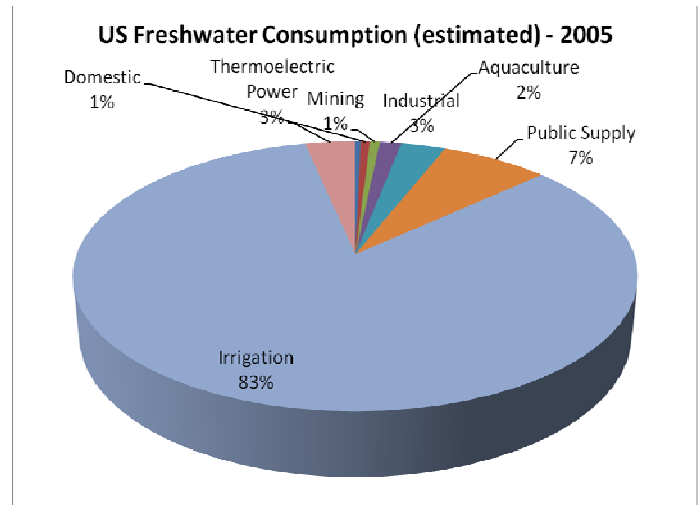
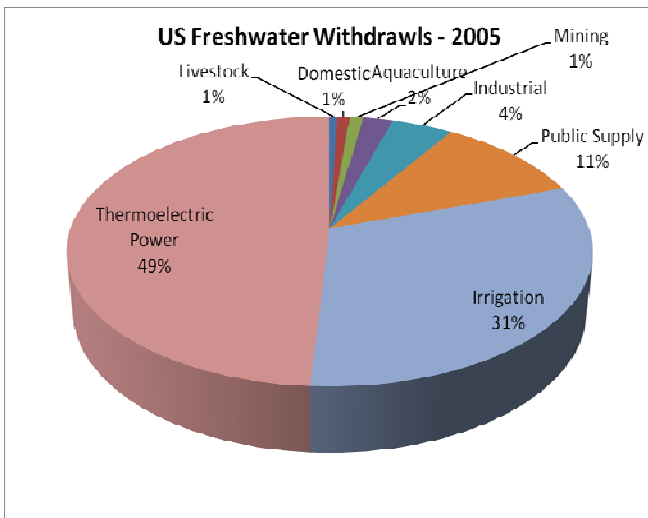


Energy-Water Nexus

Kate McMordie-Stoughton, Sriram Somasundaram
Pacific Northwest National Laboratory

According to a study conducted last year by River Network entitled “The Carbon Footprint of Water”, 13% of the country’s energy consumption (520 billion kWh/year) is used in collecting, treating, distributing, and heating water¹. This is double what is generated by all of the nation’s hydroelectric dams in an average year and equal to the output of over 150 typical coal-fired power plants! The Department of Energy estimates that freshwater needs for future electricity production will increase between 28% and 49% by 2030 depending on the type of cooling technology utilized². On the flip side, energy production has large impacts on water use. The Department of Interior estimates that 201 billion gallons of water each day are withdrawn for thermoelectric power production³, and the Department of Energy estimates that it takes over 11 gallons of cooling water for every kilowatt-hour produced for a coal fired power plant for example². Approximately 3% of all freshwater consumption in the U.S. is related to thermoelectric power production, which equates to over 4 billion gallons each day⁴. The charts below depict this data showing the percentages of fresh water withdrawal and consumed by each sector.



Herein is the “energy-water nexus” – the cross-cutting impacts of water supply and energy production and their interdependent relationship. As our country’s thirst for energy grows and our water supplies become more stressed, the increasing demands on these limited resources will only grow. This interaction offers us great opportunity to leverage efficiency improvements on both the energy and water fronts. The unit energy consumption of energy required to convey and treat water is estimated to be typically 2 kWh per thousand gallons⁵. As water efficiency improves through the use of water efficient fixtures and equipment replacement, water demand will decrease, which will in turn lower the energy requirements to convey and treat that water. This drop in water use will have a compounding effect by decreasing the water required to produce the electricity needed to supply that water. In addition, energy efficiency improvements will have a positive effect on water consumption. So for each unit of energy saved with efficiency improvements, water supply in the US can be stretched further. Therefore, efficiency improvements in both the energy and water use provide compounding returns to the energy-water nexus challenge.

¹ The Carbon Footprint of Water, Griffiths-Sattenspiel, Bevan and Wilson, Wendy, River Network, 2009.

² Estimating Freshwater Needs to Meet Future Thermoelectric Generation Requirements, Department of Energy/National Energy Technology Laboratory, 2008.

³ Estimating Use of Water in the United States in 2005, Department of the Interior, 2009.

⁴ Estimating Use of Water in the United States in 2005, Department of the Interior, 1998.

⁵ This approximate unit energy consumption is based on a literature review by the authors.