

Thesis Project Portfolio

The Design of a Desalination Plant in New Orleans, Louisiana

(Technical Report)

Water, Waste, and Society: STS Analysis of Desalination and Brine Repurposing

(STS Research Paper)

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Executive Summary

Water scarcity is a global challenge, and desalination technology emerges as a promising solution. In New Orleans, Louisiana, saltwater intrusion into the Mississippi River poses a threat to their main water source. Desalination could be just the answer. While the implementation of desalination plants addresses water shortages, they pose huge environmental and social considerations. This analysis explores the environmental and human effects of implementing a desalination plant in New Orleans, with a focus on reclaiming brine waste for fertilizer production.

The technical project designs a desalination plant to provide an alternative water source for the city of New Orleans. This plant will utilize reverse osmosis technology in order to produce potable water for the neighborhood of Algiers, a daily water demand of approximately 54,000 residents. However, like stated before, brine waste poses environmental challenges. The project innovatively repurposes brine waste for fertilizer and rock salt production. In the production of these co-products, the project not only minimizes waste but also enhances economic viability. The plant's production includes daily outputs of 10 million gallons of tap water, 15 million kilograms of fertilizer, and 13 million kilograms of rock salt.

The plant's financial assessment reveals substantial economic viability. The total annual revenue from tap water, fertilizer, and rock salt production is estimated at approximately \$3.5 billion, with the fertilizer being the most lucrative product. The initial capital investment for the plant is significant, at over \$2.6 billion, covering land, equipment, installation, and other expenses. The brine post-treatment equipment, primarily the large multi-stage evaporators, represents the bulk of the equipment cost, amounting to approximately \$565 million. However, the projected internal rate of return (IRR) of 27% and a net present value (NPV) exceeding \$4 billion highlights the project's potential profitability. This financial outlook, combined with the plant's ability to ensure a consistent water supply, proves its importance as a strategic investment for the future.

The society and technology research explores the environmental and human effects of desalination plants. The central research question steering this analysis is as follows: What are the environmental and human effects of implementing a desalination plant in New Orleans, Louisiana, with a specific emphasis on the reclamation of brine waste for fertilizer production? This question explores the entanglement of technological innovation and the consequences of its implementation on both the local ecosystem and local community. Environmental and human effects are evaluated through a utilitarian framework, combining literature review and surveys. The study emphasizes community engagement and policy implications for maximizing societal welfare.

Environmental impacts of brine disposal include increased salinity levels and disruption of marine ecosystems. Repurposing brine for fertilizer production mitigates environmental harm but raises concerns about nutrient runoff. Human health risks from desalinated water include elevated sodium levels and disinfection byproducts. Community engagement and effective policy frameworks are crucial for addressing environmental justice concerns and ensuring safety.

Implementing a desalination plant in New Orleans presents opportunities and challenges. Repurposing brine waste for fertilizer production mitigates environmental harm, but challenges remain in addressing nutrient runoff. Effective policy and regulatory frameworks are essential for balancing environmental protection and social considerations. Moving forward, exploring demographics impacted by desalination implementation could enhance utilitarian analysis.