

**Thesis Project Portfolio**

**UVA Net-Zero Residence Initiative – Energy Generation**

(Technical Report)

**The Web of the Grid**

(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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## **Table of Contents**

A Machine in Crisis

UVA Net-Zero Residence Initiative – Energy Generation

The Web of the Grid

Prospectus

## **A Machine in Crisis**

### **INTRODUCTION**

Americans have become dependent on public power. In February 2021, when the electric grid in Texas suffered rolling blackouts, millions lost power, and a hundred people died trying to weather the storm. In what follows, I explore how America can address its reliance on public power. Photovoltaics (PV), the process of converting light into electricity, is the focus of my technical project, and my STS paper explores the history of public power in America. I explore the history of public power in America, and I leave the reader with a practical solution to grid-dependency.

### **SUMMARY**

The goal of my capstone class was to design a green, net-zero house. Our goal was to explore ways to generate electricity from clean, renewable sources. The class was split into three teams with different tasks. My team's goal was to build an off-grid, solar PV system with safety as our first concern. We were able to achieve this objective, store the excess energy in a battery bank, and promote the yield of our system by getting our panel to track the sun's daily motion. My team chose to use PV because PV is a quiet, clean way to capture energy, and wind is scarce in Virginia. Solar, whether PV or not, has helped many Americans go off-grid, disconnecting from public electricity. When combined with a ground-source heat pump (GSHP) as well as eco-friendly, effective insulation methods, a system like ours can serve as a blueprint for people who want to generate their own clean energy.

As for my STS paper, I will explain the history of public power in America, dating back to the current wars of the late 19<sup>th</sup> century. At that time, electricity was a luxury item, with most skeptical of its usefulness. All that changed with Samuel Insull and his time in Chicago. Today,

electric grids are large, complex technological systems and staples of modern society. As the theory of technological momentum predicted, this expansion of electric grids has led Americans to become dependent on public power to a fatal degree. What happened in Texas revealed America's inflexibility. By exploring the history of public power in the U.S., I will learn how the grid has come to dominate society, and I hope to determine the best way to reduce our reliance on public power and slow its momentum.

## **CONCLUSION**

Writing my STS paper and studying the subject of renewable energy has given me a grasp of the technological progress of public power. In Texas, winter storms have damaged supply lines and spiked demand. At a time when technological progress has led many Texans to rely on electric power to survive, failure of our grids is often fatal. With my technical group, I explored solar energy as a solution to this problem of over-reliance on grid-power. A modular system like ours has potential to change how Americans use electricity. America has become dependent on large, central grids, and my technical project might be a perfect solution to the problem of grid-dependence explored in my STS paper.