Energy Efficiency and Energy Independence for Sustainable Wastewater Treatment

TESTIMONY OF

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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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