White Paper: The Water Smart Grid Initiative

Introduction

This white paper is designed to 1) explain why Water Smart Grid ("WSG") systems are necessary; 2) describe how a WSG system would operate; 3) identify obstacles impeding the implementation of WSG systems; and 4) provide specific recommendations for overcoming those obstacles to implement WSG systems.

Background: Why Are Water Smart Grid Systems Necessary?

Water scarcity. Today, communities across the nation are facing difficult challenges in meeting their water resource needs. A 2003 Government Accountability Office report indicated that 36 states would face water shortages by 2013.[1] The California Department of Water Resources predicts that by 2020, the state will experience water shortages equal to the needs of 4 to 12 million families of four for one year.[2] On average, the per capita residential water use in the United States is 69.3 gallons of water a day, and in many areas of the country, this rate is even higher.[3] Of course, the population continues to grow, especially in areas with higher than average per capita water consumption, imposing increased demand on our already constrained water supply. This growing demand for water will exacerbate existing environmental and conservation concerns, as well as result in significant water price increases.

Aging infrastructure. A large portion of the nation's water infrastructure dates back to the 1940s or earlier and was constructed as needed over time. As a result, today's water system is running on aging and crumbling infrastructure, including millions of miles of buried pipes of various types, such as new and lined metal pipes, plastic pipes, wood pipes of old construction, and unlined pipes that are more than 60 years old. Since most utilities expanded and automated over a 30-year time frame while technology was rapidly advancing, many of these utilities were left with disparate technology or a "mixed system" of different manufacturers, types, and models of automation equipment.

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[1] Government Accountability Office, *Freshwater Supply: States' Views of How Federal Agencies Could Help Them Meet the Challenges of Expected Shortages*, at 5 (July 2003).

[2] American Society of Civil Engineers, *2009 Fact Sheet*, at 27 (2009).

[3] The American Water Works Association, found at http://www.drinktap.org/consumerdnn/Home/WaterInformation/Conservation/WaterUseStatistics/tabid/85/Default.aspx.

For water utilities, energy costs account for 60 to 70 percent of operating expenses.[10] This sizable energy use accounts for 7,150 metric tons of greenhouse gas each year. In fact, 19 percent of the electricity used in California goes towards treating and moving water.

Indeed, water scarcity, aging water infrastructure, water quality, water distribution, and the impact of inefficient water use on our energy consumption pose significant challenges that will only worsen as the population grows, and policy makers must consider the best way to reform our nation's water distribution system.

How Would a Water Smart Grid Operate?

One innovative approach to addressing water scarcity, promoting efficient water use, updating the existing water infrastructure, improving water quality, and reducing water-related energy consumption is the development and implementation of smart grid systems for water similar to those that have been used for electricity distribution.

A WSG system would direct an innovative technology suite, including smart water meters, sensors, advanced modeling, water mapping, smart irrigation, autonomous robots, and other technologies, that would work together to create a data-driven system for the intelligent management of water resources. These systems would be comprised of a network of hardware and software that continuously monitors water use in homes, office buildings, and agricultural irrigation systems; water treatment plants; individual groundwater withdrawals; and delivery and allocation schemes to provide consumers and utilities with real-time information on water consumption from consumer, commercial, industrial, and agricultural endpoints and users.

Smart water meters would be able to send data to water companies several times a day, rather than a few times a year. Additionally, a variety of sensors would be embedded throughout the supply, distribution, and treatment infrastructure for real-time, remote monitoring and management of key parameters, such as flow, pressure, temperature, quality, storage levels, consumption and energy usage. These sensors would be designed to communicate standardized data at the same frequency to ensure that the information communicated could be easily understood and analyzed by consumers and water companies. These innovations would enable a detailed analysis and understanding of the operation of our nation's water distribution system that is not available today.

[10] Electric Power Research Institute, *U.S. Electricity Consumption for Water Supply and Treatment -- The Next Half Century*, Water & Sustainability: Vol. 4 (2002).

real-time wireless technology enables farmers and clients to achieve 15 percent to 30 percent in water savings.[12]

Ultimately, WSG systems would enable the sustainable management of water resources through the application of technology innovation, incentives, and policy.

What Obstacles Are Preventing the Development of a Water Smart Grid?

Unfortunately, there exist significant barriers to the development and implementation of WSG systems.

Awareness. There is low awareness about the existing water crisis among some policy makers and consumers and the imperative and urgent need to address this crisis. There is also a lack of information and understanding about the water management benefits of WSG systems and the recent advances in technology solutions that will enable us to implement them.

Funding. Adequate funding is necessary to implement WSG systems. In the current fiscal environment, federal funding for water infrastructure is scarce and has been put on the back burner due to competing demands. Yet, every year, the estimated price tag for repairing the nation's water infrastructure rises. According to the ASCE, America's drinking water systems face an annual shortfall of at least $11 billion that is needed to replace aging infrastructure, and this does not account for growth in demand for drinking water over the next 20 years.[13] Yet, the economic stimulus legislation in 2009 contained only about $10 billion for U.S. water infrastructure projects – out of a $787 billion in total stimulus. According to a 2002 Government Accountability Office report, the EPA and water utility industry groups estimated that communities would need an estimated $300 billion to $1 trillion over the next 20 years to repair, replace, or upgrade aging drinking water and wastewater facilities; accommodate a growing population; and meet new water quality standards.[14]

Incentives. The federal government provides no meaningful incentives for companies that can produce innovative water technology to enter and invest in this market. Technology companies would have to invest high upfront purchase costs while lacking an understanding of lower lifecycle costs. There is also a lack of agreed upon return-on-investment models by these technology providers. This problem is particularly acute for public systems that face budget constraints. In contrast, the federal government has been significantly more aggressive regarding electricity smart grid systems, with the stimulus bill including at least two programs providing specific funding for smart grid systems[15] and with two tax provisions creating incentives, one for smart electric meters and one for smart grid systems.

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[12] www.irz.com

[13] *2009 Infrastructure Fact Sheet*, at 2.

[14] Government Accountability Office, *Water Infrastructure: Information on Financing, Capital Planning, and Privatization*, at 2 (Aug. 2002).

[15] The stimulus bill appropriated $3.4 billion for the "Smart Grid Investment Grant Program" and $650 million for "Smart Grid Demonstrations."

Establishing WSG pilot demonstrations in specific locations would enable federal agencies to highlight their work to further the development and implementation of WSG systems without generating significant controversy. EPA's successful "Brownfields Showcase Communities" program serves as a successful model. The Brownfields program began as a partnership of federal, state and local agencies in 16 communities. The program had three main goals: 1) to promote environmental protection and community revitalization, 2) to foster public and private partnerships, and 3) to develop national models demonstrating the benefits of public and private collaboration. In large part because of the success of these initial showcase communities, Congress subsequently enacted a Brownfields law that has provided funding for hundreds of communities across the country. Creating a showcase communities initiative for WSG projects could similarly demonstrate the Administration's commitment toward water conservation and efficiency. These projects would also transfer past and ongoing research and development results as well as intellectual property to real-world applications that would serve as a foundation for long-term financial and technical support for WSG projects.

- **Congress and the Administration should support and fund research and establish tax and other incentives for WSG.**

Research is needed to maximize the capability of WSG, and tax and other incentives for utilities/municipalities, industry, and consumers to accelerate their purchase and deployment of WSG. These incentives could also come in the form of grants, loans, and loan guarantees.

- **NIST should develop standards for WSG technology.**

Establishing standards and protocols for interoperability for technologies would encourage companies to begin investing in producing the innovative water technology that is needed for WSG systems.