# Bi-national Wastewater Treatment and Potential for Bi-national Energy and Water Cooperation between US and Mexico in Ambos Nogales

*By Terry W. Sprouse[1],Evan Canfield[2], and Stephen P. Mumme[3]*

Abstract

Treated wastewater, utilized for riparian areas and groundwater replenishment, is a vital component of border water budgets. The flows of urban wastewater across the US-Mexico border are increasing, requiring additional wastewater treatment capacity to accommodate expanding populations and economic development. Yet there is a need for more consideration of the energy costs for the planned expansion of border wastewater services. This paper provides an overview of the energy/water link, examines the context of this growing issue in the western border region, and discusses wastewater and energy issues in Ambos Nogales (the border sister-cities of Nogales, Arizona and Nogales, Sonora). In addition, the paper outlines some existing and planned energy and water projects along the U.S. - Mexico border.

[1] Water Resources Research Center, University of Arizona, Tucson, Arizona, tsprouse@cals.arizona.edu

[2] Planning & Development Division, Pima County Regional Flood Control District, Tucson, Arizona Evan.Canfield@rfcd.pima.gov

[3] Department of Political Science, Colorado State University, Ft. Collins, Colorado smumme@lamar.colostate.edu

Overview of the Energy/Water Link

A recent report by the National Science and Technology Council (NSTC, 2004) stated:

> *A very close linkage exists between the nation's energy future and water future – water is crucial to the production of energy; different energy sources have different water needs. Conversely, many of the technologies for withdrawing, storing or treating water consume large amounts of energy. Thus, the science of water availability and use is crucial to the planning of our nation's energy future. The reliability of both energy and water infrastructures are linked to competition among all water users.*

Despite the importance of the water and energy link, the NTSC report recognized significant data gaps in understanding the relationship of water to energy. Studies are showing that water use per quantity of energy produced varies greatly from one thermoelectric power plant to another, which makes it difficult to quantify the energy-water nexus (Yang and Dziegielewski, 2007). Some plants have large water withdrawals, but ultimately do not consume much water. Other plants do not withdraw much water, but consume all of it. Even plants of similar design can use different amounts of water.

Where the link between power and water has been quantified, the numbers are daunting. In California, fully 30% of the natural gas use and 19% of the electrical power generation are water related (Grenoble, 2007).

The dynamics of limited water, costs of treatment, and cost of pumping make for some interesting redistribution and pricing of water resources. Public money made Colorado River Water available in Tucson by pumping it uphill through Central Arizona Project. Currently private entities and water companies are recognizing the economic benefits of pumping water from one basin to the next so that pipeline construction is increasing across the western U.S. (Landry and Quinn, 2007). Likewise the availability of water does not necessarily make it desirable or cost-effective to acquire. Tucson Water subsidizes its reclaimed water system by charging a surcharge to its potable water customers.

With the expanding population and increasing demand on a limited water supply, there are few areas more likely to see this competition for water and energy play out than in the Western U.S.-Mexico border region.

The Energy-Water Nexus in the Western U.S.-Mexico Border Region

The case of the NIWTP and its potential role in a binational energy-water exchange at Ambos-Nogales is indicative of growing pressure throughout the western border region to better utilize scarce water resources. This trend, as often noted by regional economists, is driven by rapid overall population growth and the rapid urbanization of border cities, rapid industrialization—seen most vividly in the near doubling of Mexico's maquiladora industry since NAFTA took effect in 1994, and the potential for growing affluence in the border region—a trend that has not yet taken hold outside growth poles like the San Diego-Tijuana metropolitan zone (Peach, 2001). Though the border region remains heavily dependent on fuels outside the border region, power provision has proven to be politically more manageable than reallocation of scarce water supplies. This accounts for the fact that throughout the arid border region on both sides of the border energy is arguably often more plentiful than non-agricultural water supply, though both are in high demand. Ten years after NAFTA the border region has experienced what might be called a "boom" in power-plant construction, with 13 new electricity projects receiving permits and 16 other projects on the drawing board (GNEB, 2003: 13). Cross-border energy exports from both countries are burgeoning along a border that is today literally crisscrossed with oil and natural gas pipelines and power lines (Sweedler, 2007). A recent report on North American energy markets by the North American Commission for Environmental Cooperation (CEC) suggests this trend will continue (CEC, 2002).

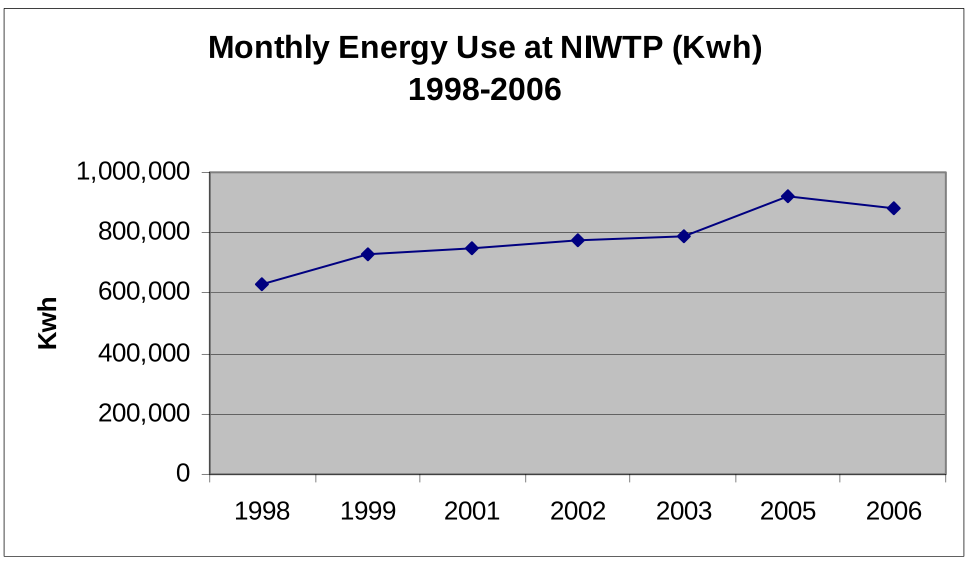
While the specific circumstance of Ambos Nogales are in a sense unique, the pressure to better utilize marginalized sources of water for human consumption, ecological uses, and energy is seen throughout the border's western region, particularly in its larger urban areas. Along the California-Baja California border at Mexicali, for instance, wastewater is in high demand. Two new power plants owned by Sempra Energy and Intergen Corp. utilize reclaimed wastewater from the Mexicali II wastewater treatment plant for cooling, enabling these plants to export more than 1,100 megawatts of power to Southern California (EcoAmericas, 2006: 9). The two plants recently defeated a lawsuit aimed at forcing the two plants to comply with U.S. environmental regulations for water and air (Lazaroff, 2002; Ecoamericas, 2006: 1). Mexicali wastewater, including power-plant effluent, has also been targeted as one of various potential sources of water supply to shore up riparian vegetation in the highly threatened Colorado River delta. Such wastewater reclamation, if it came to pass, would inevitably entail a complex exchange of energy for water. Mexicali's new energy plants may also be called upon to power up new desalination facilities now in the talking stage in Baja California's water planning. A recent U.S. court decision authorizing the lining of the All-American canal will significantly reduce seepage water supply to the Baja California border area, spurring such development (LA Times, April, 2007).

Immediately to the west, at Yuma, Arizona, plans are moving to operate the energy intensive 20-megawatt Yuma desalting plant, built to satisfy the terms of the 1973 salinity agreement with Mexico. If operated, the plant could reclaim nearly 70,000 acre-feet of water annually at the expense of damaging the ecologically important Santa Clara slough in Mexico, which currently receives bypassed effluent that would be desalted by the Yuma plant. In spring 2007, a ninety-day demonstration run was conducted at the Yuma Plant at 10% full capacity (IBWC, May, 2007). Ironically, it is possible that some of the power used by the Yuma desalination plan may eventually come from a recently proposed plant at San Luis Rio Colorado just across the border. There, North Branch Holding plans to build a 605 megawatt natural gas fired power plant to sell peak power to Arizona and California (Power Markets Week, 2006).

Further west, at El Paso, El Paso Water Utilities has nearly completed construction on the world's largest inland desalinization plant (Turner and Jahagidar, 2006). The new facility, the Kay Bailey Hutchinson Desalinization Plant scheduled to open in August 2007, is designed to produce 27.5 million gallons per day of fresh water for El Paso, reclaiming brackish groundwater from the huge Hueco Bolson aquifer underlying El Paso and Cd. Juarez (El Paso Water Utilities, 2007: 1). At $70 million dollars for an estimated draw of 30.8 thousand acre-feet of water annually, much of this expense due to the energy cost of running the plant, it significantly ups the ante on water for El Paso taxpayers but represents the last best option for this water scarce region. Many observers expect Cd. Juarez to follow suit in the years to come, capitalizing on the brackish waster in its reach of the Hueco and Mesilla bolsons.

Wastewater and Energy in Ambos Nogales

Energy use at the Nogales International Wastewater Treatment Plant (NIWTP) is on the rise. As shown in Table 1, energy consumption at the NIWTP has risen from a little over 600,000 kilowatt hours per month in 1998 to over 900,000 kilowatt hours per month in 2005 (IBWC 2007). The NIWTP, located near Rio Rio, Arizona, treats about 15 million gallons per day (mgd) of wastewater originating from both Nogales, Arizona and Nogales, Sonora. The Mexican plant allocation of 9.9 mgd per day has been regularly exceeded in recent years due to increased water supply and improved wastewater collection infrastructure in Nogales, Sonora.




(IBWC, 2007)

Another treatment plant is planned for Nogales, Sonora. After many false starts, Mexico plans to build a wastewater treatment plant in Los Alisos, about 10 miles south of border (NADB, 2006). The plant would treat wastewater in excess of the 9.9 mgd allocation at the NIWTP. Under the existing treaty, Mexico has the right to retain and reuse all wastewater on its side of the border. However, there would be a high energy cost, as the wastewater would have to be pumped up-gradient and over a watershed divide to reach the proposed new plant. Presently, the Mexican wastewater runs down-gradient to the NIWTP and no energy is expended for pumping.

A plan to build a 411-megawatt electrical generation plant in Nogales, Arizona called for utilizing Mexican effluent for cooling, and returning the water to the Santa Cruz River (Maestros Group, 2004). In 2004, an Arizona limited liability company proposed construction of a gas-powered electrical generation plant to be located in Nogales, Arizona and provide electricity to communities on both sides of the border. Mexico would have received a supply of electricity and relief from the yearly payments to treat their wastewater in Arizona. Despite the benefits offered, the plan never got any traction.

Tucson Electric Power Company (TEP) is moving ahead with a project to run a transmission line to the border is moving ahead. TEP and Mexico's Comisión Federal de Electricidad (CFE) conducted a joint feasibility study which concluded that a 345,000-volt interconnection with Mexico from TEP's substation would increase regional energy efficiency (TEP, 2003). The link would allow TEP to sell electricity to Mexico, and visa versa. The free flow of electricity across the border could enhance the reliability of western grids in both countries, including the reliability of power to the NIWTP. The project is now trying to identify a path to run transmission lines to a border substation on the western edge of Nogales, Arizona.

## Conclusion

In sum, the demand and availability of energy in the border region is a significant influence on the movement for wastewater or brackish water reclamation. This trend is growing and is sure to be a vital consideration in the comprehensive utilization of water resources in the border region for the foreseeable future. This energy-water nexus will be an important calculus for the sustainable development of the water-scarce western border region and for the border area generally in the 21$^{st}$ century. It is not strictly a market issue, however, but must reckon with long-standing treaty and law of the river considerations as border communities strive to better utilize all of their water resources. This is certainly true of Ambos Nogales where the water resources of the Rio Santa Cruz, both surface and groundwater, though hydrologically a part of the Colorado river basin, are not clearly covered by water allocation rules under the landmark 1944 Water Treaty, but instead fall under the Treaty's Article 3 authority to deal with border sanitation issues (1944 Water Treaty, Article 3).

Precisely for this reason, Mexico, as the upstream riparian, retains a valid proprietary claim to Santa Cruz river water pumped for urban uses in Nogales, Sonora and discharged as wastewater to the NIWTP in Nogales, Arizona. Any adjustment to this situation in the form of an energy for water trade would a minimum require an amendment to the Treaty in the form of an IBWC Minute clarifying the arrangement's status under Article 3. Any further binational understanding that might be in any way connected to the Treaty's articles dealing with the Colorado River system would also need to be formally clarified. Such diplomatic agreement may have implications for other energy-water exchange situations along the border and would need to be carefully considered.

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