

Energy Efficient Homes: The Energy and Water Connection¹

Nicholas W. Taylor, Brent Philpot, and Kathleen C. Ruppert²

Among the most important influences on quality of life for modern society is the availability of adequate supplies of energy and water. Fundamental relationships existing between energy and water result in a mutual dependence upon the other for generation and supply processes. During every step in the water supply process, many kilowatts of electricity are used. Because energy required for treatment and delivery of water accounts for as much as 80% of our water supply cost, an insufficient supply of affordable energy will have a negative impact on the price and availability of water.

Quick Facts

- The electricity industry is second only to agriculture as the largest user of water in the United States. Electricity production from fossil fuels and nuclear energy requires 190,000 million gallons of water per day, accounting for 39% of all freshwater withdrawals in the nation, with 71% of that going to fossil-fuel electricity generation alone.

- Coal, the most abundant fossil fuel, currently accounts for 52% of U.S. electricity generation, and each kilowatt-hour (kWh) generated from coal requires 3.3 gallons of water.
- The U.S. Environmental Protection Agency (EPA) estimates that about 8% of the nation's energy demand is used to treat, pump, and heat water.
- By 2025, Floridians are expected to use about 2 billion more gallons of fresh water each day.
- Ground water, withdrawn from an aquifer, accounts for over 60% of water used for public and domestic supply, commercial, industrial, mining, agriculture, recreation, and power generation in Florida.

Terms to Help You Get Started

- **Aquifer** An aquifer is an underground formation of rock, gravel, sand, silt, or clay that contains groundwater. The Florida aquifer is one of the highest producing aquifers in the world.

1. This document is FCS3273, one of an Energy Efficient Homes series of the Department of Family, Youth and Community Sciences, Florida Cooperative Extension Service, Institute of Food and Agricultural Sciences, University of Florida. This material was prepared with the support of the Department of Environmental Protection, Florida Energy Office. However, any opinions, findings, conclusions, or recommendations expressed herein are those of the author(s) and do not necessarily reflect the views of the Florida Department of Environmental Protection. Original publication date June 2008. Visit the EDIS Web site at <http://edis.ifas.ufl.edu>.

2. Nicholas W. Taylor, research associate, Program for Resource Efficient Communities, University of Florida; Brent T. Philpot, Florida Water StarSM specialist, St. Johns River Water Management District - Alachua, Flagler, Marion, Putnam, and Volusia counties, Gainesville, FL; Kathleen C. Ruppert, associate extension scientist, Program for Resource Efficient Communities, University of Florida, Gainesville, FL 32611.

Found throughout Florida and extends into the southern portions of Alabama, Georgia, and South Carolina. The Florida aquifer is the source of many springs in Florida.

<http://www.dep.state.fl.us/swapp/aquifer.asp>

- **Groundwater** is water below the Earth's surface. It can be found almost everywhere in the world. It is not always reachable, or clean enough to use without treatment. It can be close to the surface, as in a swamp, or it may be hundreds of feet below the surface, as in some dry areas of the West. Close to the surface, the water might be only a few hours old; at greater depths, it may be hundreds of years old; and at the greatest depths or in confined areas it may have flowed long distances and may be several thousands of years old. (Source: <http://ga.water.usgs.gov/edu/earthgw.html>)
- **Potable Water** is water that is suitable to use for drinking water. In the United States, public drinking water is governed by the Safe Drinking Water Act (SDWA).
- **Stormwater** is water that comes from precipitation events. Excess stormwater runoff can cause problems with flooding and the spread of contaminants and pollutants.

So what is the water and energy connection and what does it mean for a home like mine?

Outside of interactions with our home water heaters, most of us rarely consider the connection between our water use and energy use. Unless you have a well pump, swimming pool pump, or spa, the connection is seldom apparent in your energy bill. In order to appreciate the amount of energy it takes to run the domestic water system, you must start at the source.

Potable Water Delivery

Groundwater makes up the vast majority of potable water used in Florida. Large pumps are required to deliver the billions of gallons of water consumed daily from its source, often hundreds of feet below ground. On the water supply side, water

pumping requires the greatest amount of energy. This includes pumping untreated water to treatment plants and delivering treated water to customers. Any reduction in water use saves energy because less water must be pumped and treated. In return, more water can be saved because less water is needed to operate power plants. In addition to the large amount of energy used for pumping water, treatment, or at minimum, inspection, must occur before water is distributed to customers.

Water treatment methods include, but are not limited to ultraviolet light, filtration, water softening, reverse osmosis, deionization, and powdered activated carbon treatment. All of these processes require additional energy inputs. In addition to the energy used every day for pumping and treatment, the energy required for infrastructure installation must also be considered. The average utility customer is seldom aware of the enormous amount of energy required for clearing land, building water treatment plants, and installing water conveyance systems and piping. When we are billed for water by our utility, most of that cost is associated with simply moving the water to and from your home.

Take the following example:

Tampa Bay Water provides water to Hillsborough County, Pasco County, Pinellas County, St. Petersburg, New Port Richey, and Tampa. Collectively, the area is home to 2.5 million Florida residents. Based on records from Tampa Bay Water, it takes 1.6 watt-hours of power to produce 1 gallon of water. Tampa Bay Water produces over 178 million gallons of water per day for its customers and in turn uses over 295 Megawatt-hours of electric energy per day. The year's electric bill for Tampa Bay Water in 2007 was \$9,933,253. Tampa Bay Water only serves about 14% of Florida's total population. To reflect the entire 18 million Florida residents, it follows, then, that about 71 million dollars worth of energy per year is used to pump, treat and deliver our water. Yet this estimate does not include the cost of transporting, treating, and discharging wastewater, and stormwater. (Tampa Bay Water, January 2008)

Once the water is withdrawn and suitable for drinking, it must be distributed to all of the homes in the area. Water distribution systems can serve homes and businesses over one hundred miles away from the water's source, requiring a massive infrastructure network of piping and pumps. The U.S. Department of Energy states that an estimated 3% of national energy consumption, equivalent to approximately 56 billion kilowatt-hours (kWh), is used for drinking water and wastewater services.

What happens to water after normal household use?

Postconsumer Removal, Treatment, and Discharge

When water flows down the drain, it travels through a system of drainpipes and lift pumps to a municipal wastewater treatment plant. The wastewater treatment plant passes water through a system of biological, chemical, and mechanical processes that reduce contaminants so that treated wastewater is safer for discharge into nearby rivers, streams, or lakes.

One more water conveyance system participating in the energy and water connection is stormwater. A stormwater system consists of ditches, culverts, piping, retention ponds, and even home gutter systems. Though most of the water in this system is moved by gravitational flow, instead of by mechanical pumps, it takes a lot of energy to construct and install the infrastructure required for stormwater conveyance.

We have followed the municipal water cycle and begun to envision the energy required to install and run such a system. The next step is to find ways to reduce energy use through reducing our water use.

How do I reduce my water use?

To reduce your water use, start inside your home. The first step is to take a look at how you typically use water. Never leave water running when it is not in direct use. Take shorter showers. When machine washing laundry or dishes, wash only full loads to reduce wasted energy and water. Also, ensure that all faucets are shut off completely and that toilets do not

have leaks or faulty valves that might make them run. Once you have reduced your water use by examining how you currently use water, it will help even more to invest in water saving technologies such as low-flow faucet aerators, showerheads, and toilets.

Next, look outside of your home for excess water use. This is especially important if you have a permanent in-ground irrigation system. Consider creating a Florida-Friendly landscape that includes plants with low water requirements and, once established, can survive year round with no irrigation (except perhaps during extreme drought conditions). Installing landscaping that needs irrigation only in times of severe drought, once established, is the best way to save water outdoors. If you do maintain an irrigation system, have a qualified professional perform an audit of your system. Many utility companies have auditors or offer rebates for irrigation audits. See *Energy Efficient Homes: The Irrigation System* (available online at http://edis.ifas.ufl.edu/topic_series_Energy_Efficient_Homes) for more ways to use water efficiently when operating your irrigation system. Just as with indoor fixtures, make sure that all outdoor hose bibs are closed completely to save water.

Last, but not least, maintain a stormwater system that allows you to retain as much stormwater as possible in your yard. This may include adding a rain barrel or cistern to capture rainwater. You may also consider adding a rain garden that helps collect and infiltrate stormwater while reducing demand on municipal stormwater systems.

Now that you have made the energy and water connection, use your knowledge to help yourself and your neighbors reduce the demand on these two essential resources.

References and Resources

- Florida Water Use
http://fl.water.usgs.gov/infodata/data/Historical_Water-Use_by_Category_1970-2005.htm

- Florida Water Sources
<http://www.dep.state.fl.us/swapp/help.asp>
- Tampa Bay Water
<http://www.tampabaywater.org/index.aspx> **and**
<http://www.tampabaywater.org/documents/conservation/FiveYearPlan2007.pdf>
- For more information about water issues in Florida, go to <http://www.dep.state.fl.us/water>
- For more information on Florida-Friendly Landscaping, go to <http://www.floridayards.org> and <http://fyn.ifas.ufl.edu>
- For more information concerning water conservation in the home and/or landscape, go to <http://www.floridawaterstar.com> and http://livinggreen.ifas.ufl.edu/water/water_conservation.html
- For more information regarding landscape irrigation, see http://livinggreen.ifas.ufl.edu/water/lawn_care_and_irrigation.html
- For more information about rain gardens, go to <http://www.tappwater.org/download-guides/RainGarden.pdf>