

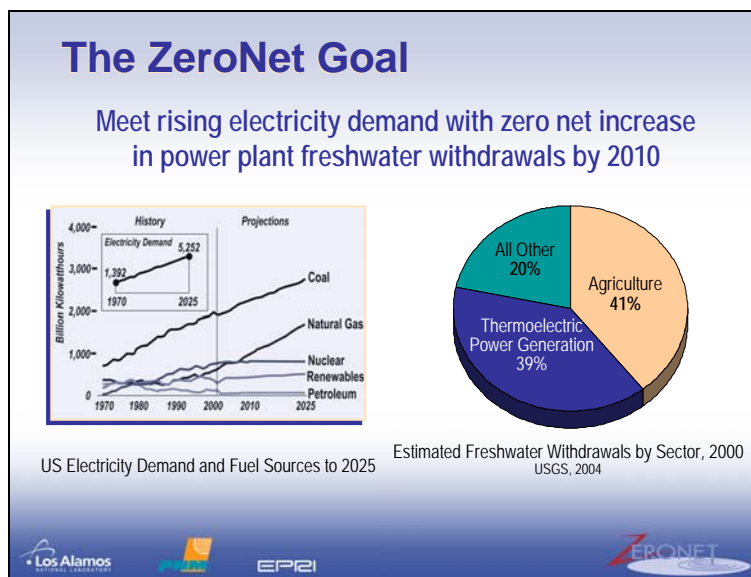
ZERONET WATER FOR ENERGY: MANAGING WATER FOR POWER PRODUCTION

Cathy Wilson and Dan Macuga
Los Alamos National Laboratory

ABSTRACT

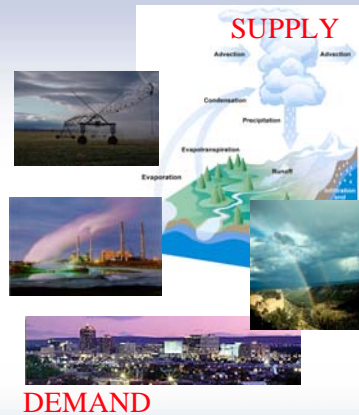
A critical sector in NM vulnerable to drought is energy production. Water is required for thermal electric power generation, which in turn is required to support existing businesses and attract new industries. While full economic impacts are difficult to quantify, the inability of NM power plants to operate reliably and affordably because of water restrictions would have a ripple effect, impacting multiple sectors and the present and future economy of the state.

The ZeroNet Water-Energy Initiative (ZeroNet) is taking action to plan and mitigate the impacts of drought on the power sector. Established in January 2003, by LANL, Electric Power Research Institute, and Public Service Company of New Mexico, ZeroNet's goal is to meet New Mexico's growing power demand without increasing fresh water withdrawals for power plant cooling by 2010. ZeroNet is not only taking action to supply more electricity to New Mexico using less fresh water, it is also developing the tools to better understand the complex nature of drought and water management tradeoffs, which can help the state plan and mitigate its potentially severe economic and social impacts. In 2004, ZeroNet activities will include (1) a produced water pipeline and water treatment technology project, to bring degraded water from oil and gas wells to the San Juan Power Plant for cooling purposes; (2) the pilot demonstration of Wet Surface Air Cooling using untreated produced water; and (3) a demonstration of the ZeroNet Water Advisor, a decision support tool to help water managers and owners optimize beneficial outcomes resulting from water management decisions.



Challenges-

- Increasing demand for water from multiple sectors
- Decreasing supply due to drought
 - Power generation restrictions
 - Economic vulnerability
 - Aquifer depletion
 - Environmental degradation
 - Social and political unrest



EPRI



Solving the problem

Requires Science and Technology to-

- Reduce fresh water use in electric power generation
- Utilize degraded water sources
- Understand inter-dependencies between natural water supply system and energy production systems
- Ensure excellence in water management



EPRI



Solving the problem

Requires Science and Technology



EPRI



ZeroNet Program Elements

Technology research and development

Degraded Water Treatment and Use

- ceramic membrane microporous filters for desalination
- surfactant-modified zeolite for hydrocarbon removal

Conservation, Efficiency and Renewables

- advanced coatings to increase cycles of concentration in power plants
- biomass power generation
- High Efficiency Reverse Osmosis filtration

Monitoring & Measurement

- LIDAR, laser based vapor fluxes
- “machine learning” algorithms for remote sensing classification
- sensor web design for efficient, real time water quality and quantity monitoring
- advanced sensors for environmental and power plant water quality assessment

Advanced Cooling Technology

- advanced spray nozzle design
- spray enhanced dry cooling
- Wet Surface Air Cooling with degraded water



ZeroNet Program Elements

Technology assessment, demonstration, integration, adoption

Demonstrations, Test Beds and Outreach

- Wet Surface Air Cooling pilot project
- Produced water pipeline, treatment and cooling project
- Vegetation management for water yield and biomass power production

Prediction and Decision Support

- ZeroNet Water Advisor
 - Shortage sharing consensus building
 - Quantify impacts of regional drought on Western power generators and power users
 - Quantify impacts of adoption of new technology and legal instruments

Policy, Economic and Market Analysis

- Test water banking & trading
- Examine impacts of settlements and agreements



Partner Capability

- PNM
 - Senior management commitment to ZeroNet goals
 - Real world problems
 - Industry-based demonstration of science and technology
- LANL
 - Leadership in defining emerging energy-water issues
 - Excellence in energy-water S&T
 - Commitment to develop and apply affordable S&T solutions
- EPRI
 - Leadership in bringing new technology to the power industry
 - Broad knowledge of power industry needs
 - Commitment to continual improvement of the nation's power sector



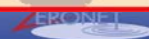
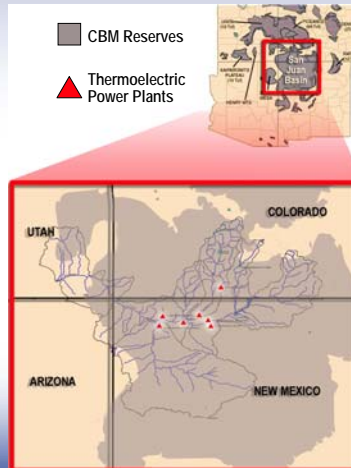
LANL Capability

- Chemical, biological and membrane-based water treatment technologies
- Facilities based expertise in water recycling, treatment and conservation
- Remote and on-site sensor development and deployment
- Monitoring and measurement of watershed properties and water/vapor quantity and quality in natural and industrial settings
- Experimental design, demonstration and outreach
- Prediction and decision analysis



Benefits specific to Four Corners Region

- Use produced water from Coal Bed Methane production
 - Treatment or disposal is costly
 - ReInjection can contaminate aquifers
 - Not suitable for Ag. without treatment
 - *Power plants can use as is*
 - Converts waste product into commodity
- All arid and semi-arid states can benefit from transfer of solutions developed in NM
- Frees up resources to meet interstate compacts



Benefits to the region and the Nation

- Meet future electricity demand without increasing water withdrawal
- Provide integrated, knowledge-based tools to manage water and energy resources
- Ensure a stable water resource for energy producers- despite drought
- Alleviate competition among water users
- Offer a transferable model to other regions
- Provide new business opportunities for produced water suppliers, water banking, and technology providers

