

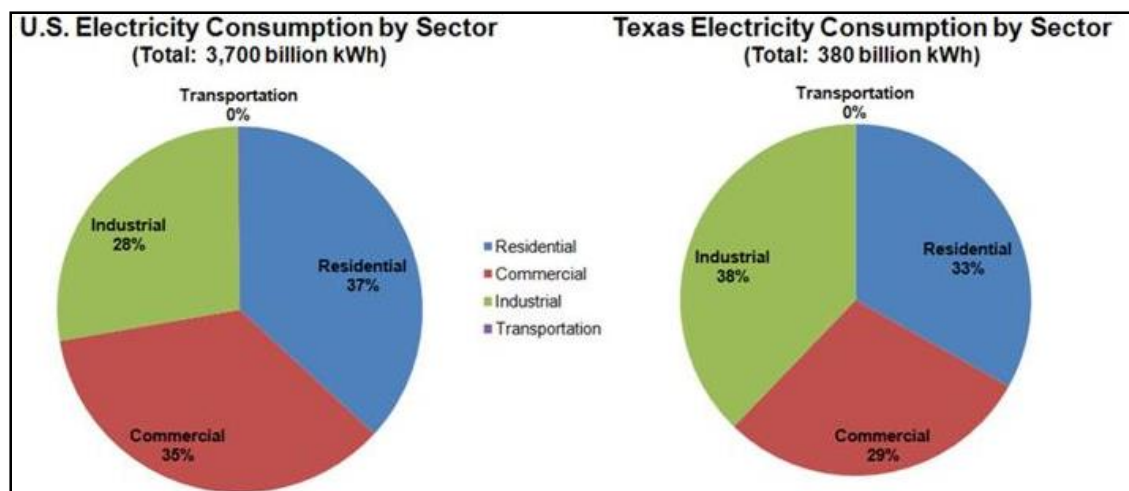
Water Grand Challenges: Economics of Water

Energy-Water Nexus

Background – The Energy-Water Nexus explains the relationship between the energy required for water and the water required for energy production.¹ In the past, energy and water have been regulated as separate entities. However, the growing Texas population and prolonged drought have required that decision makers begin to recognize the interconnectedness of these two resources when creating new regulatory policies for energy production and water use.¹

As both the second most populated state in the country and the state with the highest rate of population growth over the last decade, Texas’ energy production and consumption are the highest in the nation.¹ This growth is heavily concentrated in large, metropolitan centers along the I-35 corridor and in certain cities along the coast where water availability is not constant. High weather variability across the state results in an uneven distribution of water resources from west (drier) to east (wetter).¹ Constraints on water resources due to the increase drought and heat waves also mean increased restraint on, and cost for, energy production.² Figure 1 published by Stillwell et al. 2010 with the Webber Energy Group compares energy consumption by sector between Texas and the rest of the country.

Figure 1: Energy consumption by sector (2008)¹



Energy Required for Water –Wastewater treatment plants, coal production, and hydroelectric plants require both water and energy for different uses. Without energy, wastewater treatment plants could not effectively treat water for safe consumption, and water-intensive energy productions provide treatment facilities with the power to effectively complete daily duties.



Currently, Texas produces and consumes nearly 400 billion kilowatt-hours of energy each year.¹ The high volume of energy-intensive refining, manufacturing, and chemical industry activities result in an in-state consumption of 10% more energy created for use by the industrial sector than any other state. Nationwide, consumption of electricity in the home equals 37% of all energy consumed. The amount of electricity produced for in-home use is 33% of total energy consumed.¹

Texas ¹	Population	Energy Produced Ann. (KWh)	Energy Consumed Ann. (KWh)	Water Required Ann. (Thermoelectric ML)
Total	23 Million	400 billion	380 billion*	595,000

*Some energy is expended during production. Source: (Stillwell et al. 2010).

Water Required for Energy – The dependency of energy production on water in Texas is not solely concentrated in one area. Converting any energy source into electricity produces waste-heat, which is extinguished through a cooling process. Thermoelectric power plants operating using a “steam cycle” depend on a consistent water supply to maintain efficiency and energy production (table 1). Although the majority of water resources withdrawn for hydroelectric purposes is not directly consumed, but rather used for cooling, energy production through these plants still requires 2.5% of total water consumed statewide.¹

Emerging Texas Energy-Water Policy – Recognizing the need to support the union of energy and water industries at the policy level, the house committee for Environmental Regulation developed House Bill 4206 during the Texas 81st Legislature session in 2009.¹ This bill would required that applicants seeking a permit to construct an electric generating facility show that “a sufficient amount of water is available for use in connection with the operation of that facility.”³ Energy usage in water storage and delivery may also be analyzed in reclamation projects as a result of H.B. 4206. To learn more about this bill, please view [Current Legislative Topics](#).

Other bills at the federal level such as the [Energy and Water Research Integration Act \(S. 531\)](#), introduced in and 2009 currently in legislation, [H.R. 3183](#) and [S.B. 1436](#) (introduced in 2009 and passed in 2009) have been developed to increase research and provide decision makers with a better understanding of the nuances in the Energy-Water Nexus. As an added measure, [S.B. 1436](#) and companion bill [H.R. 3183](#) also appropriate \$33 billion to establish agencies designed to increase energy and water development.¹

Ongoing Research – Dr. Michael Webber, associate director of the Center for International Energy and Environmental Policy in the Jackson School of Geosciences and director of the [Webber Energy Group](#) through the University of Texas at Austin, is currently working on several research projects with graduate students to further explore the Energy-Water Nexus in Texas. Dr. Webber and his team are exploring ways to use less water in thermoelectric cooling, and to stop using potable drinking water for electricity production.⁴ He is also interested in exploring using reclaimed water for purposes that don’t require potable water or increased groundwater pumping, such as lawn irrigation and toilet use. In order to make better decisions regarding water



conservation and energy production, Dr. Webber says that we first need to understand which power plants are drawing water from which basin in order to better understand the cycle. Having a central repository of information will help scientists and engineers monitor the affect of losing water for energy use on watershed basins and long-term supply in different regions. Dr. Webber is in the process of studying the nuances of the Energy-Water cycle in Texas with his students. He has received sponsorship for this work through the Texas State Energy Conservation Office, National Science Foundation, Environmental Defense Fund, Energy Foundation, Texas Water Development Board (TXWDB), and others for this five-year project (2007-2012).⁵

¹ Stillwell, A.S., C.W. King, M.E. Webber, L.J. Duncan, and A. Hardberger. "The energy-water nexus in Texas." *Ecology and Society* 16, no.1 (2010).

² Poumadre, M., C. Mays, S. Le Mer, and R. Blong. "The 2003 heat wave in France: dangerous climate change here and now." *Risk Analysis* 25 no.6:1483-1494 (2005).

³ Texas Legislature Online. Legislative Session: 81(R).

www.legis.state.tx.us/BillLookup/History.aspx?LegSess=81R&Bill=HB4206 (accessed May 13, 2013).

⁴ Lebwohl, Beth. "Michael Webber on the vital link between energy and water." *EarthSky*, June 22, 2012.

⁵ Webber Energy Group. Projects. 2012. <http://www.webberenergygroup.com/projects> (accessed May 21, 2013).