

# THE IMPORTANCE OF THE WATER-ENERGY NEXUS IN FLORIDA'S FUTURE

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Florida has a long history and complex relationship with its most prominent resource: water. From the early efforts to drain swamps and channelize rivers, to the more modern efforts to restore habitat and preserve the natural environment, water is at the heart of what defines the state. Yet despite the apparent prevalence of water, increased urban development, utility demands, and the massive agriculture industry place demands on this ultimately finite resource.

The U.S. Government Accounting Office (GAO) has issued a series of reports that explore the critical interplay between water and energy production. These reports provide an important overview of how energy production utilizes significant amounts of water at every stage of the process. This article explores the findings of those reports, and discusses recent proposed legislation reflecting a growing understanding of the importance of this issue by our state legislators.

## **GAO's Findings on Energy and Water**

There is significant interaction between energy and water demands because each requires varying inputs of the other to be viable. Water treatment, distribution, and disposal each generate different levels of energy demand. In areas with difficult terrain or where desalination is necessary, energy requirements escalate dramatically. At the same time, energy production has always required voluminous water availability. Thermoelectric power plants produce the majority of electricity in the U.S. These plants must have water available for cooling and steam generation. Similarly, the expansion of biofuel production has increased the demand for irrigation, which is already the largest consumer of water in the nation. Additionally, the new techniques developed for oil and natural gas extraction all rely on significant water inputs.

## **Thermoelectric Power and Water: GAO-10-23**

The GAO first began to examine this issue in 2009 with the release of its report, "Energy-Water Nexus: Improvements in Federal Water Use Data Would Increase Understanding of Trends in Power Plant Water Use."<sup>1</sup> The report found that as of 2007, thermoelectric power plants generated approximately three-fourths of the electricity in the United States. These plants rely on massive water inputs to moderate temperatures during the

power generation process. Although this water is not “consumed,” but rather returned to the source at an elevated temperature, it nevertheless mandates an uninterrupted water source.

As with many water-energy issues, the location of a thermoelectric plant is a major determinant as to whether a current or future water constraint will exist. Because the cooling process can rely on virtually any water source, siting options vary. However, even when there is an adequate water supply, the use of the water can still have negative environmental impacts. For example, the cycling and increased temperature of the outflow can impact the surrounding water bodies.

There are alternatives to the current standard operational models that require less water, but these alternatives can be both costly and less efficient. Air-cooled steam cycling is one such alternative. However, because the heat density that air will readily absorb is much lower than that of water, the energy generation rates and the capital costs to implement this technology result in a higher energy-output cost. Another approach involves utilizing alternative water sources, such as treated effluent or groundwater that is unsuitable for drinking. Again, however, the cost and availability of such water sources are hurdles to modifying the status quo.

In conclusion, the 2009 report identified two important issues. First, the GAO recognized a need for accurate data on the water demands of standard thermoelectric plants and how various new technological approaches could reduce or modify these demands. Second, the GAO identified the need for an increased level of coordination between the federal agencies charged with overseeing both energy permitting and water management. The report specifically called for the Energy Information Administration and the U.S. Geological Survey to collaborate on these issues going forward.

### **Biofuels and Water: GAO-10-116**

Immediately on the heels of their initial report, the GAO released, “Energy-Water Nexus: Many Uncertainties Remain about National and Regional Effects of Increased Biofuel Production on Water Resources.”<sup>2</sup> Proponents originally touted biofuel as a way for the U.S. to reduce its reliance on imported fossil fuels. Early concerns included the high cost of the technology and whether government subsidies would be required to make biofuel an economically viable alternative. Over the course of time, two different issues emerged as critical: 1) the extent to which crop production for biofuel will displace and impact the cost of food production; and 2) the impact of increased agricultural production on persistent water shortages.

Irrigation for agriculture is the largest consumer of fresh water in the U.S. At the same time, the conversion of feed stocks into fuel requires water input during the fermentation, distillation, and cooling processes. The significance of these issues is location specific. For instance, in areas where rainfall is adequate for most of the growing season, irrigation demands are not problematic. However, the GAO reports that significant increases in corn production for biofuel have occurred in areas of the country where water shortages are persistent.

Improved farming techniques and modern fertilizers and pesticides have significantly increased agricultural production levels per acre farmed. Yet there are ultimately limits to what these techniques can achieve; they cannot displace the base water demands for crop production. New feed stocks for biofuel, including algal and cellulosic materials, are being explored but the viability of producing these on a commercial scale has yet to be demonstrated. Thus, the anticipated water demands of these approaches remains unknown.

The GAO biofuel report highlights the interplay between water use, aquifer recharge rates, and biofuel production. The GAO concludes by warning that policies encouraging the expansion of biofuel production must keep an eye toward balancing water demands.

### **Oil Shale and Water: GAO-11-35**

“Energy-Water Nexus: A Better and Coordinated Understanding of Water Resources Could Help Mitigate the Impacts of Potential Oil Shale Development” was released in 2010.<sup>3</sup> In this report, the GAO notes that while commercial oil shale production is not currently profitable, it may become so in the future. The current technology for extracting oil from sedimentary rock formations remains water intensive. Consequently, the GAO notes that water availability might constrain the potential scale of this industry, even if it were to become cost competitive. For future consideration of the impacts and viability of this fuel source, the GAO again asserts the need for greater baseline data on a regional scale of existing water availability and demand.

### **Energy Demands of Water Production: GAO-11-225**

The GAO next issued “Energy-Water Nexus: Amount of Energy Needed to Supply, Use, and Treat Water Is Location-Specific and Can Be Reduced by Certain Technologies and Approaches.”<sup>4</sup> This report, issued in 2011, examines the flip side of the equation — considering the energy demands for supplying potable water as opposed to considering the water demands for energy production. Energy is required at every stage, beginning

with the water withdrawal and treatment process, through conveyance to households and businesses, and during the wastewater collection and disposal process. Hot water heating alone generates a significant portion of household energy demand.

As the title suggests, the greatest energy inputs occur when water must be transported over great distances or across significant terrain. This fact has implications beyond energy demand, calling into question the logistics of locating communities and businesses. A clearer picture of where water capacity is available could assist policy makers in determining how to direct future development.

The GAO report on water supply explains that efforts to reduce domestic and commercial water use not only reduce the strain on the water supply, but also directly decrease energy demand. The GAO notes that technological advances in water delivery and treatment can result in energy savings, but the cost of retrofitting existing systems often creates a significant barrier to implementation of these improvements.

#### **“Produced Water”: GAO-12-156**

In early 2012, the GAO released, “Energy-Water Nexus: Information on the Quantity, Quality, and Management of Water Produced during Oil and Gas Production.”<sup>5</sup> “Produced” water is a term of art meaning wastewater produced during oil extraction and refinement. This water has varying levels of contamination and the appropriate level of treatment and disposal is dependent upon those levels. The water generated by hydrocarbon production can be reused in instances in which there is little to no contamination. In other cases, where the water is too contaminated for reuse, it is often re-injected into wells made for that purpose. While this approach may be permissible, the GAO recommends that these re-injection wells be adequately documented and monitored to ensure that the wastewater is not posing a threat to other water or ecological resources.

#### **Summary Report: GAO-12-880**

Finally, in September 2012, the GAO released “Energy-Water Nexus: Coordinated Federal Approach to Better Manage Energy and Water Tradeoffs.”<sup>6</sup> In this summary report based on the prior reports, current literature on the topic, and interviews of specialists in the field, the GAO concludes that while new technologies can mitigate the constraints of water and energy and the demand for both, policies must be created to eliminate the barriers to implementation of these practices.

In the report, the GAO stresses that without better comprehensive data and research, the U.S. risks having an escalating problem without a solution. Complicating the problem are the different levels of permitting required for water use in various regions and states. This inconsistency makes it difficult to create a holistic picture of where the fewest water supplies and greatest demands for water exist. Furthermore, until the potential impact of new technologies is adequately gauged, policymakers will be hard pressed to determine the most effective and efficient ways to address the problem.

The report also reiterates the critical importance of coordination among governmental and nongovernmental entities in reviewing and permitting water and energy projects. This collaboration requires sharing relevant data and helping shareholders and citizens understand what the impacts and future constraints may be. The report notes that new federal legislation has been proposed that may assist in achieving the goals stated. This legislation is examined below, along with its potential impacts.

### **New Proposed State Legislation**

Senate Bill 948, introduced by Sen. Denise Grimsley (R-Sebring), addresses regional water supply, revealing an increasing awareness in Florida that water supply is a regional issue requiring uniform data and participation by all parties to ensure the future availability of adequate water supplies.

Regional water supply plans have been statutorily mandated in Florida for some time and are maintained by a network of five water management districts. SB 948 would increase the scope of and participation in the formation of the regional supply plans. The bill expands the list of entities involved in the formation of the plans to include utility companies, private land owners, water consumers, and the Department of Agriculture and Consumer Services. Requiring utility companies to be at the table is an important step in recognizing that the water-energy nexus will continue to play an important role in Florida's future.

The bill also highlights the need for the water management districts to involve and assist "self-suppliers," including parties using private wells or onsite detention to meet their water demands. These self-suppliers are often large water users in agriculture, and the bill seeks to ensure that their needs are met and the impact of their use is addressed.

Finally, the bill requires the Department of Agriculture and Consumer Services to prepare data concerning historic, existing, and future water demands for the agriculture industry throughout Florida. This improved data aims to give the water management districts the tools they need to improve the efficacy of the regional water supply plans.

## Conclusion

The issues of water use, energy, and population growth continue to be linked as resources become more limited. Elected officials are continually forced to reprioritize water usage as energy production diverts water resources away from traditional purposes. Similarly, increasing domestic and industrial water demand and usage will require additional energy input. Although expanding water and energy resources is a worthy endeavor, legislators will nonetheless have to balance these goals to avoid increasing one at an unacceptable expense to the other.

Together, the GAO reports and recent legislative proposals demonstrate that our national and state leaders are aware of the interplay between these valuable resources. However, legislation such as SB 948 only begins to address the complicated relationship between agriculture, energy, and water use in Florida. Developing innovative sources of both water and energy will be critical as the state continues to grow and flourish, while seeking to protect the natural resources for which the state is known.

<sup>1</sup> U.S. Government Accountability Office, Report to the Chairman, Committee on Science and Technology, House of Representatives, *Energy-Water Nexus: Improvements to Federal Water Use Data Would Increase Understanding of Trends in Power Plant Water Use* (Oct. 2009), available at <http://www.gao.gov/assets/300/296960.pdf>.

<sup>2</sup> U.S. Government Accountability Office, Report to the Chairman, Committee on Science and Technology, House of Representatives, *Energy-Water Nexus: Many Uncertainties Remain About National and Regional Effects of Increased Biofuel Production on Water Resources* (Nov. 2009), available at <http://www.gao.gov/assets/300/299103.pdf>.

<sup>3</sup> U.S. Government Accountability Office, Report to Congressional Requesters, *Energy-Water Nexus: A Better and Coordinated Understanding of Water Resources Could Help Mitigate the Impacts of Potential Oil Shale Development* (Oct. 2010), available at <http://www.gao.gov/assets/320/311896.pdf>.

<sup>4</sup> U.S. Government Accountability Office, Report to the Ranking Member, Committee on Science, Space, and Technology, House of Representatives, *Energy-Water Nexus: Amount of Energy Needed to Supply, Use, and Treat Water Is Location-Specific and Can Be Reduced by Certain Technologies and Approaches* (Mar. 2011), available at <http://www.gao.gov/assets/320/316893.pdf>.

<sup>5</sup> U.S. Government Accountability Office, Report to the Ranking Member, Committee on Science, Space, and Technology, House of Representatives, *Energy-Water Nexus: Information on the Quantity, Quality, and Management of Water Produced during Oil and Gas Production* (Jan. 2012), available at <http://www.gao.gov/assets/590/587522.pdf>.

<sup>6</sup> U.S. Government Accountability Office, Report to the Ranking Member, Committee on Science, Space, and Technology, House of Representatives, *Energy-Water Nexus: Coordinated Federal Approach Needed to Better Manage Energy and Water Tradeoffs* (Sept. 2012), available at <http://www.gao.gov/assets/650/648306.pdf>.

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