The Intersection Between Water Scarcity And Renewable Energy

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ABSTRACT

The starting point for any discussion of the intersection between water scarcity and renewable energy is the now generally-accepted correlation between climate change and water resource impacts, which is creating further imperatives for both reduction of GHG emissions and water conservation. Most projections conclude that the water resource impacts of climate change will almost certainly be both diverse and wide-ranging, necessitating the implementation of new protocols for allocating water resources such as the Model Interstate Water Compact. However, a less obvious impact of predicted water shortages will be on the future ability to site new renewable energy facilities and, perhaps more importantly, on which types of renewable energy gain prominence in the future. Consequently, water reuse and reclamation facilities are increasingly being co-located with renewable energy projects, and, indeed, technological development in the two areas has begun to converge in ways that were completely unforeseen twenty years ago.

Keywords: water, renewable energy, Israel, water-smart technologies

1 IMPLICATIONS OF WATER SCARCITY ON DEVELOPMENT OF RENEWABLE ENERGY

In an era of increasing demand for limited water supplies, Federal programs such as the Endangered Species Act, and the increasing impetus to reserve water rights for parks, wilderness areas, and tribal lands, will further limit water availability for development of new renewable energy facilities. One manifestation of the coming water shortage is the already-increasing trend toward co-locating renewable energy projects with water reuse, reclamation and desalinization facilities. Another is the avid interest in new "water-smart" conservation technologies being developed in Israel and elsewhere overseas. While water reclamation projects typically are very large consumers of electricity and other energy resources, the inverse also is true. Energy project development, both conventional and renewable, is typically a prodigious consumer of water resources. As a consequence, the long-term physical and legal availability of water resources will likely play an ever more important role in the siting of renewable energy facilities, and in determining which renewable energy technologies gain favor over others in the marketplace.

2 OVERSEAS TECHNOLOGIES; DOMESTIC INITIATIVES

Other countries, however, most notably Israel, have experienced water shortages well in advance of those now beginning to occur in the United States, and have thus far dominated the development and implementation of innovative water resource management and reclamation technologies. Indeed, the United States is very much playing "catch up" in this area, and forward-thinking states and municipalities are looking abroad for new water reclamation technologies and models for progressive water resource management.

2.1 Virginia Israel Advisory Board

One prominent example of this trend is the initiative of the Virginia Israel Advisory Board ("VIAB"), a statutorily-created governor's office board, to recruit Israeli clean and renewable energy technology firms to Virginia, and to assist the firms in commercializing their technologies and services for introduction into the U.S. market. Recently, five Israeli clean and renewable energy technology companies were selected to participate in the CleanTech Gateway USA Program, a joint endeavor among VIAB, Dominion Energy, and the Dominion Resources GreenTech Commercialization Center. The program's purpose is to introduce to the U.S. market, through the establishment of manufacturing, distribution and marketing arms in Virginia, the products and services of Israeli companies with cutting-edge alternative energy technologies. Approximately 70 Israeli companies submitted applications to participate in the Commonwealth's "Go-To-Market" program. Of those 70 companies, 25 semi-finalists were interviewed. The five finalist companies attended three days of business development sessions in the Richmond, Virginia area, and meetings for each company were held with technology, marketing and financial experts to help facilitate the commercialization in Virginia of their respective technologies.

2.2 Water Technology Innovation Cluster

Another more dramatic example was the recent announcement by the Environmental Protection Agency ("EPA") and Small Business Administration ("SBA") that they intended to establish a "water technology innovation cluster" in the States of Ohio, Kentucky, and Indiana. EPA Administrator Lisa P. Jackson and SBA Administrator Karen Mills announced that the new initiative would be specifically aimed at encouraging the development of innovative technologies that would further the goal of protecting America's waters.

Based loosely on the Silicon Valley model of concentrating "high-tech" industries in the same geographic space, the initiative is characterized as a collaborative effort known as a "technology innovation cluster," which is designed to develop and commercialize technologies to solve environmental issues, encourage sustainability, and help create jobs.

This initiative, known as the Water Technology Innovation Cluster ("WTIC"), is intended to bring together public utilities, research partners, and innovative businesses to develop, test, and market innovative water research and water technologies that are, among other things, sustainable, energy efficient, cost effective, wide-ranging in the contaminants they address, and protective of human health and the environment. The decision to locate the WTIC in the southwestern Ohio, northern Kentucky, and southeastern Indiana region reportedly was based on the presence of EPA's water research laboratory in Cincinnati, Ohio, as well as the region's longstanding history of water research and water technology innovation. EPA has initially invested $5 million in the initiative, and expects that the WTIC will "flourish under its own power" soon, with the EPA serving as just one of many collaborating partners. Additional information about the WTIC is located on EPA's website.[1]

2.3 Other State And Regional Initiatives

Representatives from the Israeli and New Mexico water and clean technology industries recently gathered for a business seminar in Albuquerque, New Mexico, for an exchange of technologies and information, to encourage joint economic development, to expand trade, and to solidify social and economic ties between the two regions. Both Israel and New Mexico have arid to semi-arid climates, and face similar challenges in water and other resource conservation. Both regions are leading centers for innovating new technologies: for water conservation, cleaning and reclamation; alternative energy technologies; and general, leading-edge research into new sciences.

As witnessed by the examples discussed above, additional technology clusters are almost certain to take root in other regions of the country, as EPA and the states strive to catch up with international initiatives. Indeed, the public-private partnership model espoused by EPA has its roots in overseas efforts, where it has proven to present both fertile ground for technological innovation, as well as significant opportunities for economic growth and a forum for networking with other interconnected businesses, suppliers and service providers.

3 CASE STUDIES: WATER RESOURCE AND RENEWABLE ENERGY TECHNOLOGICAL CONVERGENCE

3.1 Water Conservation And Technology Convergence: "Water Smart Grid"

Global investment in "smart" water meters for the years 2010 to 2016 will total $4.2 billion, according to Pike Research.[2] Growth in water demand is pushing utilities to turn to infrastructure technologies to improve their operational efficiency, Pike said in a new report. One of the most important strategies for utilities will be the installation of smart water meters on customers' premises, and Pike expects 31.8 million of these units to be installed by 2016, up from 8 million in 2010. The annual market revenues for smart water meters will reach $856 million by the end of 2016, a 110 percent increase over 2010 levels, Pike said. Other technologies that water utilities are installing include advanced sensor networks and automation systems to allow more accurate leak detection, Pike said.

In a recent report[3], Lux Research argues that the most lucrative solutions will arise from technologies that can monitor the entire water infrastructure and allow owners to target sections in most urgent need of repair. Most drinking water companies still rely on acoustic techniques to find leaks, while both drinking and wastewater companies use closed-caption TV to survey pipe systems. Both techniques, however, are labor-intensive and scale poorly, offering scattershot and often poorly documented information about pipe networks.

There are similarities between the electrical grid and the water grid. Both are crucial components of societal infrastructure that are sprawling, aging and haphazardly planned. And in both cases, although there is some intelligence at the nodes, the systems are not very effectively networked.

One Israeli startup provides water infrastructure monitoring as a service and acts as the "online eyes and ears" of the network. The firm's software-as-a-service model allows water utilities to reduce water loss and improve operational efficiency with no network changes or capital expenditures. Their system is based on mathematical and statistical algorithms that use readings

from existing water metering equipment (flow, pressure, quality, turbidity, etc.).[4]

In sum, although Smart Water offers equal or potentially greater benefits than Smart Energy, Smart Water isn't getting equal coverage. In part, this stems from the fact that urban water distribution systems are not exactly "grids." A lot of energy (and money) is invested in water production, treatment, distribution and reuse, but current water systems don't comprehensively measure usage in real-time. Without measurement, there is no data to base grid management upon. The electric Smart Grid leverages the proliferation of measurement points collecting large amounts of (largely untapped) data, but this is not the case in water networks. Nonetheless, the data revolution in the water space has already begun. In fact, analyzing available flow and pressure data to determine anomalies in real-time, or scheduling pumps and valves according to energy consumption peaks and lows, is already part of the Smart Water solution today. There's no shortage of data in distribution networks. However, we're seeing signs of a change, and experts and analysis finally have acknowledged the intersection of water and IT.[5]

3.2 Wastewater Treatment To Energy Generation

Wastewater-to-energy technology is another example of the emergence of technologies intended to address the dual concerns of water quality/availability and the need for increased renewable electricity generating capacity.

However, there are regulatory challenges to the siting and operation of these types of facilities which may or may not be present with regard to other "convergence" technologies. For example:

- The construction of a new wastewater-to-energy facility might require a Clean Water Act Section 404 permit (depending on the proximity to a discharging water body). Of course, this would not be a concern if the technology was instead being used to retrofit an existing wastewater treatment facility.

- Consideration would need to be given to whether the wastewater discharge from the proposed facility would be into a water body that already has established and fully allocated total maximum daily loads ("TMDLs"), in which event there may be little room for additional load. However, this potential concern is mitigated by the fact that such facilities, by their efficient removal and beneficial reuse of the solids content of the incoming wastewater, typically discharge a cleaner treated wastewater.

- Other considerations include the fact that stricter standards for treated wastewater intended for reuse and for the land application of sludge material are likely in the near future, due largely to the increased presence of pharmaceuticals and personal care products ("PPCPs") in wastewater. However, to the extent that a wastewater-to-energy technology is applied as part of a pre-treatment system, it might well be easier for the treated discharge to meet water quality standards.

- Finally, an investor in a wastewater-to-energy venture should be mindful of some potential commercialization issues. For example, if it is contemplated that there will be a joint venture with a municipality or other political subdivision, there are certain regulatory issues that may arise dealing with taxes, bond issuance, and the like.

The "upside" to implementing or investing in a wastewater-to-energy venture is potentially huge. The new technologies revolutionize the economics of wastewater treatment by generating, instead of consuming, energy. Moreover, there are a variety of technologies which show promise in this field. One uses electrogenic bacteria to produce electricity from wastewater while cleaning the water. Others trap and extract wastewater bio-solids, and utilize the extracted bio-solids to produce a range of renewable energy products, including combustibles for power plants, feedstock for cellulosic ethanol production, and pulp products for the paper industry.

3.3 Harnessing Wave And Tidal Energy To Generate Power

One of the most interesting and promising water/energy convergence technologies involves efforts to find a way to harness energy out of ocean waves and tides for commercial use. Historically, these technological attempts suffered from a threshold problem -- low efficiency. However, new technologies finally have been successful in effectively capturing the driving force in a wave cycle to create energy. Like other successful water/energy convergence technologies, one of the most advanced wave technology originated in Israeli research and development laboratories.

In addition, a new generation of technologies has been successful in converting river, tidal, and deep water ocean currents into clean, predictable, competitive supplies of electricity. Even greater advances lie ahead.

4 CONCLUSION -- THE FUTURE OF WATER/ENERGY TECHNOLOGICAL CONVERGENCE

Both water reclamation and renewable energy projects are on the rise. There can be many benefits to co-locating such projects, and/or investing in or implementing one of the new generation of convergence technologies. However, it must be kept in mind that each project will have different

goals and challenges, and must be considered accordingly. Therefore, our advice is to do your homework, work the process, set your goals and priorities, and spend the time and money to get good advice from qualified professionals.

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