

**Thesis Project Portfolio**

**UVA Pinball Machine 2.0**

(Technical Report)

**Why Only Solar Power at UVA?**

(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 2024

Department of Mechanical Engineering

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Technical advisor: Gavin Garner, Department of Mechanical and Aerospace Engineering

#### **WHY ONLY SOLAR POWER AT UVA?**

STS advisor: Dr. Gerard J. Fitzgerald , Department of Engineering and Society

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Technical advisor: Gavin Garner, Department of Mechanical and Aerospace Engineering

STS advisor: MC Forelle, Department of Engineering and Society

## **Sociotechnical Synthesis**

This thesis project portfolio covers my technical paper on a UVA themed pinball machine and my sociotechnical research paper on why UVA has chosen to rely solely on solar power to reach their carbon neutrality goals by 2030. The technical paper outlines my group's work on our capstone project with the guidance of our advisor, Gavin Garner from the Department of Mechanical and Aerospace Engineering. Our group decided to pick up this project from a previous attempt on a UVA themed pinball machine. While most of the components of the machine were redesigned, the general idea of how the game will flow as well as the layout and ramps for the pinball to travel were adapted to our own vision of the project. The ultimate goal being our pinball machine being installed into one of UVA's student activity spaces, 1515. My sociotechnical research paper explores the factors that may have influenced the University to choose to utilize only solar power so far in reaching their carbon neutrality goals by 2030. The world is in a vulnerable state in terms of climate change and the need to transition to renewable energy sources has never been higher. This has led to many universities declaring their intent to reduce their own emissions in order to combat climate change. The addition of renewable energy sources being one of the main methods of doing so. My paper explores factors like public awareness, renewable energy projects in the past, the environmental impacts of hydroelectric dams, misinformation spread on renewable energy, and the methods other universities are using to achieve their own sustainability goals.

For our group to design a UVA themed pinball machine, we first had to understand how traditional pinball operates in both its gameplay and individual scoring and ball mechanisms. The game involves a metal pinball shot into the playfield with flippers among other mechanisms spread across the playfield controlled by the player in order to score points by shooting the ball

through other mechanisms to score points. The methods of which points are scored differ from game to game, as does the difficulty. Our design revolves around the experience of a typical UVA student as they progress through their years of college and continuing onto different paths after graduation. Three targets need to be knocked down in order to progress to the next year, whereas other mechanisms around the field are extra events. Many of the mechanisms themselves reference things across grounds, ranging from Scott Stadium to the lawn and the Rotunda itself. In the end we were not able to complete the machine, but we had completed designs along with completed mechanisms to be used in the future. We believe that our progress has set up another group in the future to fulfill our and the group's goal to create an UVA themed pinball machine to be enjoyed by the students of the University.

Increasing temperatures affects the habitats of both wild animals and humans, destroying sea life like coral reefs while simultaneously swallowing landmasses by raising the ocean level due to melting ice in the poles. This is mainly due to greenhouse gas emissions from burning fossil fuels for energy, which traps the heat provided by the Sun within our atmosphere. There is only so much carbon dioxide the environment can absorb and the energy needs of civilization aren't going away, hence the need for alternative sources of energy.

Due to our world's need to power facilities such as those owned by UVA, the concern now is where that energy comes from. Renewable energy seems to be the answer as it's rising popularity and efficiency as it is also becoming more affordable than ever. Wind and hydro power both have higher efficiencies than solar but are less versatile and more obstructive. However, political and societal forces have influence over which technologies are used. Langdon Winner's theory that technology is intertwined with political and societal forces is used in order to analyze the evidence uncovered in research. Drawing evidence from my research, I

can conclude that UVA made the correct decision to go down the route of solar power to reach their goals of carbon neutrality. The versatility of solar power is unmatched with no notable drawbacks like that observed for methods to harvest wind and water power. This leads to the least amount of resistance in order to reach their goals in the long run.