

55 Strategic Water Issues: TMDLs, Availability, Climate

Program Overview

Program Description

In the future, water policy and regulations will be driven by watershed planning, water availability constraints on electric power generation, and implications of climate change for power industry water withdrawal and consumption. This program addresses key strategic water issues confronting the electric power sector. These issues include the need to place the operation of power plants into a watershed context, match available water supply to power plant requirements, and understand the implications of climate change for power plant water use. The program delivers credible scientific information, practical guidance, proven decision-support tools, and technology assessments to help members, regulators, and other stakeholders develop and implement cost-efficient risk-based strategies for Total Maximum Daily Load (TMDL)/watershed management, improved power plant water use efficiency, reduced power plant water demand, and management of climate change impacts.

Industry Needs and Issues Addressed

- The U.S. Environmental Protection Agency (EPA) is committed to a watershed-based approach to water resource management and protection. This approach includes TMDLs, watershed-integrated National Pollutant Discharge Elimination System (NPDES) permitting, and water quality trading.
- A growing population results in increased demand for electricity and water, which produces pressures for the electric power industry to increase its water use efficiency and minimize overall use of water resources.
- There is growing national concern regarding how climate change will impact water resources and water use by all economic and societal sectors.
- Permits for new power plants require more-stringent water conservation practices, including use of nonpotable water sources and dry or hybrid wet-dry cooling systems. New and improved technologies are needed to overcome operational issues and reduce efficiency penalties.

Impact

- Maintenance and growth of electric power generation capacity through efficient water resource management
- Potential reduction of costs, estimated to be approximately \$17 billion industrywide, associated with the year 2000 TMDL rule
- Information for watershed and TMDL regulatory compliance and management decisions with respect to mercury, nitrogen, metals, heat, sediments, and acidity
- Management and technology tools to improve power plant water use efficiency and reduce overall water use

Key Accomplishments

- Electronic Watershed Assessment and Management Tool (eWAM), a comprehensive web-based information source for watershed management and TMDLs
- Watershed Analysis Risk Management Framework (WARMF), a decision-support tool for watershed management and assessment
- Watershed TMDL case studies
- Engineering and economic analyses of advanced cooling technologies and use of nontraditional water sources
- Evaluation of best management practices for noncooling-water releases
- Management and assessment methodologies for energy/water sustainability

Current Year Objectives

- Create guidance on how to technically verify TMDLs
- Analyze approaches to creating regional TMDLs
- Test water sustainability assessment framework
- Hold workshop for members to review potential climate change impacts and research responses
- Develop draft retrofit guidelines for once-through cooled thermal generating stations

Industry Involvement

- Estimated 2009 funding: \$1.2M

Program Technical Lead

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Summary of Projects

Project Number	Project Title	Value
P55.001	TMDL/Watershed Issues	Improves decisionmaking by providing information and tools to help members better understand and address watershed management and planning issues. Includes consideration of water quality trading and atmospheric deposition. Facility-specific savings can range from tens of thousands to tens of millions of dollars.
P55.002	Water Availability	Supports development of business strategies to address current and future water availability limitations on generation by providing data, information, and tools to analyze and project water supply/demand within watersheds and regions, and to analyze alternative management plans for increased water use efficiency and minimization of water use.
P55.003	Advanced Cooling	Enhances compliance processes, controls O&M costs, and expedites permitting by providing guidelines, tools, and information for use and optimization of advanced cooling strategies to meet water conservation requirements of permits. Reduces costs and heat-rate penalties associated with advanced cooling technologies. Provides methods of water treatment to enhance use of nontraditional water sources.

Project Descriptions

P55.001 TMDL/Watershed Issues (101920)

Issue

The EPA Strategic Plan defines three key strategies toward achieving the goal of clean and safe water, one of which is "Watershed Protection and Restoration: Apply a watershed approach to restoring polluted waters across the country, including developing Total Maximum Daily Loads (TMDL), implementing cleanup plans on a watershed basis, and promoting innovative, cost-effective practices like water quality trading and permitting to restore and protect water quality." For the foreseeable future, watershed assessment and management will be a major driver for water policy and regulation.

Description

This project improves decisionmaking by providing information and tools to help members better understand and address watershed management and planning issues. It enables members to create watershed management plans, derive TMDLs, evaluate alternative loading allocations, design water quality trading programs, and assess/manage atmospheric deposition loads. Facility-specific savings can range from tens of thousands to tens of millions of dollars.

Value

- Technically sound watershed, TMDL, and National Pollutant Discharge Elimination System (NPDES) regulatory compliance and management decisions
- Economically efficient watershed, TMDL, and NPDES regulatory compliance and management decisions
- Potential reduction of costs, estimated to be approximately \$17 billion industrywide, associated with the year 2000 TMDL rule

How to Apply Results

Power company environment staff will consult the Electronic Watershed Assessment and Management Tool (eWAM) and extract critical information from technical reports to derive more environmentally effective and cost-efficient TMDLs and watershed management plans through evaluation of innovative technologies and strategies, including water quality trading. Information and data will be used by power company generation staff and strategic planners, key watershed stakeholders, and regulatory agencies. In addition, EPRI will facilitate broader use and awareness of the results by briefing key stakeholders, including EPA and state agencies; developing materials for the trade press/media; and continuing service on various government, academic, and professional organization advisory panels.

2009 Products

Product Title & Description	Planned Completion Date	Product Type
Power Company Nitrogen Trading Study (Year 1): This effort will be the first year of a two-year project to conduct a feasibility case study for a water quality nitrogen trading program that would involve power companies, sewage treatment plants, and nonpoint nitrogen sources (agriculture).	12/31/2009	Technical Update

Future Year Products

Product Title & Description	Planned Completion Date	Product Type
Power Company Nitrogen Trading Study (year 2): This effort will be the final year of a project started in 2009 to conduct a feasibility case study for a water quality nitrogen trading program that would involve power companies, sewage treatment plants, and nonpoint nitrogen sources (agriculture).	2010	Technical Report
Enhance Web-based TMDL/Watershed Management Reference (eWAM): A survey of program members will be conducted to evaluate how they are using this web-based document (eWAM). Based on the results of the survey, expansion will include new case studies relevant to member interest and new topics recommended by members.	2011	Technical Resource

P55.002 Water Availability (058353)

Issue

The rapidly growing demand for clean, fresh water, coupled with the need to protect and enhance the environment, have made many areas of the United States vulnerable to water shortages. If society's dependence on reliable supplies of electricity, as well as on freshwater availability, continues to rise without regard for the potential conflicts these two demands can create, sustainability of national economic growth and electricity supply may be severely challenged. At a minimum, the conflicts could cause shortages in current supplies of electricity and could have direct impacts on power system planning and expansion. Unlike longer-term environmental concerns such as climate change, where long lead times allow for the development of coping strategies with evolving scientific and technical innovations, water and energy shortages can occur relatively suddenly and can have adverse impacts on local and regional economies.

Description

This project evaluates business strategies to address current and future water availability constraints on electric power generation. The project provides data, information, and tools to analyze and project water demand and supply within watersheds and regions under multiple scenarios, including effects of climate change. The research also analyzes alternative management plans for increased water use efficiency and minimization of water use.

Value

- Develops cost-effective business strategies to address current and future water availability limitations
- Provides strategies for increased water use efficiency, water conservation, and cost savings
- Leverages government-funded research

How to Apply Results

Power company environment, generation, and planning staff will extract information from project reports, papers, issue briefs, and presentation material. This information will also be disseminated to community water resource stakeholders and government agencies. Members will use project results to support decisionmaking with respect to meeting community and government pressures to increase water use efficiency and reduce water use in both existing and new plants. Staff will use project results to guide design and siting of new generation. The EPRI climate change research roadmap, to be developed in 2009, will be used by members to manage the risks of climate change for water resource usage. In addition, EPRI will facilitate broader use and awareness of the results by briefing key stakeholders, including EPA and state agencies; developing materials for the trade press/media; and continuing service on various government, academic, and professional organization advisory panels.

2009 Products

Product Title & Description	Planned Completion Date	Product Type
Test of Available Water Assessment and Management Framework – Year 2: This effort will be the continuation of a project started in 2008 to test the framework developed by EPRI for assessing water availability for power generation with respect to individual plants, watersheds, and regions.	12/31/2009	Technical Report

Product Title & Description	Planned Completion Date	Product Type
Climate Change Impact Research Roadmap: In 2008, a workshop will be held with members to review potential climate change impacts on available water resources for power generation, major knowledge gaps, and research opportunities. In 2009, based on the 2008 workshop and further discussions with members, an EPRI research roadmap will be developed.	12/31/2009	Technical Update

Future Year Products

Product Title & Description	Planned Completion Date	Product Type
Climate Impact on Available Water Study: One: With input from members, a high priority study will be chosen from the climate impact roadmap completed in 2009.	2010	Technical Update
Climate Impact on Available Water Study: Two: A second climate study chosen from the 2009 roadmap will be undertaken.	2011	Technical Report

P55.003 Advanced Cooling (063345)

Issue

Most thermoelectric and all hydroelectric power plants need sufficient water supplies to meet generation demands. Most of the water used by thermoelectric power plants is either withdrawn for once-through cooling or consumed by wet-cooling towers. A major drought in the United States could result in adverse economic, environmental, and social impacts, including reduced output of power plants. The siting of new power plants is critically dependent upon access to sufficient water for cooling and other plant processes. Technologies for significantly reducing water consumption and use are expensive. The geographical areas vulnerable to water availability shortages and water-induced constraints on electric power generation are not limited to the arid and semiarid West and Southwest but occur throughout the United States. This vulnerability will increase over the next quarter-century as a result of greater demands for fresh water associated with population growth. Climate change and growing concerns about environmental protection may exacerbate the situation.

Description

This project enhances compliance processes, controls O&M costs, reduces construction costs, expedites permitting, and assesses innovative, breakthrough technologies to increase water use efficiency and reduce overall water use by power plants. It provides guidelines, tools, demonstrations, and information for use and optimization of advanced cooling strategies and technologies to meet water conservation requirements of permits, regulations, and policies. The project also reduces costs and heat-rate penalties associated with advanced cooling technologies, provides methods of water treatment to enhance use of degraded water sources, and addresses siting and construction of new plants and retrofitting of existing plants.

Value

- Provides a basis for applying wet- and dry-cooling technology to thermoelectric power plants
- Reduces impacts of wet and dry cooling on power plant performance and O&M costs

- Expedites permitting by providing guidelines, tools, and information for the use and optimization of advanced cooling strategies to meet water conservation requirements
- Develops and demonstrates innovative water-conserving technologies for use at thermoelectric power plants

How to Apply Results

Power company environmental and generation staff will apply project results to evaluate alternative wet- and dry-cooling technologies to reduce water consumption for cooling, and hence vulnerability to future water shortages. Pilot and demonstration studies will be conducted with cooperating members. U.S. Department of Energy and vendor cost sharing will be solicited. Workshops will be held to foster the communication of results to members, vendors, and government agencies.

2009 Products

Product Title & Description	Planned Completion Date	Product Type
Draft Retrofit Guidelines for Once-Through Cooling: The draft guidelines will address alternate retrofit cooling strategies and technologies to replace once-through cooling. The alternative cooling technologies include evaporation ponds and wet and hybrid wet-dry cooling towers. Factors to be addressed are costs, environmental impacts, licensing issues, and energy penalties.	12/31/2009	Technical Update

Future Year Products

Product Title & Description	Planned Completion Date	Product Type
Final Retrofit Guidelines for Once-Through Cooling: The draft guidelines prepared in 2009 will be finalized and delivered as a technical report. The guidelines will address alternate retrofit cooling strategies and technologies to replace once-through cooling. Alternative cooling technologies include recirculation and cooling ponds or wet-cooling towers, dry cooling, and hybrid wet-dry cooling systems.	2010	Technical Report
Advanced Cooling Synthesis Report: EPRI will develop a web-based resource providing clients with all of the current information on the use, optimization, and operational and maintenance issues related to the use of advanced cooling and water conservation techniques. This document will provide clients with the latest information in design, case studies, new technologies, guidance, and cost-benefit analysis support.	2011	Technical Resource