

ZeroNet Water-Energy Initiative

Joint Initiative between Los Alamos National Laboratory, Electric Power Research Institute, and Public Service Company of New Mexico

Our Commitment

The ZeroNet Initiative will take significant action to address the critical water and energy issues facing the United States (U.S.). The initiative will begin by delivering new electric power capacity with “zero net” freshwater withdrawals in New Mexico by 2010. The New Mexico ZeroNet pilot program will serve as a template for a National program of water management for power generation. ZeroNet will demonstrate national leadership and technical breakthroughs that will help provide clean, affordable and sustainable water and energy – two essential resources for continued economic health and well being for the U.S.

Background

According to the 2002 Transition Report on the Office of the State Engineer and the Interstate Stream Commission, New Mexico is in a water crisis. The report states that regardless of how much snowfall and rainfall New Mexico receives in the foreseeable future, water supply will be limited and difficult decisions will be required to manage the water supply.

The ZeroNet Initiative is designed to create and apply technologies, information, data and decision support tools to help New Mexico handle this crisis. The Initiative specifically focuses on the water needs of the energy sector and the relationship of the energy sector to other water users and the overall economic and social structure of the State. Although, historically, water use by power plants in New Mexico has accounted for about 2% of total water withdrawals in the State, under current crisis conditions, all uses must be conservatively managed in an integrated manner. On a national basis, thermoelectric power accounts for over 37% of freshwater withdrawals.

Given future population growth and development throughout the U.S., the demand for water and energy is expected to increase in all regions, resulting in increased stress on water and energy supplies. The ZeroNet initiative will generate technology and decision tools that can be applied in all regions of the United States.

Who We Are

Because energy and water is essential for all, the Initiative will include a broad range of multidisciplinary stakeholders from industry, academia, national laboratories, tribal nations, environmental organizations and local to national government entities.

What We Will Do

This public/private initiative will define, develop, and deploy knowledge and technology that is necessary in order to deliver new electric power capacity with “zero net” freshwater withdrawals in New Mexico by 2010. Over the past year, initial stakeholder input has been secured through two workshops and a broad range of conversations; three main components were identified: Public Policy, Technology and Education.

Under those components, the ZeroNet Initiative developed a comprehensive, integrated work plan with the following program elements:

- Alternative Water Sources
- Integrated Modeling and Management Scenario Assessment
- Economic, Market, and Risk Analysis & Mechanisms
- Water Efficiency, Conservation, and Recycling
- Advanced Cooling
- Land Management
- Monitoring
- Policy Implications
- Education

While the ZeroNet Initiative will commence as a regional pilot in New Mexico, it will include a technology transfer program to enable implementation of the “zero net” approach throughout the U.S.

Anticipated Outcomes & Impact

We anticipate that our efforts will:

- Deliver new electric power capacity in New Mexico with “zero net” freshwater withdrawals by 2010;
- Ensure a stable water resource for energy producers;
- Reduce the energy cost of providing clean, affordable water;
- Create a detailed source of water/energy information to aid the public and policy-makers;
- Provide targeted technological solutions and technology transfer opportunities;
- Improve the quality of the nation's fresh water supply;
- Alleviate competition between energy producers and other water users, and
- Serve as a new and innovative model to help other states and regions achieve sustainable energy production while preserving precious freshwater resources.

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Program Elements

In order to achieve a total solution to the energy-water challenge, the ZeroNet Initiative will take a comprehensive and integrated approach. The following outlines the ZeroNet Initiative program elements.

Alternative water sources – Alternative or degraded water sources can be used in cooling systems preserving the efficiency and capacity of these cooling systems while freeing freshwater for other uses. There are many sources of degraded and/or produced water from oil/gas/coal, brackish groundwater, treated sewage effluent, process wastewater, etc. Barriers to these waters replacing high-quality water in cooling towers include source location/quantity/quality, economical treatment options, and regulatory issues including wastewater treatment and disposition. The approach will address these barriers providing users with information and technologies that they can adopt for their situation.

Integrated Modeling and Management Scenario Assessment – An integrated watershed modeling capability is needed to assess relative merits and limitations of alternative ZeroNet management strategies using various combinations of technologies, land use, and climatic patterns. Approaches include the Watershed Analysis Risk Management Framework (WARMF) and Integrated Basin Model (IBM) models and decision support tools. The WARMF model can be used as a teaching and management tool providing a “user friendly” interface to the stakeholders. The IBM provides a detailed representation of processes occurring in a watershed and a scientific basis for decision analysis tools.

Economic, Market, and Risk Analysis and Mechanisms - This component will develop market-based approaches to managing water within the current policy-driven environment. Approaches include water banking and trading, economic modeling to develop incentives, and applying control theory techniques to avoid or cope with scarcity/crisis.

Water Efficiency, Conservation and Recycling – Enhancing water use efficiency depends on changing operating practices, employing new technologies, or a combination of these two methods. Approaches include determining the impact of energy efficient technologies on power production and associated water withdrawals, optimization techniques and models to minimize

freshwater use in industrial settings, and technologies that directly or indirectly reduce freshwater withdrawal or provide recycling advantages such as ozone, ultraviolet, membranes, electroseparation and photocatalysis.

Monitoring – To assess ZeroNet on a watershed basis and to evaluate the performance of advanced technologies, monitoring of water quantity and quality are required. Approaches include remote sensing of land attributes, real-time field and facility based water quality and quantity sensors, and data -to-knowledge tools to interpret monitoring data streams, support modeling, and drive actions.

Advanced cooling – Advanced cooling technologies are needed to preserve current thermal efficiencies while overcoming penalties such as capital costs and operating capacity and efficiency penalties. Approaches include spray enhancement with advanced nozzle designs, degraded water use, systems optimization, phase-change systems, deluge towers, and evaporative condensers.

Land management – Vegetation management, including thinning of Pinon and Juniper woodlands and upland forests, and removal of non-native riparian species, has the potential to increase water yield to streams and reservoirs. The objective of this element is to quantify the costs and benefits of comprehensive vegetation management for increased water yield, and biomass-based electricity generation.

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