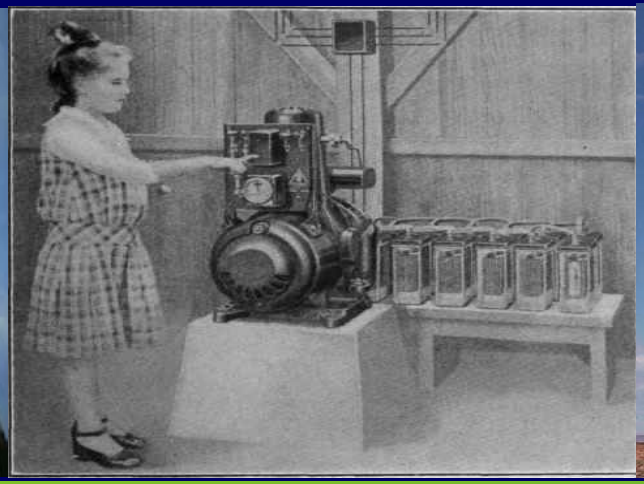
Energy and Water: Implications for Energy Development

A Look at Thermoelectric Demand for Water



Jeff Wright, Director

Office of Energy Projects

FEDERAL ENERGY REGULATORY COMMISSION

April 7, 2010

Washington, D.C

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.

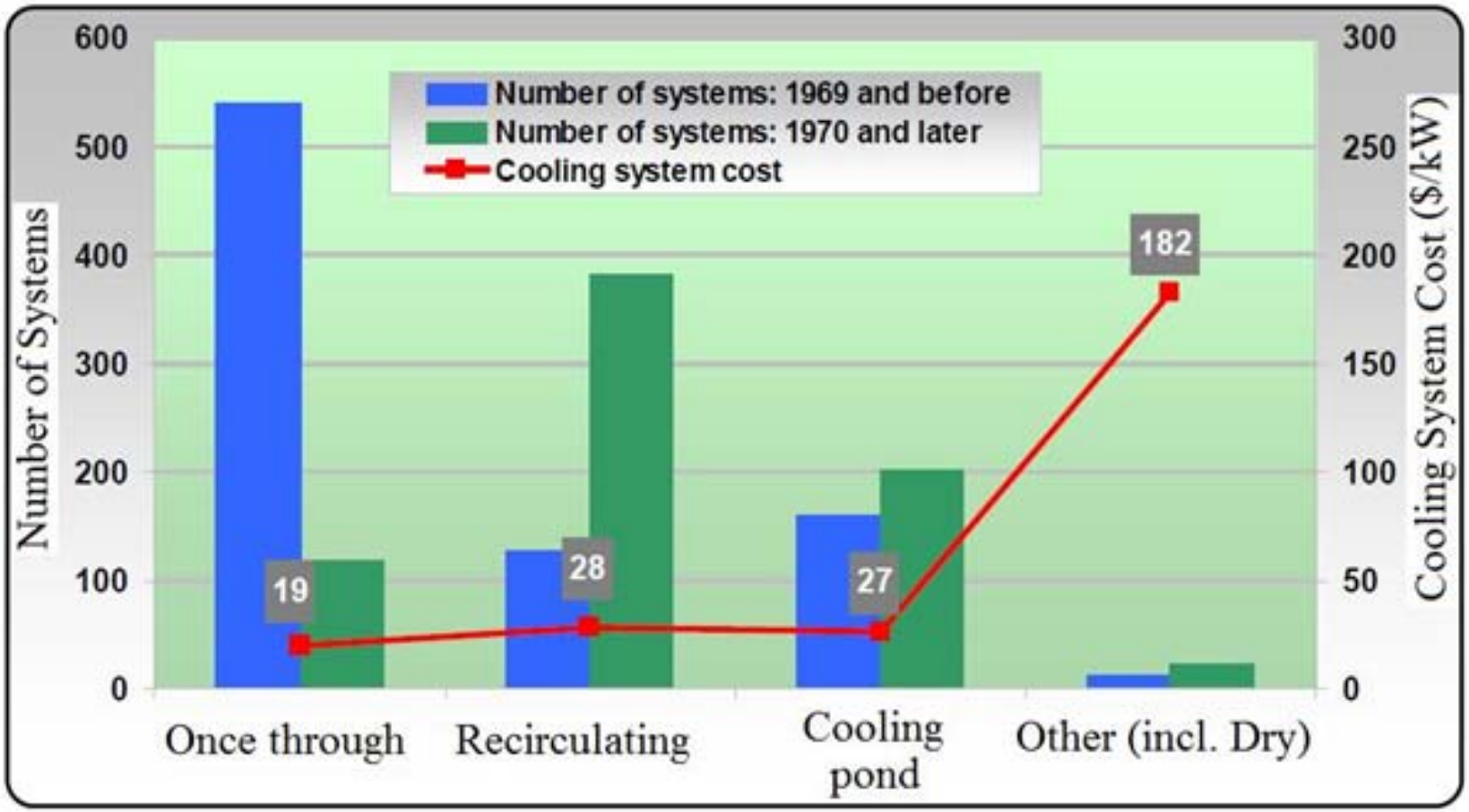
Basic Cooling Technologies

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

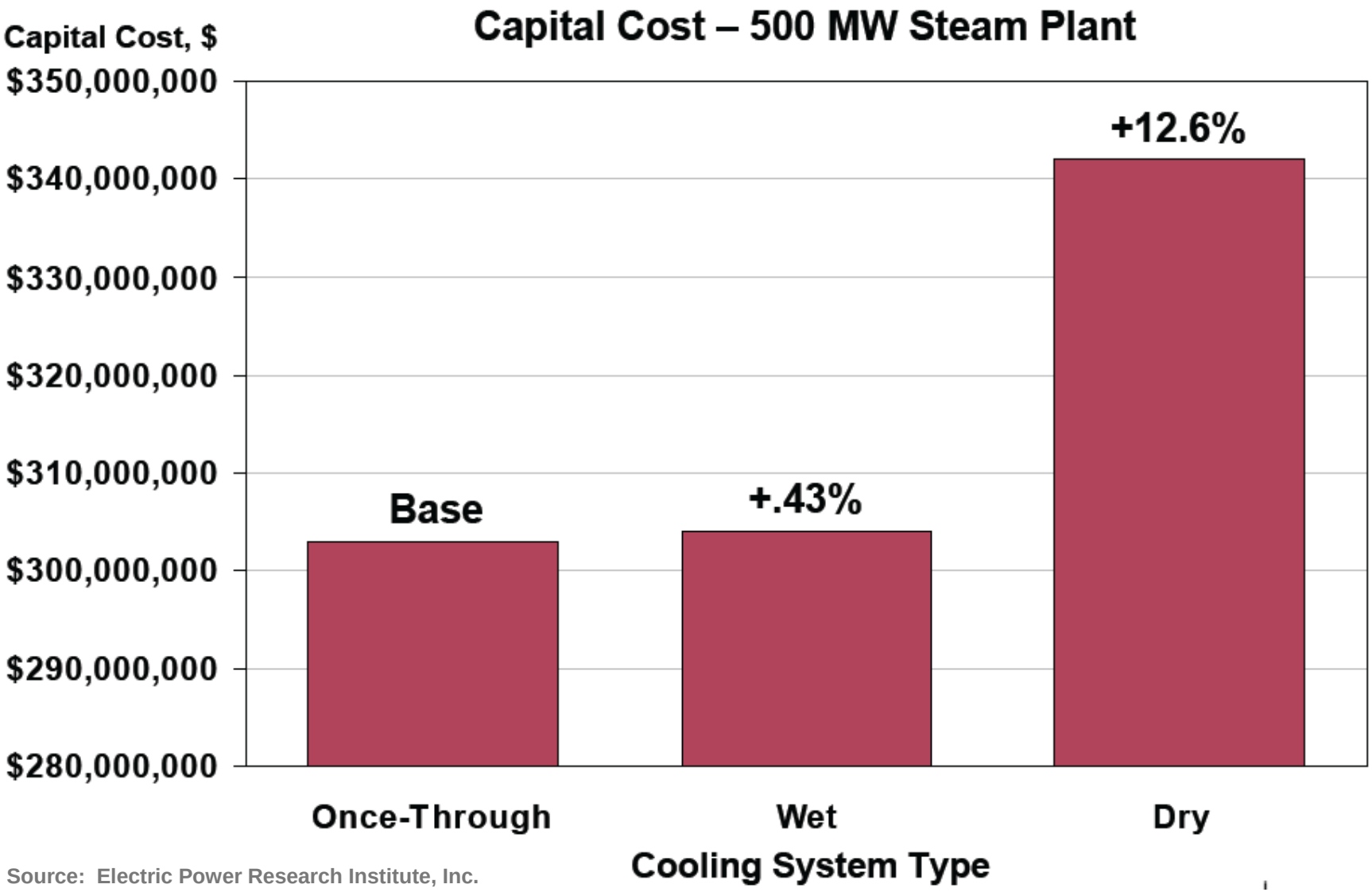
Cooling Systems Technology Trend



Average Total Cost and No. of Cooling Systems by Type

Source: DOE/NETL – Estimating Freshwater Needs to Meet Future Thermoelectric Generation Requirements Update 2009 – September 2009

Capital Costs of Cooling Systems



Source: Electric Power Research Institute, Inc.

Regulatory Impacts on Water Withdrawal and Consumption

- 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

Future Thermoelectric Water Withdrawal and Water Use Projections (2005-2030)

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

Source: EPRI's "Increasing Thermoelectric Generation Water Use Efficiency" First Western Forum on Energy and Water Sustainability March 22 & 23, 2007

Conclusions