Environmental and Economic Dimensions of Desalination in California

"If we could ever competitively, at a cheap rate, get fresh water from salt water, … it would really dwarf any other scientific accomplishments." *John F. Kennedy, 1962*

Project Summary

Desalination has long held promises to solve chronic water shortages in arid areas, yet its widespread adoption has been delayed because of environmental concerns and preoccupations about its cost. This project will focus on two objections to the widespread use of desalination in California, and especially in Orange County.

The first question we want to address is the potential environmental impacts of discharging salt residues back into the ocean. We want to understand how this local increase of salinity could impact aquatic life by studying how blue mussels and sea urchin larvae react to hyper-salinity. Moreover, we would like to explore potential engineering solutions by designing better ocean outfalls that more effective foster dilution and reduce the potential killing zone around the outfalls discharging salt residues.

In addition, we would like to study sanitary microbiology and develop a near real-time biosensor for measuring the efficiency and integrity of reverse osmosis (RO) membrane. Although the primary application of RO membranes is desalination, RO constitutes an excellent if not the best treatment barrier to pathogens. We propose to use epifluorescence microscopy method to evaluate the efficiency of microbial removal of RO treated water and develop this fluorescence method to a real-time bio-sensor to monitor the integrity and efficiency of RO membrane during desalination process.

The second focus of this project is to better understand the economics of desalination in the context of the booming California population, recurring droughts, cuts in the allocation of Colorado River water, and uncertainty about the future price of energy. We propose to analyze the portfolio of water supply options available to Orange County and build scenarios to understand the value of making desalination available. We will also construct simple real options models to assess the impact of various forms of uncertainty on the decision to invest into a desalination plant.

We would like to work closely with a local water agency to collect real data and make this project applicable for decision making.

Project Team.

Our multidisciplinary project team includes faculty from five UCI schools: The Henry Samueli School of Engineering, the School of Biological Sciences, the School of Social Sciences, The UCI College of Medicine, and the School of Social Ecology.

PI: Jean-Daniel Saphores, Associate Professor, Civil & Environmental Engineering, Economics, and Planning, Policy & Design.
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