Energy and Water: Implications for Energy Development

A Look at Thermoelectric Demand for Water
Water Is A Critical Resource

Many Uses

- Human Consumption
- Irrigation
- Recreation
- Habitats
- Energy…Electric Generation

Many Concerns

- Population Growth
- Environmental Protection
- Shortages Due to Weather Impacts
- Demand For More Energy
Current Water Withdrawal and Generation

The U.S withdraws approximately 410 billion gallons of water per day (fresh and saline) from surface and groundwater sources.

The thermoelectric generating industry is the largest withdrawal user.

70% of the thermoelectric withdrawal use is from fresh surface water sources and the remaining 30% is almost all from saline water sources,

Approximately 70% of total thermoelectric water withdrawal is used in fossil-fuel-based electricity generation.

Water is used at thermoelectric facilities primarily for cooling purposes.
There are three basic cooling technologies:

- Once-Through Cooling
- Recirculating Cooling or Closed Loop Cooling
- Dry Cooling

Source: Impacts of Electricity Generation Portfolio on Water Resources by John Bistline, Carnegie Mellon University
Cooling Systems Technology Trend

Capital Costs of Cooling Systems

Capital Cost – 500 MW Steam Plant

Source: Electric Power Research Institute, Inc.
Section 316(b) of the Clean Water Act requires EPA to ensure that the “location, design, construction and capacity of cooling water intake structures reflect the best technology available for minimizing adverse environmental impacts”

Ongoing consequences of Section 316(b)

Deployment of carbon capture technologies due to potential amendments to the Clean Air Act would increase water use

Nationally

• Average daily freshwater withdrawal could range from 113 BGD to 146.8 BGD for all scenarios

• Average daily consumption could range from 4.2 BGD to 4.7 BGD

Regionally

• SERC will have the highest water withdrawal

• ERCOT and NY will have the largest decrease in water withdrawal in each case

• All regions except CA & NPCC/NE show an increase in water consumption
Challenges Facing Electric Industry

- Generation needs water
- Carbon capture technologies could increase the water demand of thermoelectric power plants.
- Consequences of both growing electric power and water demands will result in:
  - Pressure on electric power sector to use less water
  - Greater integration between water and energy planning
  - More intensive regional watershed planning
  - Enhanced science and technology to support planning and management needs
Strategies to Increase Efficiency of Water Use

- Increase electricity generation efficiency
- Increase in use of renewable generation
- Increase use of dry/hybrid cooling technology
- Recycle water within plant
  - Capture vapor produced in wet cooling towers
- Use degraded/impaired waters such as:
  - Waste water treatment plant discharge
  - Storm water flow
  - Saline aquifers
  - Coastal waters and sea water desalination

Conclusions