to our urban areas. Some of the valuable services they provide include: sewerage collection and treatment, regulation of industries to prevent toxic substance discharges into treatment plants, leadership in promoting innovative water quality policies, and partnerships with other members of their community to restore local bodies of water. These facilities are often use energy efficient processes and frequently implement sustainable practices such as recycled water and biosolids recycling. Nonetheless, there is opportunity for these facilities to build upon their leadership in environmental stewardship by further reducing their need for energy.

This report is an investigation into what it would take for Oregon domestic wastewater treatment plants to become energy independent by optimizing plant energy efficiency and using renewable resource opportunities. For the purposes of this report the term "energy independence" means to use digester gas and renewable resources to eliminate the need for purchased electricity. This report provides valuable information for plant operators and managers, and policy-makers, and will be a valuable tool in directing significant investment in wastewater treatment plants. The report estimates the benefits and costs of implementing recommended energy efficiency measures while describing the cost, the operational impacts, and the environmental impacts of developing selected renewable resources. The project was conducted for the Oregon Association of Clean Water Agencies (ACWA) in partnership with the Energy Trust of Oregon (Energy Trust).

The analysis was based on an evaluation of two demonstration facilities at the Gresham Wastewater Treatment Plant and Corvallis Wastewater Reclamation Plant in Oregon. Energy audits were initially conducted at the two demonstration sites including the review of prior energy audits and installed energy efficiency measures (EEMs) were reviewed to identify opportunities for additional energy efficiency improvements. Following the facility analysis, the project team researched and analyzed seven renewable resource options for consideration in seeking energy independence. The seven renewable resources included in this investigation were:

1. fuel cells using digester gas
2. internal combustion (IC) engines using digester gas
3. micro-hydro using a treatment plants outfall to a river
4. microturbines using digester gas
5. solar photovoltaic (PV) systems
6. on-site small wind turbines, and
7. using fats-oils-and-grease (FOG) and green waste to increase digester gas production and related energy production).

The resources were assessed using a common template that was developed using with standardized criteria to assess each of the facilities. Costs were determined using a standardized spreadsheet with consistent assumptions and formulas to facilitate in comparing the various renewable options. The resource assessments described a brief history of the resource, how the resource works, and its size and kilowatt-hour (kWh) production. The resources assessment also included potential funding and incentives, its cost, the political and community impacts, as well as the environmental, greenhouse gas and operational impacts of each resource option.

Seven evaluation criteria were developed by the Project Team and approved by the Association of Clean Water Agencies (ACWA) Energy Independence Project Technical Advisory Committee (TAC). To simplify the evaluation process, the evaluation criteria were prioritized and given a weighted score that reflects their importance to the TAC as decision-making criteria. The weighted scoring system allowed a maximum of 100 total points to be assigned to each resource option. The weighted scoring of the evaluation criteria was:

Evaluation Criteria	Possible Points
Cost	50
Environmental Impacts	20
Technology Maturity & Reliability	10
Political and Community Impacts	5
Adequate Size	5
Greenhouse Gas Impacts	5
Operational Impacts	5
TOTAL =	**100**

Based on the criteria and weighting described above, the evaluation team analyzed each of the seven resource options for the report. A score was then developed for each of the resources to provide a basis for comparison. The resource scoring is summarizes as:

1. FOG & Green Waste – 88 points
2. IC Engines (385 kW) – 82 points
3. Microturbines (35 kW) – 81 points
4. Fuel Cells (400 kW) – 70 points
5. Micro-Hydro Turbines (35 kW) – 68 points
6. Small Wind (10 kW) – 55 points
7. Solar PV (100 kW) – 52 points
8. Small Wind (100 kW) – 60 points
9. Micro-Hydro Turbines (5 kW) – 46 points.

Summary of Recommendations for the Gresham Wastewater Treatment Plant

Since the Gresham Wastewater Treatment Plant (WWTP) already uses nearly all of the available digester gas in its Caterpillar IC Engine, none of the resource options that use digester gas as a fuel (IC engines, microturbines, or fuel cells) would be available for this facility to become energy independent. In addition, the plant site does not appear to have a significant wind resource eliminating the use of the small wind resource at this site.

To achieve energy independence the Gresham WWTP would need to rely on a combination of energy efficiency, micro-hydro and solar PV. The first recommendation is to install the three cost-effective energy efficiency measures identified in this study: replacing four existing motors with premium efficiency motors, reducing the system's pressure, and replacing the aeration diffusers with newer more efficient fine bubble diffusers. This facility could also investigate and implement potential energy efficiency savings associated with changes to their process. The second recommendation would be to install one of the micro-hydro 35 kW units. The final recommendation would be to meet the balance of the plant's energy needs (kWh) with 22 solar PV units of 100 kW each for a total of 2.2 MW of energy if sufficient land is available. The estimated total net cost to become energy independent would be approximately $9.6 million.

Summary of Recommendations for the Corvallis Wastewater Reclamation Plant

The Corvallis Wastewater Reclamation Plant (WWRP) has commendably already implemented all the cost-effective EEMs available to them. Since the Corvallis WWRP site does not appear to have a significant wind resource, small wind is not available to help achieve energy independence. Additionally, the micro-hydro option is not recommended because of the cost of the micro-hydro option and its lowest overall score; the micro-hydro option is not recommended. Since the Corvallis WWRP has commendably already implemented all the available cost-effective EEMs in their facility, they could also investigate potential energy efficiency savings associated with changes to their treatment process.

To achieve energy independence the Corvallis WWRP would need to rely on a combination of microturbines using their existing digester gas supply and solar PV. The first recommendation is to install two microturbines, to make use of the available digester gas. While IC Engines are a more cost-effective option, the Corvallis plant only has a limited amount of available digester gas which is insufficient to operate an IC Engine. Two microturbines use roughly one-third the digester gas that an IC Engine would use making them a much better fit for the Corvallis plant given their limited digester gas.

Serious consideration should be given to a lease option for the microturbines that would not require up-front capital from the plant. It could result in some of the savings available to the leasor from tax credits being passed along to the municipality while requiring no additional staff for operations and maintenance (O&M) and potentially lower operating costs. The second recommendation would be to meet the balance of the plant's energy needs (kWh) with 28 solar PV units of 100 kW each to produce a total of 2.8 MW of energy if sufficient land is available. The estimated total net cost for the Corvallis WWRP to become energy independent would be about $12.1 million.

Summary of Recommendations to Further Investigate a FOG and Green Waste Program

It is recommendation that Gresham and Corvallis further investigate the development of FOG and Green Waste to energy projects. Both the Corvallis and Gresham wastewater treatment plants currently have excess digester capacity for which they could use FOG and Green Waste to generate more digester gas to run renewable resource options. A FOG and Green Waste project would cost about $1.1 million to process 3,000 gallons of grease and 20 tons of food scrap per day; would create approximately 107,000 CFD of digester gas, and could generate enough digester gas to run three microturbines (1.6 million kWh/year), one fuel cell at 80 percent capacity (1.4 million kWh/year), or one Caterpillar IC Engine at approximately two-thirds capacity (0.9 million kWh/year)..

U.S. House of Representatives
Subcommittee on Water Resources and Environment
Committee on Transportation and Infrastructure

SUSTAINABLE WASTEWATER MANAGEMENT
February 4, 2009

Written Testimony Submitted by
Glenn Reinhardt, Executive Director
Water Environment Research Foundation
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Alexandria VA 22314
703-684-2470

The American Society for Civil Engineers, in their report card issued on January 28, 2009, graded wastewater infrastructure with a D-, which is the lowest grade they gave. The dismal assessment points to a national infrastructure that is unable to meet current and future demands and, in some cases, may be unsafe. In early recognition of the crisis, the Water Environment Research Foundation has been in front of the curve, conducting research that helps communities provide reliable and cost effective wastewater service as we seek to improve the sustainability of wastewater treatment facilities across the country.

BACKGROUND ON WASTEWATER SERVICES IN U.S. COMMUNITIES

Wastewater services have undergone explosive growth over the past three decades. The population receiving wastewater treatment from publicly owned treatment works (POTWs) increased almost 250 percent from 1972 to 2004, from 84 million people to 205 million. Local governments across the United States estimate that they will serve approximately 285 million people by 2024.

There are 16,600 POTWs in the United States (not including Native American tribal facilities). In addition to collection and treatment facilities, America's water systems include 600,000 miles of sewer line.

About 70 percent of centralized wastewater treatment and collection facilities serve small communities, comprising only 10 percent (27.2 million people) of the population served by centralized collection.

The water quality industry is facing tremendous growth. The 2004 U.S. EPA Clean Watersheds Needs Survey indicates that, on average, 34.4 billion gallons of wastewater actually flows through the facilities each day. The designed national capacity is 47.2 billion gallons per day and, as of 2004, facilities had plans to increase capacity to 52.5 billion gallons per day.

The people who run our communities' wastewater treatment plants are true public servants. In 2004, local governments employed 124,380 full time equivalent "sewerage" workers, with an annual payroll of $5.54 billion. These wastewater treatment employees face a daunting task, building new systems and replacing or rehabilitating current systems.

INFRASTRUCTURE CHALLENGES ARE BIGGER THAN JUST REPLACING DETERIORATING PIPES

Bigger service areas, increased flows, and replacement or rehabilitation of deteriorating infrastructure translate into additional financial need. In 2004, the U.S. EPA estimated that wastewater treatment and collection projects require $189.2 billion in capital costs alone.

While replacing or fixing the infrastructure, agencies must address demands for better treatment and removal processes for an increasing array of contaminants – while using less energy, imposing smaller carbon footprints, and dealing with the challenges of climate change. Meeting the challenges will require a multi-pronged research effort: analyzing conditions, developing and assessing technologies, measuring results, and providing solutions.

Infrastructure must address climate change challenges. Wastewater utilities are well aware that changes in temperature, precipitation, sea levels, and the hydrologic cycle in general affect delivery of services and potentially affect receiving water quality. Changes in human behavior – such as changes in water demand, changes in land use and land cover, and more legislative protection of adversely affected species – may also accompany climate change. These factors add additional uncertainty to the future sustainability of municipal wastewater services.

The wastewater industry must minimize air emissions (such as methane and nitrogen greenhouse gas) and mitigate other impacts resulting from energy and chemical use. Plant managers must weave economic considerations into every decision and find the best balance between multiple goals: achieving effluent quality requirements; planning for add-ons that will meet future effluent requirements; using all resources (i.e., powering equipment with methane); and optimizing the use of external resources (such as chemicals and electricity).

RESEARCH PAVES THE WAY FOR PLANNING "SHOVEL READY" PROJECTS

Researchers are examining new processes and technologies that will help communities conserve resources, especially improving energy efficiency and reducing the amount of potable water used in wastewater treatment. WERF is particularly looking to reduce sludge production, lower methane and nitrogen greenhouse gas releases, and lessen chemical usage. Researchers are also testing new technologies that reuse sludge, nutrients, methane, and treated wastewater.

One WERF project, started this summer, is identifying and measuring key factors that contribute to the sustainability of a wastewater treatment facility. The project, *Improving the Wastewater Plant Environmental Footprint: Options for Your Locality*, will help wastewater treatment plants define their current carbon and ecological footprint as they take timely and truly effective steps towards reducing impact. Communities will be better able to collect information on the mass, energy and ecological footprint of wastewater treatment facilities on a unit process basis. That information will support a database that plants can use to match their processes and optimize their sustainability.

The researchers selected the Strass wastewater treatment plant (WWTP), near Innsbruck, Austria, as a case study. The Strass WWTP has achieved a laudable goal that the rest of the wastewater community aspires to: producing more energy than is needed to operate the facility. Through a two-pronged approach of continually exploring options to improve the plant's overall energy efficiency and optimizing methane production from the anaerobic digesters, the plant is producing more energy than it needs to operate the entire facility. The Strass WWTP is an ideal candidate for testing the new evaluation metrics, and establishing a benchmark in the database against which other facilities can compare themselves.

The mass and energy balance template containing the Strass WWTP data will be available in early 2009. WERF will subsequently develop a web-based self-evaluation tool that each wastewater facility can use to plan, design and build facilities that will meet the quickly emerging challenges of the 21st century.

RECOVERING ENERGY FROM SLUDGE

It's been a problem since the first indoor toilets were installed – what do you do with the sewage? Innovative wastewater agencies are doing a lot, it turns out. They are pulling reusable compounds out of the sludge and they are also using the sludge to generate alternative energy. That makes particular sense since research demonstrates that sewage actually contains ten times the energy needed to treat it.

Early in 2008 WERF and its global research partners issued a report, *State of Science Report: Energy and Resource Recovery from Sludge*, which presents an exciting picture of the possibilities. Interest in extracting products from sludge, while not recent, is rising because of increases in energy costs and impacts of global warming. Resource recovery from sludge is currently a worldwide topic and has become a key aspect of almost all sludge management master plans.

There is a lot of sludge to work with. In the U.S. alone, the 16,583 wastewater treatment facilities produce over 64 pounds of sludge per person, every year. It is estimated that the U.S. produces 6.5 million metric tons of "dry solids" – sewage sludge with the water squeezed out of it – annually. Currently, 45 percent of that sludge is incinerated or goes to landfills, 49 percent is treated and used in land applications, and only 6 percent is reused for other purposes – like energy production.

Wastewater treatment plants are net users of energy. In the U.S. they consume an estimated 21 billion kilowatt hours per year. There are important reasons for this energy use, as society demands increasingly intensive treatment to remove nutrients and chemicals from wastewater before it is discharged back into water bodies or is reused. But energy use is coming under increasing scrutiny, with the financial cost of energy and the environmental cost of energy generation driving new interest in the conversion of sewage sludge to energy.

Sewage contains ten times the energy needed to treat it, and it is technically feasible to recover energy from sludge. As renewable energy, it can be directly used in wastewater treatment, reducing the facility's dependency on conventional electricity. The greater the quantity of energy produced by the industry, the more the industry can help reduce emissions of greenhouse gases. Using solids as a resource rather than a waste may help stressed public budgets as well. Wastewater solids must be processed prior to disposal, and solids handling accounts for as much as 30 percent of a wastewater treatment facility's costs.

Converting solids to energy is feasible and desirable, from a treatment perspective. The challenge is finding a process that is also affordable, cost-effective, and acceptable to the public.

While the current technology is promising, none of the processes can fully extract all the energy available in wastewater. New technological developments, or improvements of current technologies, are necessary to take advantage of the maximum energy available in sewage and sludge. Researchers are leaving no stone unturned; they are examining physical, mechanical, biological, and chemical processes that can produce or contribute to energy recovery from sludge.

HELPING CITIES AND TOWNS MAKE INFORMED DECISIONS

There are about 2,000 central sludge processing facilities in the U.S. As of 2004, 650 of those facilities used anaerobic digesters to process its sludge. When sludge is digested, it produces methane gas. As an aid for municipalities considering energy recovery from digester gas, a Water Environment Research Foundation project developed the Life Cycle Assessment Manager for Energy Recovery (LCAMER) model. This model enables the cities and their engineers to judge the feasibility of recovering energy from anaerobic digestion of wastewater solids based on site specific design and operating conditions, and energy pricing.

Some examples of current use of technology:

- Watsonville, CA uses restaurant grease to increase sludge digester gas production by over 50%.
- Thermally dried biosolids substitute for 5-10% of coal used to fuel a cement kiln in Maryland.

- Methane as source of hydrogen to produce energy with molten carbonate fuel has been demonstrated at King County (WA) South Treatment Plant.
- In 2005 in the U.K., waste (including sewer sludge) combustion and biogas production accounted for 10.8% and 4.2% respectively of all UK renewable energy.
- In 2005, an average of 113% of the electricity used by a German plant was generated onsite by gas engines.
- A Swedish treatment plant produces and sells biogas to Stockholm's bus company, which uses it to run at least 30 buses.
- Stockholm's energy company uses heat recovery pumps to extract heat from treated sewage to provide hot water and heating to 80,000 apartments.
- The Sewerage Bureau of Tokyo Metropolitan Government turns dewatered sewage sludge into fuel charcoal for thermal power generation.

WERF'S INFRASTRUCTURE RESEARCH IS HELPING COMMUNITIES NOW

WERF is committed to putting research results into actionable form. Our current tools, accessible to wastewater agencies across the United States include:

Sustainable Infrastructure Management Program Learning Environment (SIMPLE)
SIMPLE makes asset management comprehensible. This software tool provides essential components of a state-of-the art program, promotes information exchange, and suggests practical implementation guidelines.

SAMGAP
This benchmarking mechanism, incorporated into SIMPLE, facilitates self assessments, allowing utilities to compare themselves to best management practices of North American industry leaders.

Sewer Cataloging, Retrieval and Prioritization System (SCRAPS)
This sewer inspection tool helps small- to medium-sized wastewater utilities estimate the probability and consequences of pipe failure. Utilities use SCRAPS to strategically focus sewer inspection programs in those areas most likely to need attention.

Condition Assessment Strategies and Protocols for Water and Wastewater Assets
This report assists water and wastewater utilities in their long-term planning as well as their day-to-day management of assets. It identifies the advantages and disadvantages of various tools and techniques for measuring the condition and performance of utility assets. (Stock no. 03CTS20CO)

New Pipes for Old: A Study of Recent Advances in Sewer Pipe Materials and Technology
Should a public wastewater agency rehabilitate, renovate, or replace their buried pipe? This report assesses the various pipe materials used by agencies throughout the United States, and presents additional options in the use of plastics, composites, and pipe structures. It also reviews designs for installation and rehabilitation of manholes. (Stock no. 97CTS3)

An Examination of Innovative Methods Used in the Inspection of Wastewater Systems
Investigation and diagnosis is fundamental to effective strategies for rehabilitation and replacement of our wastewater systems. This report provides a comprehensive review of investigation technology and suggests a structured approach to the investigatory process. Public agencies can use the information to determine which technology will serve them best. (Stock no. 01CTS7)

Methods for Cost-Effective Rehabilitation of Private Lateral Sewers

Millions of sewer laterals — the sewer pipes connecting individual properties to the public sewer network — exist throughout the United States. This report discusses options for inspection, evaluation, and repair of sewer laterals. It also addresses the financial and legal issues regarding access to private property in maintaining a public asset. (Stock no. 02CTS5)

Minimization of Odors and Corrosion in Collection Systems
This report explains the science underlying odor and corrosion mechanisms in sewer pipes, and suggests control strategies within the asset management framework. Researchers review affordability, system planning, design, and operations and maintenance. They also provide insights on public outreach and regulatory issues. (Stock no. 04CTS1)

WERF NEEDS CONGRESSIONAL SUPPORT TO MEET EMERGING CHALLENGES

We are grateful for Congressional support in the past, especially as WERF received special designation in FY '08 as a "national Congressional priority." To undertake a robust response to the growing challenges, WERF respectfully requests an appropriations match to the $7 million annual commitment from WERF subscribers. Certainly, the aggressive research agenda in front of us calls for no less than the $4 million allocated to the Foundation in fiscal years 2000 through 2005.

WERF, a 501(c)3 nonprofit organization, is one of the nation's leading research foundations and is supported by over 300 subscribing organizations. These organizations include approximately 200 wastewater and stormwater utilities, which provide service to over 75% of the sewered population in the United States. More than a dozen global manufacturers with private wastewater facilities also support WERF, as do nearly 100 companies that provide services and equipment to both public and private facilities.

WERF provides products and services to clean water professionals that are not available anywhere else. Constituent support attests to the value of WERF research. In a 2007 survey, 96% of WERF's subscribers said they would recommend WERF to others, and 90% use WERF research to improve processes, reduce costs, assist with compliance on regulatory issues, or to educate customers.

The need for WERF's credible, forward-looking research has never been greater, and recent funding reductions are crippling WERF's ability to serve the water quality profession and the ratepayers to whom we provide services. Fully funding WERF at between $4 and $7 million will ensure that vital programs – most importantly including the vital renewal of sustainable infrastructure – can be pursued with the vigor that the times demand.