WATER MANAGEMENT
RESEARCH AND DEVELOPMENT

OVERVIEW

Water research encompasses the need to reduce the amount of freshwater used by power plants and minimize potential impacts of plant operations on water quality. The vision for this program area is to develop a 21st-century America that can count on abundant, sustainable fossil energy and water resources to achieve the flexibility, efficiency, reliability, and environmental quality essential for continued security and economic health. Crosscutting research is needed to lead a critical national effort directed at removing barriers to sustainable, efficient water and energy use, developing technology solutions, and enhancing understanding of the relationship between energy and water resources.

NETL

NATIONAL ENERGY TECHNOLOGY LABORATORY

In concert with the Energy-Water Nexus initiative, the Water Management Research and Development (R&D) technology area focuses on reducing water use and consumption for thermoelectric power generation. Thermoelectric power generation accounts for more than 40 percent of freshwater withdrawals (143 billion gallons of water per day) and more than 3 percent of freshwater consumption (4 billion gallons per day) in the United States. Thermoelectric power plant water consumption is slated to increase from 3 percent (1995 USGS data) to as high as 10 percent given the expansion of closed loop cooling and cooling towers. To further exacerbate the problem, water consumption projections for the power generation sector will dramatically increase with the implementation of carbon capture technologies. As the cost associated with water consumption increases, so will the cost of water treatment, recovery, and reuse.

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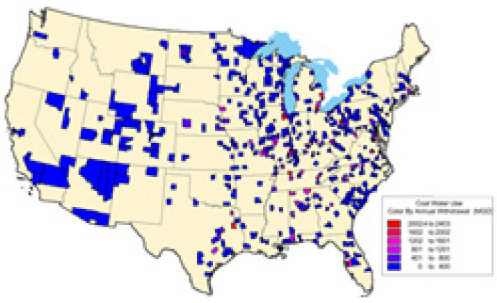
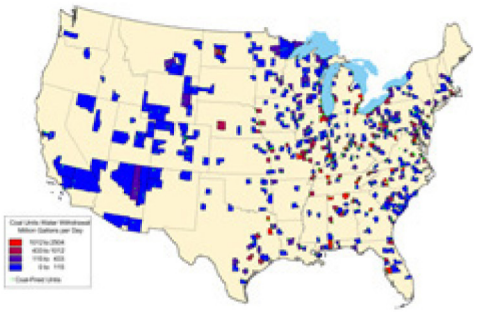
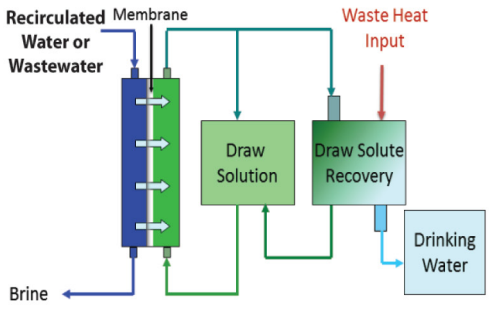
The current goal is to identify projects which will develop a range of technologies to optimize and/or reduce freshwater use for energy processes through improved waste heat recovery, alternative heat transfer fluids, and new sources of water (i.e., utilizing treated wastewater). Acquisition of research projects is based on a comprehensive, multipronged R&D approach with a portfolio of technologies that follow multiple paths toward enhancing the probability of research success, and at the boundaries of current scientific understanding. The R&D covers a wide range, integrating advances in fundamental research, technology development, and large-scale testing. The success of this effort will enable cost-effective implementation of technologies throughout the power generation sector. These projects are being developed on 3- to 5-year timelines.



U.S. Water Withdrawal
Coal Fired Units – County Level



U.S. Water Consumption
Coal Fired Units – County Level



Generalized Forward Osmosis Design

PROCESS EFFICIENCY AND HEAT UTILIZATION

Greater process efficiency and heat utilization will be needed to reduce water use as improvements in heat transfer technology and better thermal integration of power plant systems (particularly new plants that include carbon capture technologies) are made.

WATER TREATMENT AND REUSE

Research on water treatment and reuse is being performed to develop advanced technologies to reuse power plant cooling water and associated waste heat and to investigate methods to recover water from power plant flue gas. Considering the quantity of water withdrawn and consumed by power plants, any recovery or reuse of this water can significantly reduce the plant's water requirements. Water treatment research is focused on high dissolved solids waste streams.

DATA MODELING AND ANALYSIS

Data modeling and analysis activity is to improve the quality and amount of data collected, conduct comprehensive modeling efforts of complex systems, and provide crosscutting analyses to help decision-makers and support policy development. Stakeholder decision making must target qualitative and quantitative scenarios, probabilistic approaches, insights into system shocks and extremes, and improved uncertainty characterization.

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