



BLUEPRINT FOR INTEGRATING TECHNOLOGY INNOVATION INTO THE NATIONAL WATER PROGRAM

(Version 1.0 - March 27, 2013)

“Technology innovation can accelerate progress toward our goals of clean and safe water. EPA and many stakeholders will strive to support technology innovation to solve water resource problems... cheaper, faster and using less energy!”

Nancy Stoner, Acting Assistant Administrator for Water, U.S. EPA

Purpose of this Blueprint

Over the past 40 years, great progress has been made in protecting the nation’s water resources through an array of efforts by federal, state, and local governments and the private sector under the auspices of the Clean Water Act and Safe Drinking Water Act. But the United States is facing serious challenges to its water resources, including deteriorating infrastructure, continued population growth and development, impacts of climate change, emerging contaminants, widespread nutrient pollution and strains on water supply. We need to discover new ways forward to meet today’s demands and tomorrow’s challenges.

Accelerating innovation and technology will help address the complex challenges facing America’s water resources. Technology innovation presents opportunities to achieve greater progress toward clean and safe water substantially faster with significantly less cost and energy consumption. Technology innovation can be a means to assure that future actions are more sustainable and be an economic driver, help businesses thrive, create jobs and be a source of U.S. exports.

The U.S. is a global leader when it comes to environmental technology innovation. According to the Department of Commerce, in 2011 the U.S. environmental industry generated about \$319 billion in revenues. In 2011, the environmental industry employed nearly 1.7 million Americans and included approximately 117,000 companies. Water equipment and chemicals is the largest component of the environmental technology sector – about 37 percent of exports. In 2009 we saw almost \$10 billion in these exports and a \$3.9 billion surplus in trade.

The U.S. Environmental Protection Agency (EPA) Office of Water is committed to fostering the development and use of innovative technology to advance EPA’s goal of clean and safe water and sustainable water utilities. This Blueprint highlights the EPA Office of Water’s plans to advance and promote technology innovation across various water programs.

What is Technology Innovation?

For purposes of this Blueprint, technology innovation should be considered in its broadest meaning and applications. Technology innovation includes an array of approaches: the development and deployment of new technologies; new applications of existing technology; production changes; and organizational, management and cultural changes that can improve the condition and sustainability of our nation’s water resources.



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Opportunities for Technology Innovation - Solving Problems

The Office of Water (OW) has identified several opportunities to employ innovative technology to help solve current water resource issues. These are the “top ten” key market opportunities:

Energy Reduction and Recovery at Drinking Water and Wastewater Facilities

– The 150,000 drinking water and 15,000 wastewater facilities nationwide account for as much as 4 percent of the national electricity consumption, equivalent to approximately 56 billion kilowatt hours costing about \$4 billion. Energy conservation and recovery hold significant promise for reducing energy consumption and treatment costs. Certain technologies may even turn some of these facilities into net energy producers.

Innovative Technology in Action

East Bay Municipal Utilities District (MUD) in California has implemented a series of actions to reduce and produce energy including generation of methane from waste that in turn powers generators to run a renewable energy system at its wastewater treatment plant. East Bay MUD’s wastewater treatment plant is one of the first in North America to be a net-energy producer.

Innovative Technology in Action

The Hampton Roads Sanitation District (HRSD) Struvite Recovery Facility in Virginia recovers phosphorus and nitrogen from wastewater recycle streams. The recovered nutrients are transformed at HRSD’s Nansemond facility into an environmentally friendly, commercial fertilizer called Crystal Green®.

Nutrient Recovery from Wastewater – Nitrogen and phosphorus are leading causes of water pollution across the nation, threatening surface water quality and drinking water supplies. New techniques are needed to reduce nutrient pollution at substantially less cost and with reduced carbon footprint. Emerging technology can even recover nutrients, such as phosphorus and nitrogen, from water/wastewater for use/reuse elsewhere.

Improving and “Greening” of the Nation’s Infrastructure – The need for rehabilitation of the nation’s water and sewer infrastructure is staggering, estimated to cost over \$650 billion. New and more cost effective assessment (e.g., leak detection) and rehabilitation techniques are needed. Increased emphasis should be placed on green infrastructure for stormwater management and decentralized approaches that can reduce pumping and treatments costs, as well as provide other local environmental and economic benefits.

Innovative Technology in Action

The City of Lancaster, PA has a combined sewer system that releases untreated or inadequately treated sewage to local streams during wet weather events. The city is aggressively pursuing green infrastructure (green roofs, rain gardens, infiltration and bioretention systems) to capture and retain stormwater equal to nearly one million square feet of impervious area.

Water Reuse – The nation’s 15,000 municipal wastewater facilities discharge approximately 9.5 trillion gallons of wastewater per year. Because of drought and increasing water demands, wastewater is being viewed through a new paradigm as “water that is wasted.” There are significant needs for technologies and approaches that foster substantially greater water reuse, which in turn can reduce pollution and conserve energy.

Improved and Less Expensive Monitoring – Less than 30 percent of the nation’s surface water bodies are assessed by EPA, states or tribes partly because of the high cost of traditional water quality monitoring. Smart sensor technology as well as remote sensing (satellite imagery)



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hold opportunities to generate substantially more data at less cost. Sensor technology, coupled with telemetry and information technology, can make this data available for a broader range of applications.

Improving Reliability of Small Drinking Water Systems – Over 93 percent of the more than 150,000 public water supply systems are small, serving fewer than 3,300 people. Operating and maintaining these small systems can be technically complex and costly. New technology and operational controls offer hope for protecting public health at less cost and with greater reliability.

Technology Evaluation and Performance – Technology developers have long expressed concerns about the challenge of bringing new technology from pilot testing to market. This challenge is sometimes referred to as overcoming the technology “valley of death.” Other technology providers describe a complex system of federal, state and local requirements that discourages acceptance, adoption and use. There is a growing chorus expressing the need for technology evaluation by independent third-parties to assess performance for a spectrum of water-related technologies.

Reducing Water Impacts from Domestic Energy Production – Vast amounts of water are used each year for energy production in the United States. Produced waters pose difficult challenges for effective management. Advances in oil and gas development (e.g., shale gas) also involve significant water consumption, treatment and disposal. New technology can help alleviate water quality and quantity issues related to energy production.

Resiliency of Water Infrastructure – Super Storm Sandy showed us just how vulnerable our water infrastructure can be to extreme weather events. Perhaps technology innovation can help us rethink how and where we rebuild existing and new infrastructure to achieve greater resiliency.

Improving Water Quality of Our Oceans, Estuaries and Watersheds – Less than half of the nation’s surface waters achieve their intended uses (e.g. potable water supply, swimming, fishing). Similarly, the nation’s groundwater is also vulnerable to pollution. New technologies can help address nonpoint sources of pollution, help rebuild ecosystems, restore watersheds and address threats from invasive species and other impacts. Often times, we need new and innovative approaches and partnerships to protect and restore our oceans, estuaries and watersheds.

Innovative Technology in Action

The Emerald Coast (FL) Utilities Authority (ECUA) saw their Pensacola Beach wastewater treatment plant inundated and destroyed by Hurricane Ivan in 2004. With the help of funding from FEMA and other sources, the treatment plant was relocated outside the City of Pensacola and away from the coastal plain. ECUA also rebuilt the Central Water Reclamation Facility using treatment technology which has fostered 100 percent reuse of the nearly 20 million gallons per day flow.



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EPA's Commitment to Promoting Technology Innovation

EPA understands the importance of technology innovation to achieve a clean environment and robust economy. For example:

- EPA's Strategic Plan (FY 2011-2015) lays out five strategic goals and five cross-cutting fundamental strategies to focus EPA's efforts in attaining these goals. The third cross-cutting strategy (Advancing Science, Research and Technological Innovation) states:
 - "EPA will promote innovative solutions to environmental problems."
 - "EPA must help drive... technology innovation to sustainably address air quality, climate change, water quality and quantity... and other environmental issues."
- In April 2012, EPA issued the *Technology Innovation for Environmental and Economic Progress: An EPA Roadmap*. Among other things, the roadmap states:

Building upon the EPA's history of scientific and technological expertise, the Agency will seek out prospective technological advances that have the greatest potential to achieve multiple environmental goals. Consistent with its statutory and regulatory authorities, the EPA will partner with a diverse set of new and existing stakeholders to speed the design, development and deployment of the next generation of environmental technologies, creating a cleaner environment and a stronger economy for our nation and the world.
- EPA formed a Technology Innovation Network in 2012, representing the EPA Regions and national programs, to coordinate actions related to innovative technology across the agency. The Office of Water is actively contributing ideas and support to the network.

Recognizing the Challenges and Barriers to Innovation

Central to the promotion of technology innovation is an understanding of the existing challenges and barriers. The Office of Water is continuing dialogue among its internal and external partners and stakeholders to discuss ways to promote innovative technology. EPA is also an active participant in the many dialogues with external partners and which recognize the importance and fragility of our nation's water resources, as well as the benefits of technology innovation. These conversations are providing valuable insights into the process of technology innovation and how it can be more effectively incorporated into national water programs. Some examples of these significant venues of discussion include:

- Water Environment Federation Technical Exposition and Conference (WEFTEC), New Orleans, October 1-3 2012
- American Water Summit: Business Models for the Future, Chicago November 14-15, 2012.
- Water: Emerging Risks & Opportunities, GE Goldman Sachs Summit, New York, February 8, 2013
- Innovating for Water's Future, US Water Alliance/NACWA/WWEMA, March 4, 2013



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Feedback from Water Environment Federation (WEF) CEO Roundtable Regarding Innovative Technology

On October 1, 2012, WEF convened a discussion with EPA Administrator Lisa Jackson, Acting Assistant Administrator Nancy Stoner and 16 CEOs of major corporations to discuss how EPA can support and advance technology innovation in the water sector. Highlights from the CEO roundtable include:

- Public-Private Partnerships – A new era of public-private partnerships is needed. Solutions need to be supported by the private sector and the public sector.
- Technology Evaluation – Technology evaluation is considered the single greatest need; the ability to share performance data while also protecting intellectual property is also crucial.
- Innovation Support and Risk Taking – EPA must assist in enabling innovative technology. In turn, local governments must be prepared to take on some of the risks associated with innovative approaches/technologies. Risk is considered among the primary inhibitors to innovation.
- Communication and Education – Greater public education and understanding is needed regarding how innovative technology can protect water resources.

The Path Forward... Actions to Promote Technology Innovation

This Blueprint is intended to be an evolving plan, reflecting the ongoing and expanding conversations within EPA, particularly with the Regions and the Office of Research and Development (ORD). The Blueprint will also reflect conversations with a full array of external partners and stakeholders to discuss plans for advancing innovative technology. This Blueprint is a work in progress and will be continually revised. Following is a working list of actions that the Office of Water will pursue with the EPA Regions, states and others.

Communicating OW's Goals and Actions

- Showcase and celebrate examples of how public and private entities are using technology innovations (e.g. events, website) to address water resource challenges.
- Maintain a website showcasing its efforts and examples of innovation.

Technology Evaluation

- Support (e.g. advisory capacity) the Water Environment Federation and Water Environment Research Foundation *Leaders Innovation Forum for Technology* (aka LIFT) Program which will develop and share information about technology performance.
- Integrate and help communicate how ORD research integrates with and supports our water resource needs and objectives.

Technology Innovation Cluster Initiatives

- Assist ORD in supporting regional technology innovation "cluster" efforts such as *Confluence*¹ including support for reciprocal protocols for technology evaluation and acceptance.

¹ EPA's Office of Research and Development (ORD) is EPA's lead for networking with Regional technology innovation clusters, which are geographic concentrations of interconnected firms – businesses, suppliers, and service providers – and supporting institutions – local government, business chambers, universities, investors, and others – that work together in an organized manner to promote economic growth and technological innovation.



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Institutionalizing Technology Innovation

- Pursue ways to promote technology innovation more as a part of our culture, including through recognition in the 2014 OW Program Guidance.
- Facilitate development of a network of “Innovation Champions” in the Regions and OW.

Looking for the “Regulatory Space” to Foster Technology Innovation

- Explore ways to create opportunities to foster technology innovation on a site specific basis. EPA’s Integrated Planning Framework (Stoner-Giles Memo dated June 5, 2012) is an example forum.
- Consider ways the effluent guidelines program can more explicitly foster opportunities for technology innovation during the development and implementation of the guidelines.
- Support innovative financing efforts for water, wastewater and stormwater infrastructure including green infrastructure.

Partnering and Leveraging Actions with Others

- Work closely with our State partners to explore how CWA and SDWA Programs can promote technology innovation.
- Work closely with ORD to assure that its research aligns with OW’s efforts to support technology innovation.
- Explore ways to optimize the collective efforts of DoE, DoT, USDA, Commerce, and other federal partners to promote technology innovation for clean and safe water.
- Explore how cooperative agreements with the Heinz Center² and others can help foster effective dialogues and actions.
- Support the efforts of NACWA, WEF, WERF, U.S Water Alliance and others to rethink how wastewater utilities can be “utilities of the future” and “centers of regeneration” that emphasize water, energy and nutrients as resources.

Comments/Feedback: As indicated previously, this Technology Innovation Blueprint (Version 1.0) is an evolving plan for promoting innovative technology to help solve the water resource issues and opportunities framed above. The EPA Office of Water welcomes questions and feedback on this Blueprint. Questions and comments can be directed to: Jeff Lape, Deputy Director, Office of Science and Technology, Office of Water, U.S. EPA, 1200 Pennsylvania Avenue, Washing DC 20460. Jeff’s email is lape.jeff@epa.gov and phone is (202) 566-0480.

² The “Partnership on Technology Innovation and the Environment” is a non-binding, non-legal, voluntary collaboration of business, government, academic, and environmental organizations (Heinz Foundation, Duke University, American University, Environmental Defense Fund and EPA) committed to accelerating the development, adoption, deployment and export of technologies that protect health and the environment.