Oil and Water: Fueling Questions

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On a recent routine Saturday afternoon trip to the grocery store I bought a gallon of bottled water for $2.45. On my way home I stopped to fill up my tank with gasoline, for about the same price per gallon. For some reason, that struck me as odd. Were water and gasoline really of equal value? I began to think about the way societies and governments value, protect, use, depend upon, litigate, and even go to war over both oil and water. For scientists and lawyers who follow water and energy resource issues, there is already recognition that water is the next oil, a scarce resource that must be carefully protected and managed. There is also recognition that water and energy are inextricably linked and that while we may be able to replace oil or coal with other types of renewable energy resources, there is no replacement for water. We may be able to run our cars and heat our homes with energy generated by wind, sun, corn, or switchgrass, but we cannot drink, bathe, or water our lawns with any of those; we must have water. So the bottle of water and the gallon of gasoline prompted some exploration, which is the subject of this article.

First, I decided to find the answers to two questions: (1) How much water did it take to make the gallon of gasoline I just bought? (2) How much oil did it take to manufacture that bottle of water? As to the first question, according to a recent study by the World Business Council for Sustainable Development, it takes between 1 and 2 billion gallons of water per day to refine 800 million gallons of petroleum products in the United States. *See* World Business Council for Sustainable Development, Water, Energy and Climate Change: A contribution from the business community (Mar. 2009), www.wbcsd.org/DocRoot/Dg6GYWJq7xuaLO0OwZOi/WaterEnergyandClimateChange.pdf [hereinafter World Business Council]. That is in the range of 1.5 to 2.5 gallons of water per gallon of refined petroleum product. But that is not where it ends, or I should say, begins. Before the oil ever makes it to a refinery it must be extracted from its subterranean reserves. It can take anywhere from 1 to 40 gallons of water per gallon of oil for extraction, depending on the maturity of the field. *Id.* From those numbers it can be estimated that it took anywhere from 2.5 to 42.5 gallons of water to create that gallon of gasoline, not including whatever water was used in transporting the gasoline to the refinery and then to the station where I purchased it. It seems clear that I indirectly used a great deal of water to buy that gallon of gasoline.

As to the question of how much oil it took to make the bottle of water, a new study by Peter Gleick, president of the Pacific Institute, and his colleague Helen Cooley, evaluated just how much energy is used at each step of that process. According to Gleick and Cooley, "an estimated total of the equivalent of 32 million to 54 million barrels of oil was required to generate the energy to produce the amount of bottled water consumed in the United States in 2007." *See* Cooley, H. S. and Gleick, P. H. *Energy Implications of Bottled Water*. Environmental Research Letters 4 (2009) 014009, www.iop.org/EJ/toc/1748-9326/4/1. The majority of energy or oil used for bottled water is in making the plastic bottles, followed by treating the water, filling and capping the bottles, and transporting the bottles to the homes or businesses that use them. *Id.* Global sales of bottled water topped 200 billion liters in 2007, around 33 billion liters in the United States, averaging almost 30 gallons of water per person. *Id.* Using those figures, it took an estimated 0.15 to 0.26 gallons of oil to make my gallon of bottled water. (Note that production and transportation of bottled water uses up to 2,000 times more energy than that required for an equivalent amount of tap water. *Id.*)

Thus, even from these small examples it is clear: it takes abundant supplies of water to extract and refine oil, and it takes abundant supplies of oil to make bottled water available for human consumption. As the World Business Council for Sustainable Development's latest report points out, both water and energy are essential to every aspect of life: social equity, ecosystem integrity, and economic sustainability, and the global demands for both water and energy are increasing. *See* World Business Council, *supra*. Indeed, the increasing demand and potential shortage of water was addressed in a new report by CERES and the Pacific Institute, which points out that water-intensive industrial sectors, such as technology, beverage, agricultural, electric, power/energy, apparel, biotechnology/pharmaceuticals, forest products, and mining, all face serious near- and long-term economic risks related to their water dependence. *See* CERES and Pacific Institute, Water Scarcity & Climate Change: Growing Risks for Business and Investors (Feb. 2009), www.ceres.org/Page.aspx?pid=1041.

In light of this interdependence between oil and water and the growing concern about shortages of both, a more crucial question comes to mind: what are we, as lawyers, scientists, elected officials, and concerned citizens, doing about it? It appears that Congress has acted on at least a couple of fronts. On February 11, 2009, the House of Representatives passed H.R. 469, the Produced Water Utilization Act of 2009 (Act). The purpose of the Act is to "encourage research, development and demonstration of technologies to facilitate the utilization of water produced in connection with the development of domestic energy resources and for other purposes." Under the Act, "produced water" is defined as "water from an underground source that is brought to the surface as part of the process of exploration for or development of coal bed methane, oil, natural gas, or any other substance to be used as an energy source." According to Representative Ralph Hall, (R-TX), the sponsor of the bill, "there is a critical interdependency between energy and water. . . [A] barrel of extracted oil generates approximately 10 barrels of saline, brackish and generally unusable water, and the United States currently generates 5 billion gallons of produced water every day. That's enough water to accommodate 14.3 million homes." Jesse Greenspan, *House Passes Water Conservation Bills*, Law 360

(Feb. 13, 2009), www.opencongress.org/bill/111-h469/text. "Water is needed to produce energy, and the treatment and distribution of water requires energy." *Id.*

The Act provides for the Secretary of Energy to carry out a program of research, development, and demonstration technologies for environmentally sustainable utilization of produced water for agriculture, irrigational, municipal, and industrial uses, or other environmentally sustainable purposes. These programs are to be "designed to maximize the utilization of produced water in the United States by increasing the quality of produced water and reducing the environmental impacts of produced water." In other words, it is a recycling program of the highest order and importance. Program elements address: (1) produced water recovery, including research for desalination and demineralization to reduce total dissolved solids in the produced water; (2) produced water utilization for agricultural, irrigational, municipal, and industrial uses, or other environmentally sustainable purposes; and (3) reinjection of produced water into subsurface geologic formations to increase energy production. *Id.* As of this writing, the bill has not yet passed in the Senate.

Foreseeable shortages of water have also spurred Congress to address water conservation. On February 10, 2009, the House of Representatives passed H.R. 631, the Water Use Efficiency and Conservation Research Act. H.R. 631 directs the U.S. Environmental Protection Agency to establish a research and development program that promotes water efficiency and conservation, including research into technologies and storage and distribution systems. Among other things, H.R. 631 provides that the National Academy of Sciences will complete a study of strategies for the management of water supply, wastewater, and storm water, including examining the state of research, technology development, and emerging practices both in the United States and abroad; identifying and evaluating relevant system approaches for comprehensive water management, including the interrelationship of water systems with other major systems, such as energy and transportation; identifying priority research and development needs; and eventually providing key findings to Congress to serve as a practical reference that recommends innovative and integrated solutions. *See* www.opencongress.org/bill/111-h631/text. *See also* National Water Research and Development Initiative (H.R. 1145) at www.govtrack.us/congress/bill.xpd?bill=h111-1145 (introduced by Rep. Barton Gordon (D-TN); still in the Committee on Science and Technology as of Mar. 26, 2009).

In addition to water conservation efforts prompted by Congress, innovative water and energy conservation techniques are being used by many companies around the world. In its latest report, the World Business Council on Sustainable Development highlights numerous case studies of companies, from oil refineries and mining operations to water providers and detergent manufacturers, using new approaches to reduce water and energy consumption. *See* World Business Council, *supra.*

Clearly, water consumption and oil consumption are on a precariously parallel course. The cycle and flow of both resources and their interconnections must be understood and addressed. Better science, better understanding, better laws, and better choices are needed. We should all have a new appreciation for the real cost and the real value of the water and oil that sustain our homes, businesses, and lives.

All of that, from a trip to the grocery store.

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