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Energy-Water Nexus

Prepared for the Energy/Water Nexus Forum
Meeting of the Board on Energy & Environmental Systems
Division on Engineering & Physical Sciences
National Academies

- **GAO's Work Related to the Energy-Water Nexus**
- **Energy-Water Data and Analysis—Availability and Usefulness of Data and What GAO Has Recommended?**
- **Five Key Themes from GAO's Energy-Water Work**

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Key GAO Reports Related to the Energy-Water Nexus

- **Thermoelectric power plants** – Energy-Water Nexus: Improvements to Federal Water Use Data Would Increase Understanding of Trends in Power Plant Water Use, http://www.gao.gov/products/GAO-10-23
- **Biofuels** – Energy-Water Nexus: Many Uncertainties Remain about National and Regional Effects of Increased Biofuel Production on Water Resources, http://www.gao.gov/products/GAO-10-116
- **Energy for water** – Energy-Water Nexus: Amount of Energy Needed to Supply, Use, and Treat Water Is Location-Specific and Can Be Reduced by Certain Technologies and Approaches, http://www.gao.gov/products/GAO-11-225
- **Oil shale** – Energy-Water Nexus: A Better and Coordinated Understanding of Water Resources Could Help Mitigate the Impacts of Potential Oil Shale Development, http://www.gao.gov/products/GAO-11-35
- **Produced water** – Energy-Water Nexus: Information on the Quantity, Quality, and Management of Water Produced during Oil and Gas Production, http://www.gao.gov/products/GAO-12-156 . **Oil and Gas –** Information on Shale Resources, Development, and Environmental and Public Health Risks, http://www.gao.gov/products/GAO-12-732
- **Energy-Water Nexus –** Coordinated Federal Approach Needed to Better Manage Energy and Water Tradeoffs, http://www.gao.gov/products/GAO-12-880

Ongoing GAO Work Related to the Energy-Water Nexus

- Class II Underground Injection Wells—Regulation and Enforcement
- State and Federal Permitting Issues Related to Shale Oil and Gas Development
- Assessment of Water Conservation Technologies for Energy Development

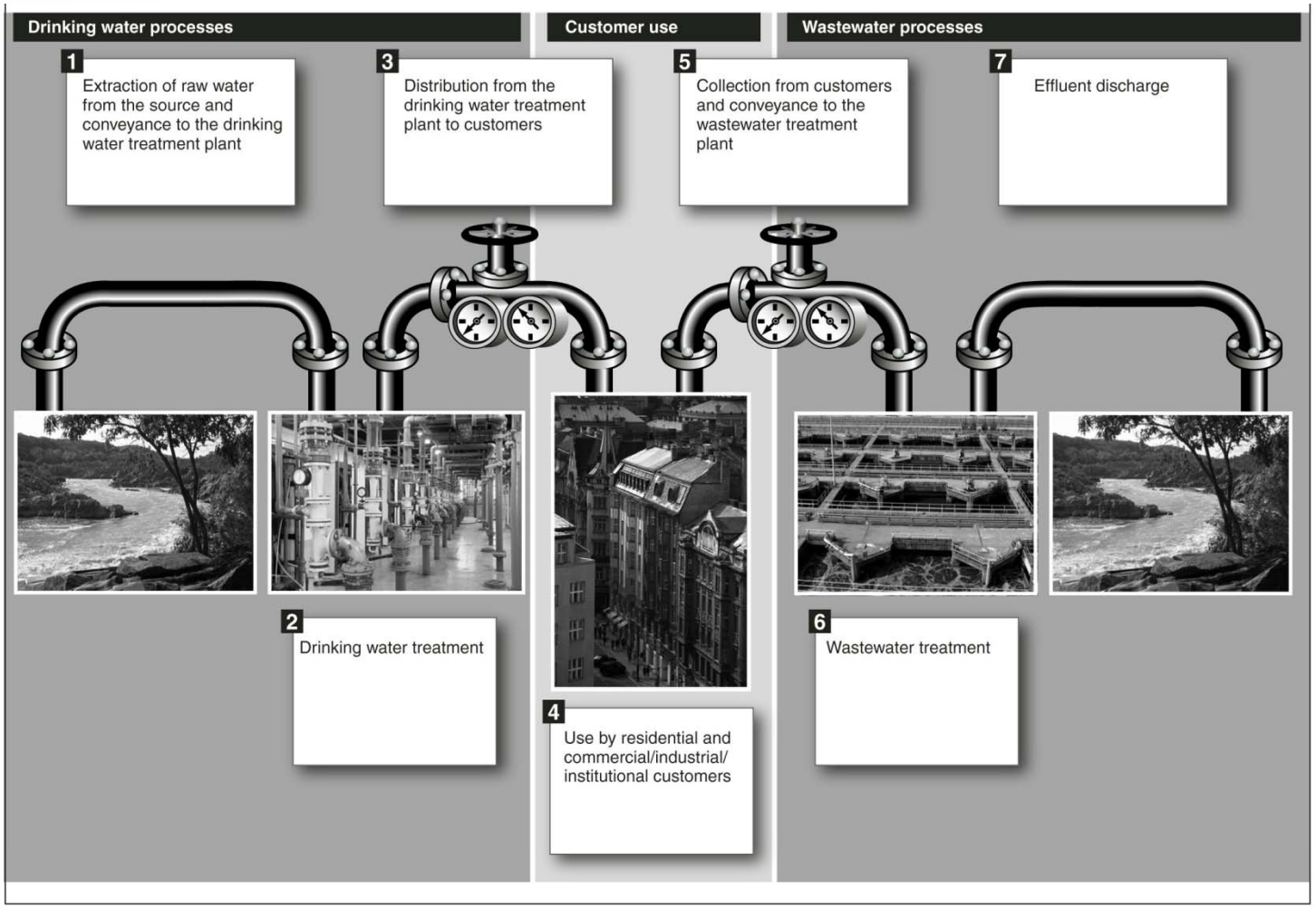
Thermoelectric Power Plants

- In 2000, thermoelectric power plants accounted for 39 percent of fresh water withdrawals in the United States.
- How much fresh water did they consume in 2000? We do not know.
- How much fresh water did thermoelectric power plants withdraw and consume in 2012? We do not know.
- The answers to these questions depend on the types of cooling technologies used and the source of cooling water.
- GAO has recommended, among other things that
  - EIA collect data from thermoelectric power plant operators about the cooling technologies used.
  - USGS resume collecting water use data by thermoelectric power plants.
  - EIA and USGS coordinate with each other and other interested parties to improve data collection and dissemination.
- Status:
  - EIA and USGS are coordinating.
  - EIA has acted to begin collecting data on cooling technology, expanding reporting of water use and cooling technology data and collect use of alternative water sources for cooling, such as brackish water or treated wastewater.
  - USGS is taking steps to reinstate collection of water consumption data by thermoelectric power plants and to expand efforts to disseminate data on use of alternative water sources.

Biofuels

- Impact of increased production of biofuels on water resources depends on what and where feedstock is grown and whether irrigation is required. Corn-based biofuels use a lot of water but are almost at a maximum under RFS guidelines.
- Open Questions
  - What advanced biofuels feedstocks will be grown and where?
  - How much fresh water will advanced biofuels withdraw from surface or groundwater sources and how much will they consume?
  - What are the characteristics of and interactions between the ground and surface water and where are the potential sources of contamination?
- No GAO Recommendations related to data but experts identified research needs.
  - Relationship between feedstock choice and biofuel conversion and water use.
  - Better data on water availability.

Energy for Water—Energy Use Depends on Geology, Geography, Topography and Water Quality



Sources: GAO analysis. Photos from left to right: GAO; US EPA Photo, Eric Vance; Art Explosion; DC Water; and GAO.

Oil Shale

- Oil shale deposits are primarily located in arid regions of Colorado and Utah.
- Extracting and processing oil shale will use a great deal of water but the amount will depend on technology used.
- There are no good comprehensive water availability data.
- Need models of regional groundwater movement and interaction with surface water to understand the potential for transport of possible contaminants associated with development of oil shale.
- GAO recommended that BLM and USGS :
  - Establish comprehensive baselines for surface and groundwater quality and quantity.
  - Model regional groundwater movement and interaction with surface water.
  - Coordinate with DOE and states to implement GAO's recommendations.
- Status: The first two are in process; we have no update on the third.

Produced Water from Oil and Gas Production

- In 2009, an Argonne National Lab study estimated that 56 million barrels of water are produced each day in the production of oil and gas.
- Volumes and quality of produced water depend on geology and geography.
- Most produced water is re-injected into class II injection wells.
- Since 2009 study, shale oil and gas production (note: not oil shale) has grown substantially, shifted from federal to state jurisdictions in many cases.
- There are no comprehensive of data on water use for shale oil and gas development but it is clearly a big issue, especially in water-scarce regions.
- No GAO recommendations.

Energy-Water Nexus—Five Key Themes

- Five key themes across all energy-water nexus reports
  - Location, location, location…
  - Technologies exist to mitigate energy-water trade-offs but are generally costly—will not likely be adopted unless cost falls or water prices are rationalized.
  - Data and analysis gaps hinder development of effective policies. Systems modeling is needed but available data are insufficient to support this.
  - Things can change quickly and uncertainty abounds—shale oil and gas is the poster child for how quickly energy-water nexus issues can arise.
  - Better coordination between federal agencies and states and others is needed to improve energy-water planning.
- GAO recommends DOE establish a federal program to address the energy-water nexus.
- Status—DOE is taking steps and we may have an update in the last panel today.

End

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