**Thesis Project Portfolio**

# Ground Source Heat Pump Design

(Technical Report)

# Sustainable Built Environment Imaginaries as a Mechanism for Symbolic Corporate Environmentalism

(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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**Sociotechnical Synthesis**

Both my technical project and STS research project are loosely coupled around a theme of green building systems and their development in the United States. In these projects, I explore the codification and certification green buildings in general while also looking into what makes an individual component successful in its integration into such a building. My STS work concentrates on an imagined future of green buildings and how different actors engage with it. Answering questions about who defines such a broad categorization, and how systems are enforced to reach a goal. In the technical portion, specifics about geothermal energy for residential home heating and cooling were explored in detail. Reflections of both projects simultaneously lead to more cumulative understanding of sustainable building systems.

My technical work began with a plan to integrate a ground source heat pump (GSHP) into the design of a carbon neutral house. The building to be retrofitted was the reCOVER house located at Milton Airfield. The GSHP component was a planned 1-ton water to air heat pump with around 600 feet of buried ¾" HDPE piping. Due to the involvement of the University and the facilities department we were unable to carry out the design as intended, so our group shifted to a scaled design. The scaled design was composed of twenty feet of furled polyethylene tubing buried in 27 cubic feet of sand. Heated water was pumped through the scaled ground loop and effects of its flow rate and initial temperature were observed through eight thermocouple probes within the piping as well as buried in the sand. While we were not allowed to complete the full scale of the intended design, our smaller scale design helped to highlight important considerations for residential GSHP designs.

For my STS research paper, I explored how four different categorizations interact with the imagined future of green buildings as well as how these interactions can provide an

environment for symbolic corporate environmentalism to flourish. My research focused more specifically on the USGBC's LEED standards for green building construction and how its flexible approach to defining sustainable built environments allows room for corporations to flaunt their green status in a world where green practices have become increasingly trendy. By understanding how and why such interactions take place, a more cautious understanding of green building imaginaries can be built.

In working with both projects simultaneously, my overall experience and understanding of each was enhanced greatly. My STS research encountered a broad spectrum of green building codes and practices while my technical work drilled more into specifics of an individual green component. Furthermore, specifics from green codes helped identify and diagnose deficiencies in the GSHP design. For example, maximum ground temperature increase as well as pipe material and depth were all influenced by environmental concerns outlined in code and best practices. Overall, working on both projects enhanced my understanding of the green built environment as well as the importance of proper implementation of individual building components.