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Water Quality Trading in the Ohio River Basin and EPRI Nitrogen Research

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EPRI's Interest in WQT

- EPRI wants to establish a project where power companies will participate as buyers and/or sellers of nitrogen credits.
- Such a project will allow power companies manage their nitrogen discharge with WQT.
- Project will serve as a model for other trading programs in the U.S.

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Rationale

- N load from power plants may increase in near future
  - Selective Catalytic (and Non-Catalytic) Reduction (SCR, SNCR)
  - Flue Gas Desulfurization (FGD)
  - CO_2 scrubbing (amine or ammonia based sorbents)
- New NPDES permits may have more stringent limits on N discharges
- Potential reduction in cost of compliance by trading N & P loads with other sources

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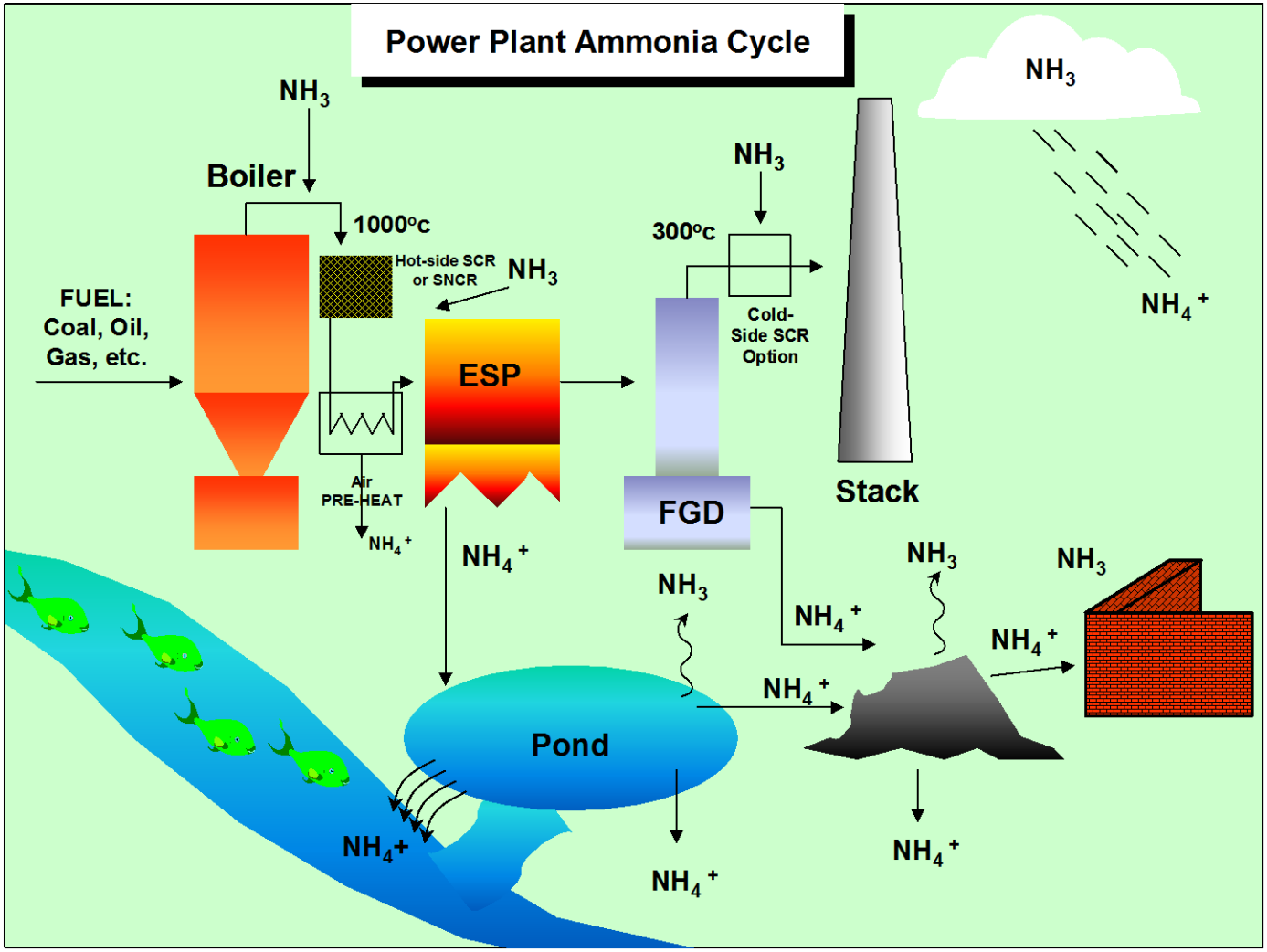
Nitrogen in Power Plants



Power Plant Ammonia Pathways

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Characteristics of Successful Water Quality Trading Programs

- Approximately 80 WQT pilot projects, feasibility assessments, and trading programs have been conducted throughout the U.S. in the last 15 years.
- Few have resulted in actual trades.
- These projects, assessments, and programs provide lessons regarding characteristics that may promote or hinder success of WQT.

- Considered WQT Pilot Programs in:
  - Ohio River Basin
  - Chesapeake Bay
  - Catawba River Basin

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EPRI Report: Water Quality Trading Programs Pilot Project Review

Screening Criteria	Ohio River	Chesapeake Bay	Catawba River Basin
Pollution cap - measurable and restrictive	▯	▯	○
Type	▯	▯	○
Timing	▯	▯	▯
Nutrient discharge regulations	▯	▯	○
Nitrogen	▯	▯	○
Phosphorus	▯	▯	▯
Permitting cycle	▯	○	▯
High Compliance Costs	▯	▯	▯
High variability in pollution control costs	▯	○	▯
PS - Facilities with high impending treatment costs	▯	▯	▯
NPS – Reduction costs	▯	○	○
Basis for strong credit supply and demand	▯	○	○
Baseline for PS and NPS (% reduction for all sources)	▯	▯	▯
Industry mix	▯	○	▯
Seed funding (multiple potential funding sources)	▯	○	▯
Program champion	▯	▯	▯
Lead identified	▯	▯	▯
Supporting organizations identified	▯	○	○
Conducive regulatory environment	▯	○	○
Interstate Coordination	▯	○	○
Organizations	▯	○	▯
Regulatory authority	▯	▯	○
Stakeholder Willingness	▯	○	○
Buyers	○	○	○
Sellers	▯	○	○
Public	○	▯	○
Methods for calculating pollutant equivalency	○	▯	○
Modeling for load allocations	○	▯	○
Modeling	▯	▯	○
WQ Data	▯	▯	▯

Prepared By Shaw Environmental

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Ohio River Basin Chosen

- High nutrient loading
- Pending regulatory program will create potential
- WQT credit demand
- Presence of multiple sources of N & P
- Regulatory climate favorable to WQT
- Presence of numerous coal-fired power plants with potential or actual N loads
- Many stakeholders: Farmers, WWTP, Power Industry
- Links to Gulf of Mexico Hypoxia issues

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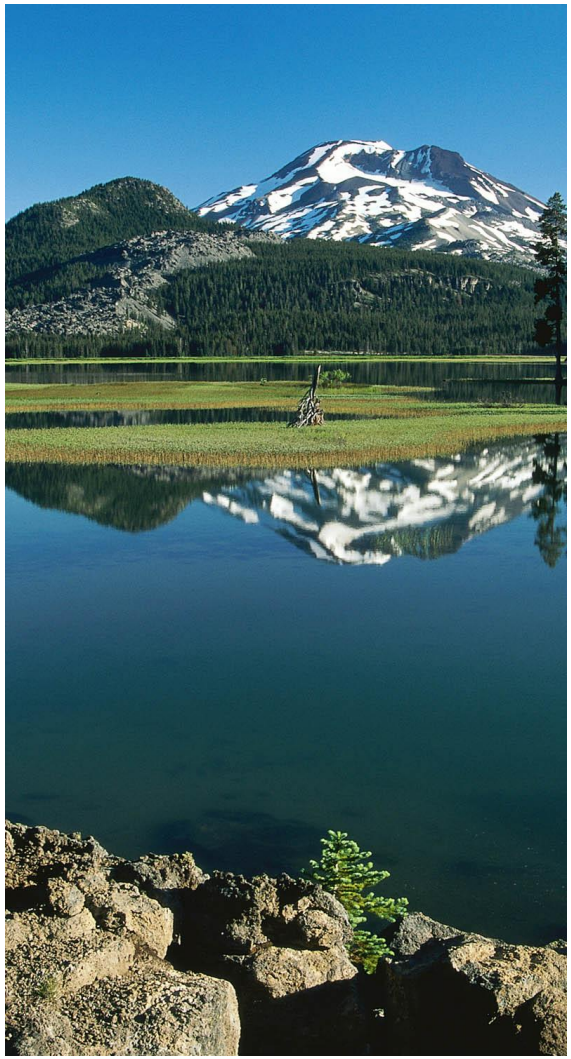
Project Collaboration



Electric Power Research Institute

Kieser & Associates

Ohio River Valley Water Sanitation Commission (ORSANCO)

American Electric Power

Duke Energy

American Farmland Trust

Miami Conservancy District

UC Santa Barbara

Hunton & Williams

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Ohio River Trading Program Goals

- Participants will achieve cost-effective outcomes
- Add WQT trading to the toolbox of large set of stakeholders
- Ecosystem Service Benefits
- Regional Effort
- Collaborative process
- 3-5 years to established program (trading in 1-2 yrs)

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Trading Types

- **Point/Point** - Point source pays another point source for reduction credits
- **Point/Nonpoint** - Permitted and non-permitted sources with voluntary (market driven) credit generation
- **Non-point/nonpoint** - Regulated nonpoint source such as municipal storm water permittees and unregulated nonpoint sources such as agriculture

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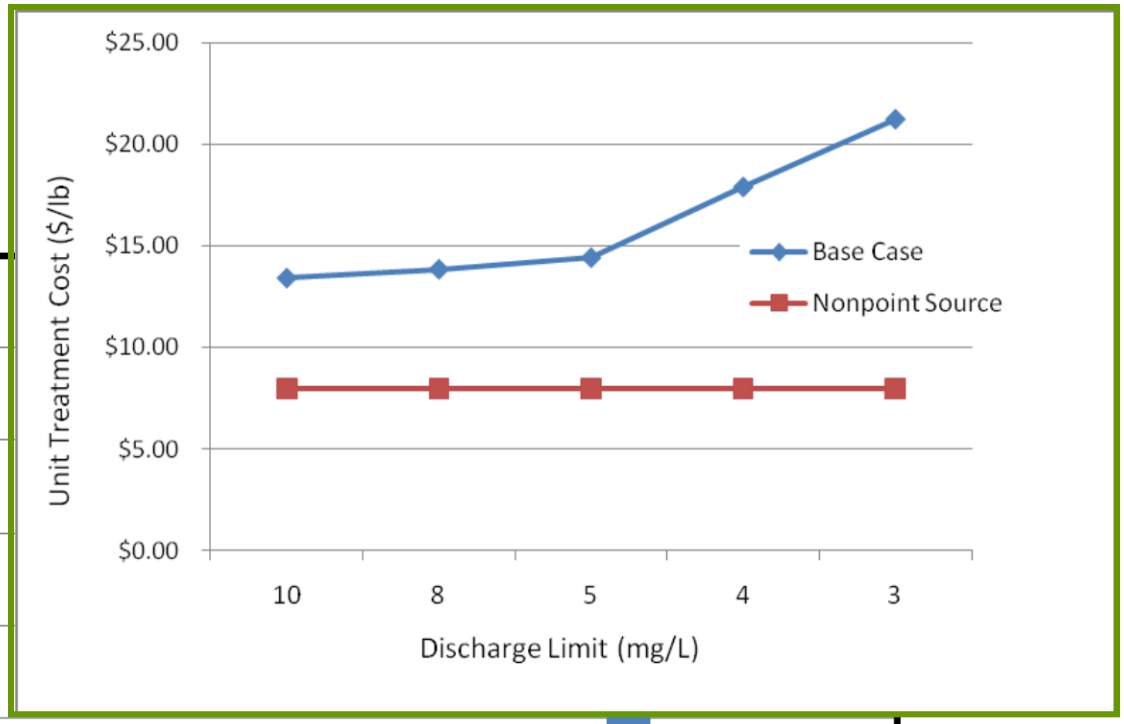
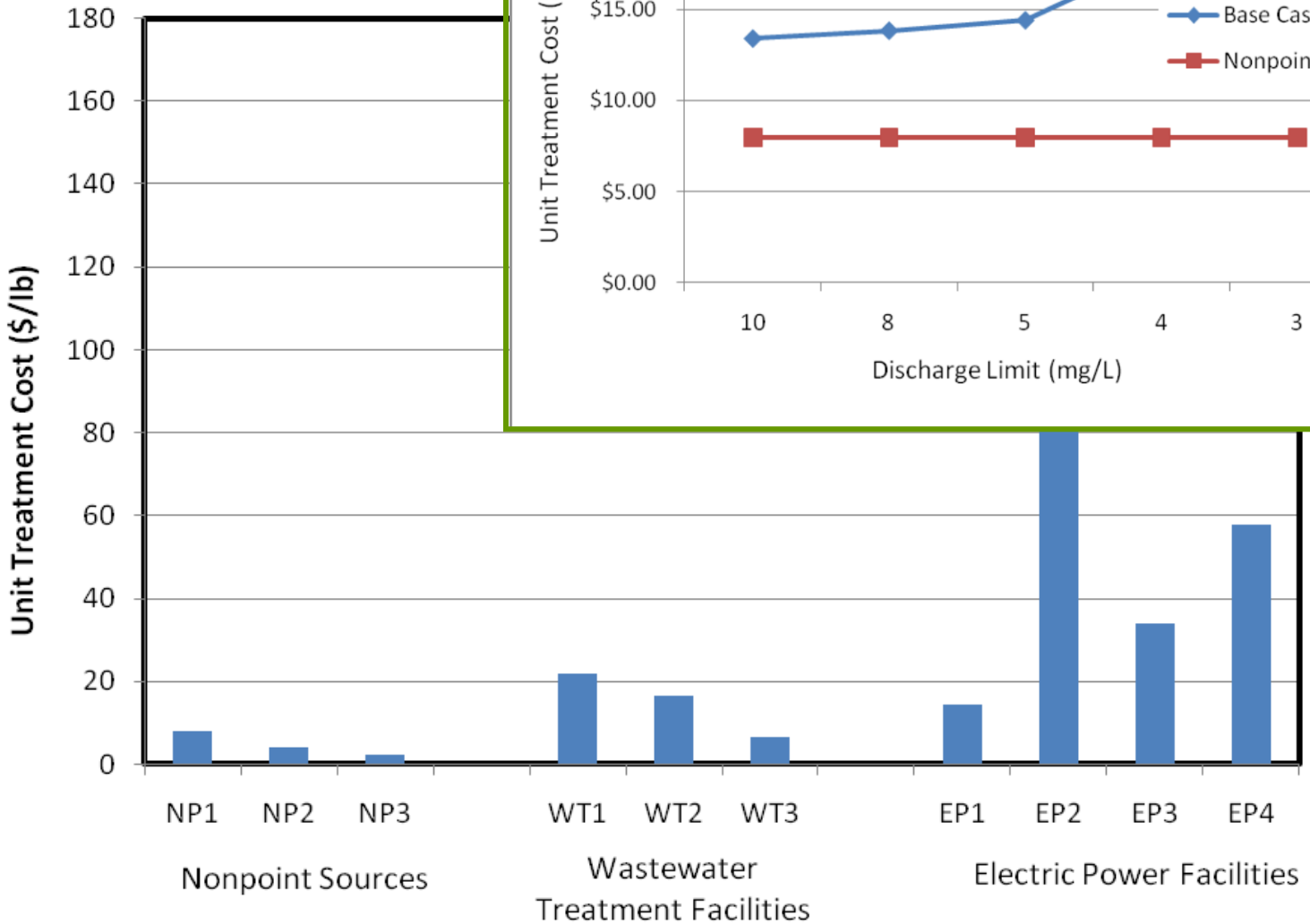
Treatment Costs





Source: EPRI Business Case, Prepared by Shaw Environmental and Kieser & Associates

Watershed Modeling

Watershed Analysis Risk Management Framework (WARMF)

Dr. Arturo A. Keller, Ph.D.
Bren School of Environmental Science & Management
University of California, Santa Barbara

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Download WARMF from EPA

US EPA Watershed Analysis Risk Management Framework (W...

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Watershed Analysis Risk Management Framework (WARMF)

To facilitate TMDL analysis and watershed planning, WARMF was developed under sponsorship from the Electric Power Research Institute (EPRI) as a decision support system for watershed management. The system provides a road map to calculate TMDLs for most conventional pollutants (coliform, TSS, BOD, nutrients). It also provides a road map to guide stakeholders to reach consensus on an implementation plan. The scientific basis of the model and the consensus process have undergone several peer reviews by independent experts under EPA guidelines. WARMF is now compatible with the data extraction and watershed delineation tools of EPA BASINS. WARMF is organized into five (5) linked modules under one, GIS-based graphical user interface (GUI). It is a very user friendly tool suitable for expert modelers as well as general stakeholders.

WARMF Components

The Engineering Module is a GIS-based watershed model that calculates daily runoff, shallow ground water flow, hydrology and water quality of a river basin. A river basin is divided into a network of land catchments (including canopy and soil layers), stream segments, and lake layers for hydrologic and water quality simulations. Land surface is characterized by land use / land cover and precipitation is deposited on the land catchments to calcuate snow and soil

WWQTCS Info

- WWQTCS Home
- Technical Support
- Tools
  - Watershed Models
    - Basins
    - LSPC
    - WAMView
    - SWMM
    - WARMF
  - Water Quality Models
    - WASP
    - QUAL2K
    - Aquatox
    - EPD-RIV1
  - Hydrodynamic Models
    - EFDC
    - EPD-RIV1

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Types of Analyses

- Modeling nutrient fate and transport within the basin
- Evaluating effectiveness of BMPs at different scales
- Studying the effects of specific nutrient trades
- Evaluating different "what if" scenarios that the stakeholders would like to try
- Informs key technical questions (trading ratios, discounting)
- Helps to evaluate potential ecological benefits of trading programs
- Helps to develop and inform a water quality monitoring program

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Investigating Credit Stacking with GHGs

Adam Diamant, EPRI Global Climate Program

- Demonstrating the potential to achieve large scale, cost-effective GHG emissions offsets by reducing N_2O emissions from agricultural crop production.

- EPRI developed this project in collaboration with one of the world's foremost experts on non-CO_2 GHG emissions from agriculture:

  Dr. Phil Robertson,
  Professor of Crop and Soil Sciences
  Michigan State University (MSU).

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Benefits of Regional WQT Program

- Save millions of dollars in future start-up and program costs (compared to many small, localized trading programs)
- Allow point sources with multiple discharges to manage compliance needs under one primary trading framework
- Incentivize non-point source load reductions
- Provide uniformity in credit calculations across basin
- Legal framework for interstate trading
- Support nutrient standards development with modeling applications and flexible compliance tools
- Centralize trading debate/program design efforts to facilitate multi-state communication

Flexible, cost-effective compliance options with greater net environmental benefits

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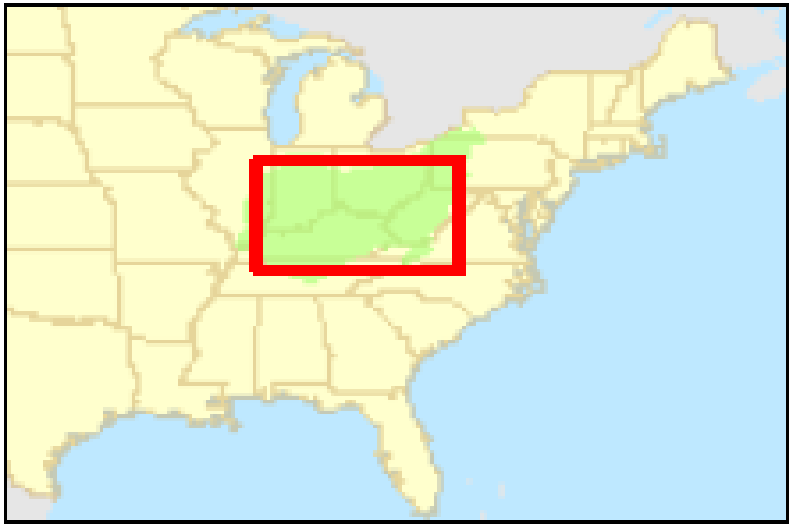
Project Summary

- Due to the large set of stakeholders in the project area, this effort will allow **power companies, farmers, and other industrial dischargers** to work together to improve water quality, minimizing costs to the public.



- This project will be a regional multi-credit trading program and represents a comprehensive approach to designing and developing markets for **nitrogen, phosphorus and potentially GHG credits**.

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Supplemental Project (1018855)

- Organization and Facilitation of Stakeholder Group
- Support Trading Program Design
- Continue Watershed Modeling (WARMF)
- Evaluation of Credit Stacking with Carbon and Water quality credits

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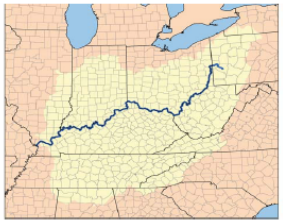
Ohio River Basin Trading Program for Water Quality and Greenhouse Gases



Ohio River Basin Project Area. Water quality trading offers Ohio River power companies opportunities to meet discharge limits, reduce emissions and protect watersheds at lower costs.

- Cost-effective option for reducing nitrogen discharges and greenhouse gas emissions
- Innovative approach to "stack" carbon and nitrogen credits
- Rigorous, ecologically based trading program design that unravels local/regional regulatory and stakeholder complexities
- Framework for long-term water quality management in the Ohio River Basin
- Implications for improvements in the Gulf of Mexico hypoxic zone
- Early experience understanding the role of trading in future company compliance strategies and business planning

Water quality trading is an innovative market-based approach to achieving water quality standards through programs that allow emitters to purchase pollution reductions from another source. Control costs for any one pollutant can differ from one emitter to another, and water quality trading provides an option for meeting pollution permit targets in a cost-effective manner. Similarly, carbon credit markets enable the most cost-effective solution for meeting anticipated carbon caps. Properly designed and deployed, the proposed trading program in the Ohio River Basin will produce both greenhouse gas (GHG) and water quality credits, protecting watersheds at lower overall costs. This project will be a first-of-its-kind regional multi-credit trading program and represents a comprehensive approach to designing and developing markets for nitrogen, phosphorus and GHG credits. Due to the large set of stakeholders in the project area, this effort will allow power companies, farmers, and other industrial dischargers to work together to improve water quality, minimizing costs to the public and stakeholders. The program will also benefit receiving water bodies that are now threatened by nitrogen and phosphorus pollution.

Value

The design and adoption of market mechanisms offers a flexible approach to finding the lowest cost options for improving water quality and reducing GHG emissions. The demonstration of a wide-scale, multi-pollutant approach enhances the value above a single pollutant credit market.

This work is timely as existing challenges to meet nutrient discharge limits may be amplified by increased effluent discharges of nitrogen (due to operation of air pollution controls), coupled with more stringent water quality based limits for surface waters.

Drivers and Trends

EPRI recently completed a feasibility analysis for multi-state water quality trading in the Ohio River Basin (EPRI Report 1015409). By participating in a regional trading program, power companies could receive benefits as either a purchaser or as a provider of credits. The benefits of participation may be realized as a long-term compliance strategy, an interim strategy prior to facility upgrades, or for compliance during difficult seasonal discharge management periods. The EPRI study also identified robust and diverse stakeholder interest and willingness among various stakeholders to participate in multi-credit, regional trading program for the Ohio River.

In addition to developing a regional water quality trading program for nitrogen and phosphorus, this project will build on EPRI work to quantify greenhouse gas credits for avoided

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2008 Research Summaries

>> Water Quality Criteria Development and Assessment - Program 53 (110KB PDF)

Ohio River Basin Trading Pilot Project

Control costs for any one pollutant can differ from one emitter to another. Water quality trading (WQT) is an innovative market-based approach to achieving water quality standards that allows emitters to purchase pollution reductions from another source. A trading program enables facilities facing high pollution control costs to buy reductions from another facility with lower pollution control costs. The net effect is the same water quality improvements at lower, more efficient costs. Today, a few states have trading frameworks in place or in development but none operate on an interstate or regional basis. EPRI recently completed a feasibility study for a regional water quality trading program in the Ohio River Basin and is currently working with stakeholders and trading partners to develop a working pilot project. EPRI leads this effort with support from Kieser & Associates, LLC, American Farmland Trust

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