# Energy/Water Nexus: Ensuring the Resiliency of our Interdependent Water and Energy Systems

## An Overview

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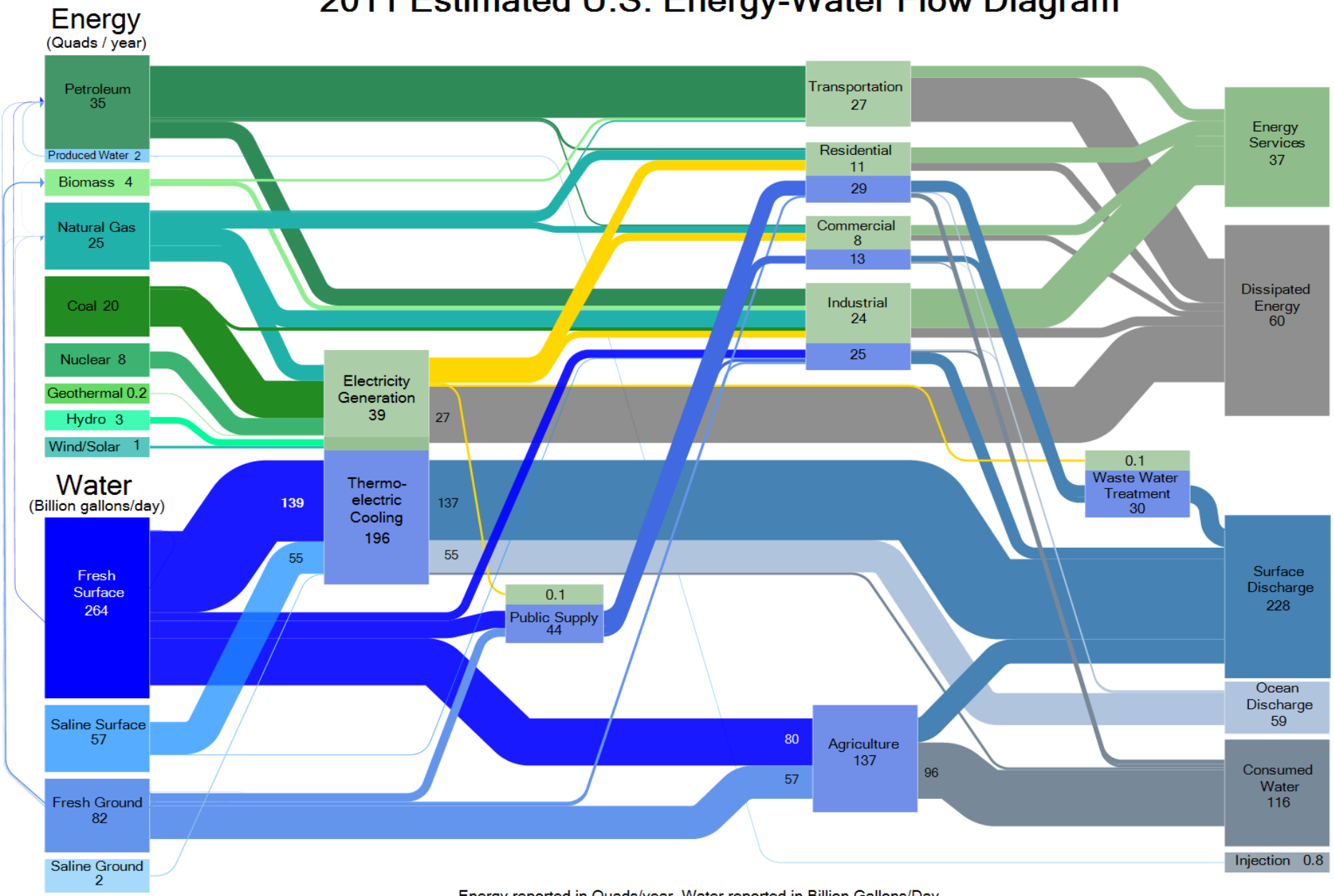
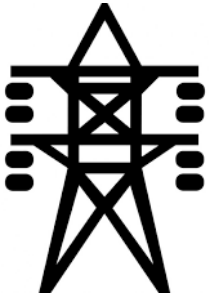
# 2011 Estimated U.S. Energy-Water Flow Diagram




Energy reported in Quads/year. Water reported in Billion Gallons/Day.

# The Energy/Water Nexus: How We Use Water for Energy

- *Electricity Generation*: Nearly half of all water withdrawn in the U.S. keeps power plants cool enough to function safely and efficiently.



- *Oil & Gas*: Water is used for hydraulic fracturing, enhanced oil recovery, and other fossil fuel production processes.

- *Renewable Energy*: Water is essential for hydroelectric power and is also used for concentrated solar power, for geothermal energy and to produce biofuels.

Source: U.S. Department of Energy

# The Energy/Water Nexus: How We Use Energy for Water

- *Pumping*: We use energy to pump water from aquifers for agriculture and to transport to treatment facilities and consumers.
- *Water Treatment*: Energy is needed to treat wastewater before it's returned to the environment and to desalinate water.
- *Heating & Cooling*: Energy and water work together to keep buildings and equipment at safe, comfortable temperatures.
- *Delivery*: We use energy to distribute and heat water for cooking, showering, cleaning, and drinking.

# Energy/Water Nexus: Central Issues

***We cannot assume the future is like the past in terms of climate, technology, and the evolving decision landscape.***

- Energy and water systems are *interdependent*.
- *Water scarcity, variability, and uncertainty* are becoming more prominent, potentially leading to vulnerabilities of the U.S. energy system.
- It is time for a more *integrated approach* to address the challenges and opportunities of the water-energy nexus.

# Energy/Water Nexus: Some Recent Developments

- When severe drought affected more than a third of the United States in 2012, limited water availability constrained the operation of some power plants and other energy production activities.

- Hurricane Sandy demonstrated the compounding ramifications of vital water infrastructure losing power.

- The recent boom in domestic unconventional oil and gas development brought on by hydraulic fracturing and horizontal drilling has added complexity to the national dialogue about the relationship between energy and water resources.

# Energy/Water Nexus: Trends

- First, *climate change* has already begun to affect precipitation and temperature patterns across the United States.
- Second, U.S. *population growth and regional migration* trends indicate that the population in arid areas such as the Southwest is likely to continue to increase, further impacting the management of both energy and water systems.
- Third, introduction of *new technologies* in the energy and water domains could shift water and energy demands.
- Moreover, *policy developments* addressing water impacts of energy production are introducing additional complexities for decision making.

# Energy/Water Nexus: Strategies

1. Optimize the freshwater efficiency of energy production, electricity generation, and end use systems
2. Optimize the energy efficiency of water management, treatment, distribution, and end use systems.
3. Enhance the reliability and resilience of energy and water systems
4. Increase safe and productive use of nontraditional water sources
5. Promote responsible energy operations with respect to water quality, ecosystem, and seismic impacts
6. Exploit productive synergies among water and energy systems

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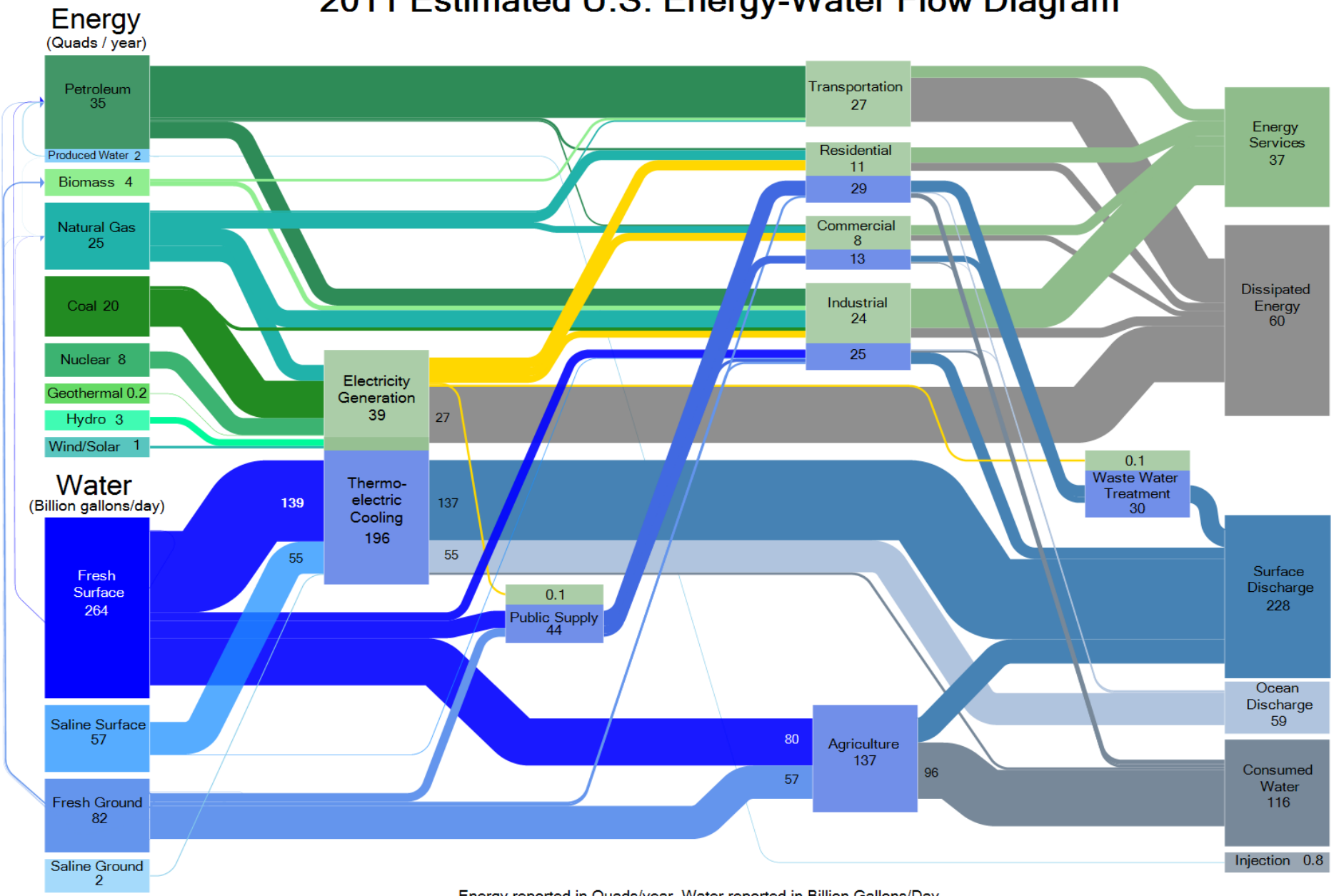


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## A Deeper Dive

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