Thesis Project Portfolio

Capacity Planning and Investment for Electrification of Maritime Container Ports

(Technical Report)

Understanding the Effects of Port Operational Emissions: A Sociotechnical Examination of the Port of Los Angeles Using Actor Network Theory

(STS Research Paper)

An Undergraduate Thesis

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In Fulfillment of the Requirements for the Degree

Bachelor of Science, School of Engineering

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Sociotechnical Synthesis

For my technical work and STS research, I focused on understanding the quantitative and qualitative effects of emissions from maritime container port operations. My technical project centered around using simulation-based optimization to improve sustainability of the Port of Virginia's operations and to reduce their overall carbon footprint. In contrast, my STS research paper focused on the actor-network that was responsible for adverse treatment of the health and well-being of local residents of the Port of Los Angeles. By understanding the social and political factors at play at maritime ports as well as findings from simulations of a maritime port and its various equipment, both my technical work and my STS research center around ensuring sustainable and equitable port operations.

My technical work investigates the simulation of the effect of the changes in equipment at the Port of Virginia and observations of resulting financial and time costs. Our simulation of the maritime port was conducted within Simio, a simulation software program. Using this program, our capstone team created several small simulations of various heavy-duty electric equipment that transport containers around the port. By taking into account the fuel times and maintenance requirements of electric vehicles and considering the financial limitations of the port, the use cases enabled the identification of opportunities for full-electrification of the Port of Virginia.With the results from these use cases, The Port of Virginia was given a set of recommendations intended to guide its planning efforts over a span of 3-5 years, with the ultimate goal of reducing emissions and enhancing energy utilization.

My STS research paper explores maritime ports from a different perspective, the social impact of port operations on surrounding communities. I claim using Actor-Network Theory, that port officials and community-representing boards at the Port of Los Angeles are the key

actors responsible for failures in addressing environmental degradation, the poor health of residents, and an insufficiency to improve the port community. My study has two goals: to influence future port planning and policy-making efforts, and to improve present understanding of the impact of social, political, and economic factors on the outcomes of large-scale infrastructure projects such as maritime container ports.

Working on these two projects concurrently provided me with a thorough grasp of the intricate interplay between the technical and social components of marine container port operations. My technical work focuses on tangible solutions for enhancing sustainability and lowering carbon footprint, whereas my STS research focuses on the social and political issues that influence port operations and their consequences on local people. Overall, my study illustrates the necessity for a comprehensive approach to port design and policy development that takes into account both technical and social variables. By working for sustainable and equitable port operations, we can ensure that these critical assets fulfill the requirements of both the economy and the people they affect.