Thesis Project Portfolio

River Water Treatment in Chennai: Producing Drinking Water by Reverse Osmosis and Biocrude Oil by Hydrothermal Liquefaction

(Technical Report)

Residents' Responses to Poor Clean Water Management in India

(STS Research Paper)

An Undergraduate Thesis

Presented to the Faculty of the School of Engineering and Applied Science

University of Virginia • Charlottesville, Virginia

In Fulfillment of the Requirements for the Degree

Bachelor of Science, School of Engineering

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Spring, 2022

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Table of Contents

Sociotechnical Synthesis

Both the technical work and STS research presented here revolve around the challenge to provide clean water to everyone, focusing on how change is enacted, how we govern the use of such a valuable resource and the innovations required to do so. The technical design involves the implementation of a drinking water treatment plant that provides potable water to residents of Chennai, India by processing polluted water from the Cooum River. The design provides water in a way that makes use of the pollutants in the river through a process known as hydrothermal liquefaction. In this process, wet biomass (such as sewage) is depolymerized into a biocrude oil that can be burned to provide energy to reverse osmosis, a key filtration process. This design provides drinking water to approximately 230,000 residents per day.

This capstone research is especially important for the chosen location since water resource management has led to marginalization in India. Class divides are created, and people's cultures are threatened. This has forced citizens to protest through social movements. Focusing on "repertoires of contention," in this case how citizens make demonstrations against poor water policy, provides a perspective on how social movements draw upon similar motivations and frameworks. It also provides some perspective as to why some social movements are more successful than others. Activists that have performed the most aggressive actions, such as sacrificial rituals, have been able to influence local and national government bodies. The analysis shows that lack of proper water management infrastructure and continued waste dumping into rivers limits development in India.

By analyzing both the technical and social sides of water treatment, I was able to gain perspective on how environmental engineers solve more problems in society beyond just sustainability issues. Their designs solve issues related to inequalities among people, as physical

development of a country is just as important as social development. This design specifically provides water to slum areas of Chennai. By doing so, the gap between urban residents and slum residents is closed, bringing India closer towards becoming a developed nation. The project was therefore fruitful, and the team overcame adversity by recognizing that water resource management goes beyond removing pollution to provide clean water. It also involves taking advantage of resources that are available (the raw biomass proved to be quite useful) and making appropriate assumptions to implement this into a design. Reviewing the assumptions made to implement different processes into the design should be examined for future research. The STS research allowed me to learn that the placement of infrastructure is just as important as the design itself, as the location needs to consider how it impacts residents' lifestyles. As a result of both the technical and STS capstone work, I have learned to think about engineering from social, technical, and ethical perspectives.