

STUDENT POSTER AWARD WINNER

Water-Energy Trade-Offs in the Tennessee Valley

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As water and energy production are inextricably linked, effective management of natural water resources is crucial to meeting the public demand for both. This task is becoming more challenging where water supplies are diminishing due to anthropogenic use or changes in regional weather patterns. Historically, water scarcity in the Tennessee (TN) Valley has not been regarded as a major concern. However, recent natural events, such as the 2007 drought in the southeast, have brought new attention to water management and policy in this region during times of water shortage. The majority of surface waters in East TN fall within the TN River Watershed and under the jurisdiction of the Tennessee Valley Authority (TVA). As TVA manages the river system for multiple uses, including power production, navigation, flood control, recreational use, and ecosystem health, this region presents a unique opportunity to observe water-energy management, policy, and trade-offs from a whole system perspective. In this study, we investigated water-energy relationships with a focus on the TN Valley region.

Energy production in the TN Valley is supported by coal (40%), hydroelectric dams (37%), nuclear (22%), and natural gas (1%). Information was gathered to assess relative water demands corresponding with each type of energy produced. We found that, although water use per unit energy is well expressed on a national level, a regional quantification of this data for the TN Valley is lacking. National data indicate that thermoelectric (coal and nuclear) power plants and hydroelectric dams account for most water use in the energy industry. Further, energy producing facilities within the TN Valley were mapped with respect to primary water resources to identify areas most likely to be subject to water-energy nexus issues. We highlight the Ocoee River as a case study as it has been managed for energy, diversion of flow to hydroelectric facilities, as well as recreation, namely seasonal whitewater rafting. As water scarcity becomes a more prominent issue, the capacity of the river to support current levels of use may become compromised. Water use regimes for both the energy and recreation industries are already in place on the Ocoee; however, these management plans do not provide clear guidelines for adjusting management strategies for reduced water levels. As a result, contracts for recreational use on the Ocoee, due to expire in 2018, may be jeopardized. This example demonstrates the need to provide clear management guidelines during times of water shortage. In order to accomplish this, we have identified the following potential areas of future research to better inform trade-off decisions and policy:

- Quantification of water use per energy unit by energy type for the TN Valley region under management of TVA.
- Development of a regional specific model predicting the impacts of global climate change on water levels and temperatures.
- An assessment of the environmental and socio-economic impacts of water use management strategies and trade-offs as a result of climate change.
- An assessment of data collection methods and regimes currently implemented to meet and develop management guidelines outlining regulations for water use and discharge within the energy industry.