WWEMA

Water & Wastewater Equipment Manufacturers Association Inc.

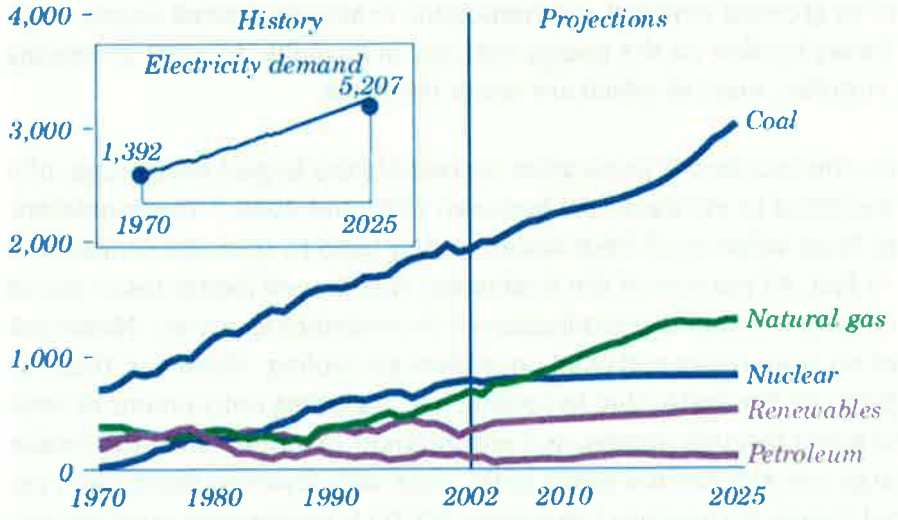
WATER / ENERGY NEXUS POSITION PAPER

1) Issue Statement

In almost every circumstance water and energy are inextricably co-dependent. Yet, if present practices remain unchanged they are on a collision course of supply and demand that has already proven to be unsustainable. Some industry experts have referred to this interdependent intersection of water and energy scarcity as the water/energy nexus choke point.

Many major ground water aquifers are already seeing reductions in water quality and yield.[1] Water shortages are now common throughout the Western U.S. and double-digit population increases are predicted nationally--even in some of the driest areas. Recent trends in climate change are only serving to further exacerbate the scale and scope of the problem. Alternative energy sources can be more water intensive than traditional energy sources. As industry strives to address climate change by evaluating alternative energy sources, we must not lose sight of the need to preserve our high national standards of water quality while working to conserve this precious resource.

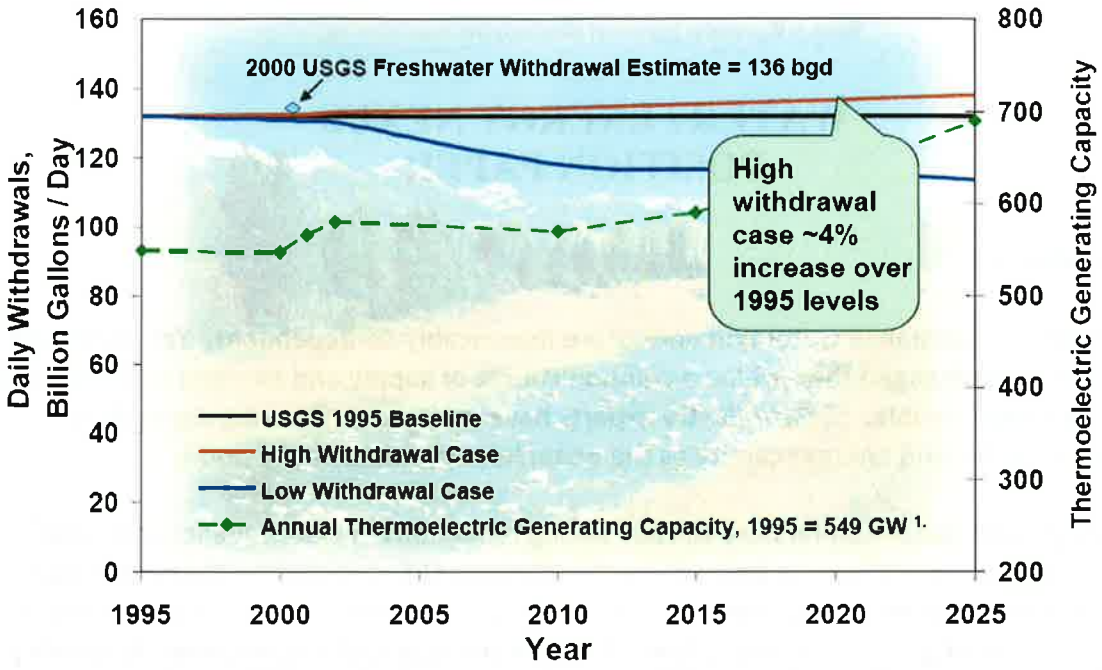
Electricity generation by fuel, 1970-2025 (billion kilowatt-hours)



Source: Energy Information Agency, AEO 2004

[1] Sanda National Laboratories. 2010 Mike Hightower. *Energy and Water.* DOE/EIA Energy Conference presentation.

Daily Freshwater Withdrawals Needed to Meet Forecasted Increases in Thermoelectric Capacity



Source: DOE/NETL, "Estimating Freshwater Needs to Meet 2025 Electricity Generating Capacity Forecasts," June 2004

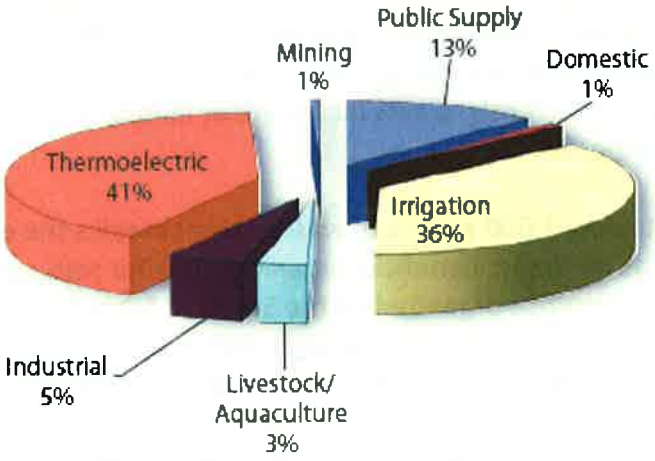
The population of the U.S. is expected to reach 440 million by 2050 and energy demand is on track to increase by 40 percent. Water prices continue their upward trajectory, increasing at a rate of 8% - 9% throughout much of 2010. However, water prices still do not reflect the true cost of providing this essential resource. Until water is priced in relation to the value provided and the cost to produce, there will be no incentives to better utilize that resource, nor give any consideration to the water-related aspects of renewable energy options. Future energy costs are going to be defined by growing demand and reductions in already limited supply. Higher water prices will place a heavy burden on the energy industry in its ability to meet increasing demand for affordable energy supplies, most of which are water intensive.

In the United States, thermoelectric generation represents the largest percentage of electricity production and is expected to increase 18% between 2005 and 2030.[2] Thermoelectric power generation requires large volumes of fresh water, mostly used to cool and condense steam after it exits the turbine. In fact, 41 percent of the freshwater withdrawal (water taken out of lakes and rivers) is used for cooling water in the production of thermoelectric power. Historically, power plants were located on large rivers and used once through cooling. However, there are environmental impacts on the water due to cooling use, including entrapment of small organisms which are damaged going through pumps, and entrainment of larger fish in the intake screens. The thermal discharge can also harm a water body, especially lowering the oxygen content of the water. The National Energy Technology Laboratory (NETL) is researching methods to decrease the impact of electrical power production on water resources. One method being researched is the use of treated municipal wastewater for process and cooling water. According to the National Energy Technology Laboratory, "Eighty-one percent of power plants proposed for construction

[2] Biswas, A.K. and Tortajada, C. (2009). *Water Management in 2020 and Beyond.* Berlin, Germany: Springer-Verlag

would have sufficient cooling water supply from one to two publicly owned treatment works within a 10 mile radius, while 97 percent would be able to meet their cooling needs with one to two POTWs within 25 miles of these plants." The United States withdraws approximately 410 billion gallons of water per day from its rivers, lakes, aquifers and the sea. About half is used to cool thermoelectric power plants.[3] Water and wastewater equipment providers can help meet power production cooling needs and help the environment by reducing the freshwater withdrawal from lakes and rivers.

U.S. Freshwater Withdrawal in 2005



Source: Overview of NETL's Water Energy R&D Activities – September 2010

Energy production requires water, whether it is a conventional fuel or an alternative fuel. For example: a thermoelectric power plant consumes 300 to 400+ gallons of water per megawatt; a natural gas power plant consumes 100 to 180 gallons of water per megawatt;[4] to produce a gallon of conventional oil or gas requires 1.5 gallons of water. Alternative sources of energy are even more demanding on water resources. For example: biofuels require 4 gallons of water to process each gallon, not to mention thousands of gallons in irrigation water to grow the feedstock (1,000 gallons water to produce one gallon of ethanol from corn; 6,500 gallons water of water to produce one gallon of biodiesel from soybeans); oil shale requires 2 to 3 gallons of water per gallon to produce; and concentrating solar power generation requires 740 to 900 gallons of water per megawatt. It takes water—and a good deal of it—to produce energy, no matter how you approach the process.

Conversely, it takes a good deal of energy to move, handle, and process water. Pumping ground water from 120 feet requires 540 kilowatts per million gallons and from 400 feet the requirement is 2,000 kilowatts per million gallons. In fact, 75 percent of the cost of municipal water processing and distribution is for energy (typically in the form of electricity).[5] Municipal water supply and wastewater treatment systems are among the most energy-intensive facilities owned and

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[3] Circle of Blue. 2010. Keith Schnider. *In Era of Climate Change and Water Scarcity, Meeting National Energy Demand Confronts Major Impediments.*

[4] U.S. Department of Energy. 2006. *Report to Congress on the Interdependency of Energy and Water.* Washington, DC.

[5] Ibid

operated by local governments and account for about 35 percent of energy used by municipalities.[6] Water supply and treatment processes use nearly four percent of all U.S. power generation.[7] If drinking water and wastewater systems reduce energy by just 10% through cost-effective investments to improve energy efficiency, collectively they could save approximately $400 million and 5 billion kWh annually.[8] The EPA's Energy Star Portfolio Manager is a great tool to help wastewater utilities to develop an energy management plan and track energy efficiency improvements. However, somewhat ironically, the energy potential contained in wastewater and biosolids exceeds by ten times the energy used to treat it, and has the potential to meet up to 12 percent of the national electricity demand. Even today, some of the world's best performing wastewater treatment plants can produce 100 percent of the energy they need to operate.

There are 16,583 publicly owned wastewater treatment facilities in the U.S. and these plants produce over 64 pounds of biosolids per person, every year. The U.S. produces 7.2 million metric tons of "dry solids" annually. (Currently, plants incinerate or landfill 45 percent of the biosolids, and treat and land apply 49 percent.)[9]

It has been calculated that every 1,000 gallons of wastewater contains the equivalent of $1.88 worth of fertilizer, energy as methane, beneficial organic matter for soils and clean water. In an example used in a recent conference organized by the Stanford School of Engineering, the City of Palo Alto treatment plant, which processes an average of 24 million gallons per day, has a calculated potential to generating $16.5 million a year in energy and by-products.[10]

Most experts agree that innovation will bring increased opportunities for energy reduction and water preservation as it relates to the water and wastewater industry. However, there are currently serious barriers to the pursuit of these opportunities.

While some of these barriers are purely scientific in nature, most are financial in form. Today, there are $25.1 trillion in the U.S. marketplace ($2.71 trillion in social interest funds)[11] and venture capitalists are investing 4 to 6 billion dollars each quarter in "Clean Technology Deals"[12], but this money is not finding its way to technology development investments in the water and wastewater sector.

In the water and wastewater industry, innovation—such as is needed to avoid the predicted water/energy nexus choke point—is currently strangled by several factors. One of the most devastating is the condition of current patent protections, which provide only rare protection for

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[6] American Council for an Energy-Efficient Economy. 2005. R. Neal Elliott, Ph.D., P.E. *Roadmap to Energy in the Water and Wastewater Industry*. Report Number IE054. Washington, DC.

[7] U.S. Department of Commerce, Office of Energy & Environmental Industries. *Water and Energy: A View to Industry Symbiosis.*

[8] http://www.epa.gov/owm/waterinfrastructure/pdfs/guidebook_si_energymanagement.pdf

[9] The National Association of Clean Water Agencies. 2009. *Renewable Energy Recovery Opportunities for Domestic Wastewater*. Washington, DC.

[10] Stanford University. 2010. Research Profile. *Wastewater Summit Highlights the Value of Regarding Sewage as a Rich Resource*. Palo Alto, CA.

[11] Social Investment Forum. 2010. *Socially Responsible Investing Facts*. Washington, DC.

[12] PricewaterhouseCoopers/National Venture Capital Association. 2010. *MoneyTree™ Report*.

inventions (and the investors that fund them) from exploitation by foreign duplicators. Another, barrier to innovation is the predominance in the U.S. of procurement practices that focus primarily on initial capital costs almost to the exclusion of life-cycle cost considerations. Further, the "OR EQUAL" language found in local, State, and Federal procurement laws/procedures can block the economic driver for innovation as specific advantages are all but erased by this rule on bid day.

One barrier to improved technology is local, State, and Federal procurement laws/procedures. This barrier can be broken down into two sub-components. The first sub-component is the laws/procedures requiring municipalities and consulting engineers to specify "OR EQUAL" equipment. Specifying competing products that are truly equal is generally fine and even healthy for the industry. The problem arises with the accepted definition of "EQUAL." In most cases to be EQUAL, the product must simply meet the process performance criteria written in the specifications. Total life cycle costs (i.e.: The life of the product, Maintenance costs over the life of the product, Energy costs associated with the product, etc.) are not evaluated as part of the procurement decision. As a result, if the product meets the process performance criteria, projects are won on bid day with the lowest initial cost and not necessarily with the lowest cost of ownership. Equipment should only be considered EQUAL if the life of the products are the same, average maintenance costs over the life fall within a comparable range, and operational costs (i.e.: energy) fall within a comparable range. The second sub-component is the laws/procedures requiring manufacturer's to have X number of proposed equipment installed at other sites, and to have been operating for a specified time period to qualify. While this seems logical to ensure proven equipment is being used, it makes it extremely difficult to penetrate the market with new and improved technology. Such new and improved technology could have a major impact on reducing the energy requirements of any given plant, however, with the current procurement practices, too often older; less energy efficient equipment is being purchased. Local state and federal agencies should work towards quicker acceptance and availability of new technology.

While there is ample interest in investing in water technologies as the next "liquid gold", the return on investment on innovation in the industry is so protracted that it is ultimately unattractive. For example: it can take more than ten years to achieve industry acceptance in the current climate of state-by-state pilot testing, limited direct funding available to municipalities, and large penalties for any system lapses or leaks during trial and testing procedures. These factors make investors reluctant to invest and system specifiers, owners and operators reluctant to experiment with innovative products.

Government funding is generally in pure research and does not cross over into commercialization. Likewise, research at universities and labs is not funded in a manner that supports commercialization or scale.

Is there, perhaps, a business model that would optimize private capital, government funding and the research capabilities of universities toward the water/energy nexus?

Is there a solution that will bring us into the future quickly enough to avoid a choke point in water and energy?

Bottom line, the private sector is on the front line of delivering realistic solutions to the challenges of the water/energy nexus, but first we have to answer salient question: where's the incentive financially for the innovation that is now urgently needed in the water and wastewater industry.

2) Water-Energy-Climate Legislation in the 111th Congress

H.R. 469 – Produced Water Utilization Act of 2009
Sponsor: Rep. Hall, Ralph [TX-4] (introduced 1/13/2009) Cosponsors: 1
Related Bills: None
Latest Major Action: 2/12/2009 Passed the House; referred to Senate Committee on Environment and Public Works.

Encourages research, development, and demonstration of technologies to facilitate the utilization of water produced in connection with the development of domestic energy resources.

H.R. 3598 – Energy and Water Research Integration Act
Sponsor: Rep. Gordon, Bart [TN-6] (introduced 9/17/2009) Cosponsors: 16
Related Bills: None
Latest Major Action: 12/2/2009 Passed the House; referred to Senate Committee on Energy and Natural Resources.

Ensures consideration of water intensity in the Department of Energy's energy research, development, and demonstration programs to help guarantee efficient, reliable, and sustainable delivery of energy and water resources.

H.R. 4455 - Expanding Industrial Energy Efficiency Incentives Act of 2009
Sponsor: Rep. Thompson, Mike [CA] (introduced 1/13/2010) Cosponsors: 4
Related Bills: S. 1639
Latest Major Action: 1/13/2010 Referred to House Committee on Ways and Means.

Improves and extends certain energy-related tax provisions, including tax credits for industrial process water use projects that achieve a reduction in energy consumption per million gallons of water used. [WWEMA endorsed this bill when originally introduced in the Senate as S. 1639.]

S. 531 – Energy and Water Integration Act of 2009
Sponsor: Sen. Bingaman, Jeff [NM] (introduced 3/5/2009) Cosponsors: 1
Related Bills: S. 1462
Latest Major Action: 3/10/2009 Referred to Senate Committee on Energy and Natural Resources; hearings held.

Provides for the conduct of an in-depth analysis of the impact of energy development and production on the water resources of the United States.

S. 1462 – American Clean Energy Leadership Act of 2009
Sponsor: Sen. Bingaman, Jeff [NM] (introduced 7/16/2009) Cosponsors: 0
Related Bills: S. 531
Latest Major Action: 7/16/2009 Passed the Senate Committee on Energy and Natural

Resources and awaiting final action by the Senate.

Provides for the conduct of an in-depth analysis of the impact of energy development and production on the water resources of the United States, and of the use of energy in the procurement, treatment and delivery of water, among other provisions.

S. 1639 – Expanding Industrial Energy Efficiency Incentives Act of 2009
Sponsor: Sen. Bingaman, Jeff [NM] (introduced 8/6/2009) Cosponsors: 3
Related Bills: H.R. 4455
Latest Major Action: 8/6/2009 Referred to Senate Committee on Finance.

Improves and extends certain energy-related tax provisions, including tax credits for industrial process water use projects that achieve a reduction in energy consumption per million gallons of water used. [WWEMA endorsed this bill when introduced.]

3) Recommended Position

It is recommended that WWEMA take a leadership position in the evolution of the thinking around the water/energy nexus and champion funding structures that support innovation and the development of technologies that positively impact the water/energy equation. Consider hosting a specialty conference, bringing in champions from other countries leading the way in public-private partnership technology transfer models.

It is recommended that WWEMA encourage tax credits for R&D to encourage investment in the private sector, tax credits for the manufacturing of technologies that are energy efficient and climate sensitive, tax credits for homes, businesses and municipalities to offset the cost to invest in these technologies.

It is recommended that WWEMA establish a standing committee relating to the water/energy nexus to maintain a close and continuing link with this important subject, which is likely to have impacts on all WWEMA members.

It is recommended that WWEMA bring awareness of the water/energy nexus to the marketplace and support the creation of a larger market for energy efficient technologies.

It is recommended that WWEMA strongly support the evolution of the municipal procurement process away from one that is focused only on initial capital costs toward approaches that value advantages in life-cycle costs.

We recommend input to the Commissioner of Patents regarding the overly abusive use of 35 USC 103 by the Examiners. With the help of the U.S. Supreme Court v. Telflex, the United States has gone back to a pre-1963 Supreme Court decision in Graham v. John Deere wherein the Examiners rejected everything under the Sun as being obvious. Graham v. John Deere was a good ruling and was reasonably fair to both the inventors and the examiners turned gate-keepers. Many inventors and their supporting organizations have dropped out of innovation because they have understood that none of their U.S. Patents will issue and thereby protect their ideas and investments.

Adopted by the WWEMA Board of Directors on April 21, 2011