UVA Themed Pinball Machine

The Public Perception of Renewable Energy Affecting UVA's Solar Energy Decision to Achieve Carbon Neutrality by 2030

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On my honor as a University student, I have neither given nor received unauthorized aid on this assignment as defined by the Honor Guidelines for Thesis-Related Assignments.

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Introduction

Burning fossil fuels for energy is the main contributor to climate change and the cause of many other issues in the world. Fossil fuels are a resource that takes millions of years to be replenished by the planet, meaning they are nonrenewable. Examples of such resources are coal, oil, and natural gas. Additionally, the burning of these resources produces gases like carbon dioxide and methane into the atmosphere, which consequently heats up the Earth more by trapping the heat within the atmosphere. When issues like extreme weather, environmental changes to plants and animals, and increasing ocean levels are examined at a deeper level, climate change is at the core of each problem (London, 2020). As a result, the call for the world to transition to more sustainable energy sources grows each year that passes by. One could argue that some countries don't have access to power or are already using mainly renewable energy like some parts of South America, large parts of Africa, and Northern, Eastern, and Central Europe (Ritchie & Rosado & Roser, 2023) and therefore isn't their problem, if climate change gets out of control, it becomes everybody's problem regardless of if they were the ones causing it in the first place.

The birth of terms like carbon neutrality or fossil fuel-free is used to describe an organization's carbon "footprint". Carbon neutrality is when the organization's carbon emissions in an area are offset by the environment's natural absorption of carbon in that same area, and fossil fuel-free means they are no longer using fossil fuels for anything. These terms allow countries, cities, or even individual entities like universities, the focus of this paper, to separate themselves from the masses and say that they are trying to work towards a sustainable future. The University of Virginia in particular, has pledged carbon neutrality by 2030 and to be fossil fuel-free by 2050, providing a plan and annual reports on their progress found on their UVA

Sustainability website (2023). My STS research will focus on what social factors may have led to the University of Virginia choosing solar power, while feasible, to reach their carbon neutrality goals instead of other equally viable or even more efficient forms of renewable energy like hydropower or wind power to reach their goals faster.

The technical project I will be completing is a UVA-themed pinball machine, aiming to be installed in 1515 by December, one of the many buildings that UVA is aiming to power while working towards carbon neutrality. Picking up this project from 2016, our group aims to complete the machine by redesigning certain mechanisms, adding new features, and UVA-related structures within the game. The end goal is to build a machine that UVA students, alumni, and faculty can appreciate.

Technical Topic

Pinball, typically a high-speed game involving a metal ball launched by solenoid-driven flippers to score points within the playfield, has seen a bit of a revival in recent years. My group aims to revive an incomplete capstone project from about 8 years ago that attempted to create a UVA-themed pinball machine from scratch. Our version of the machine will have structures like the Rotunda, The Lawn, Beta Bridge, Scott Stadium, and other tributes to the University of Virginia within the game and its playfield. Progressing through the game will be similar to the tracks individuals can go through while at UVA: starting off in their undergraduate years and deciding whether to go into graduate school or go out into the workforce. Different years at UVA correspond with a variety of activities that must be completed to move on as well as complementary objectives for bonus points and different modes.

Leading up to the revival of pinball around 2010, their popularity was on the decline due to the preference for the variety and space efficiency provided by video games, and was even

banned during part of WWII (History of the Pinball Machine, 2023). Not to mention that pinball hadn't really evolved throughout the years since its inception. Currently, big companies like Stern or Jersey Jack Pinball are the main producers of pinball machines, but it is up to our team to design and bring to life a machine that is based on UVA. Utilizing physics and mechanical design concepts to design components and features like drop targets, slingshots, pop bumpers, ramps, ball detection, and much more will have to be designed and tested in order to make this machine a reality. By taking inspiration from prior designs of classic pinball machines and combining them with modern technology, we can innovate and improve upon them. Even with all these resources, building a pinball machine will not be trivial. Software and modern technology will reduce the number of mechanical components compared to before, but the design considerations required for any machine, let alone a pinball machine will be a great challenge in itself.

An example of pinball machines modernizing is the new LED TV screens to keep scores and display to the player what the objective is, whereas old pinball machines were unable to relay this information. Players would just have to know how the game operated in order to make informed decisions on what to go for within the playfield to maximize their points. This innovation allows players to get into pinball much easier without as large of a learning curve for each different machine.

Our goal is to not only design and build a pinball machine but one that embodies UVA and its innovative nature to push the envelope of what is possible.

STS Topic

How has the public perception of renewable energy sources over the years influenced the University of Virginia's decision to utilize solar power to achieve its carbon neutrality goals? It

is interesting to see that so many Universities around the world opting for solar power to work towards carbon neutrality as seen in a survey by the *Journal of Cleaner Production* (2019). To preface, hydropower uses the flow of water to generate energy by spinning a turbine in a dam for example. Wind energy is very similar in that it uses the natural flow of air to turn the turbines instead. Solar power utilizes the energy from photons sent to the Earth's surface from our sun to produce electricity. Especially when compared to hydropower and wind energy, solar is by far the smallest contributor in the world in terms of renewable energy sources (Ritchie & Rosado & Roser, 2023). To investigate this, I will utilize the theory that technology also has social and political forces behind it (Winner, 1980). Applying this theory, I will be researching the different viewpoints and the general awareness different groups of people have on each one of these renewable sources. A survey was conducted within Saudi Arabia about just that, many people understood and knew about renewable energy, but tended to prefer solar power (Almulhim, 2022). Additionally, researching conflicts over the implementation of renewable energy sources will be a line of research relating to political forces driving the selection of solar power over other forms of renewable energy. As well as analyzing other Universities that have decided to make the transition over to renewable energy and what sources they chose to use.

The Race to Zero site for Universities & Colleges (2023) is one place I will find Universities with plans to reach neutrality and eventually be fossil fuel free and compile a list of what types of renewable sources they are planning to and are using. Universities that have already achieved carbon neutrality, American University (AU) (2018) to name one, have utilized solar power from an external solar farm in North Carolina and purchased energy credits. The use of purchasing credits has been the only way that other Universities have also achieved carbon neutrality on paper (Earls, n.d.). While that may put into question whether Universities can achieve carbon

neutrality without buying these credits, that is not the pursuit of this paper. Turning back to the University of Virginia, from their renewable energy tracker site (2023), anyone can see their spread of renewable energy sources and note that there is only solar power starting from 2015. Additionally, “As of 2023, approximately 15% of UVA’s electricity comes from solar energy sources…” (University of Virginia, n.d.). Noting that while there are some solar panels on the university grounds, most of the solar power comes from solar farms external to the university. This raises the question of why the University of Virginia is selecting solar power as its sole form of renewable energy when there are other potential sources like hydro or wind power. From my point of view, choosing to use energy from a hydro or wind power source external to the university could potentially be a better option.

While other forms of renewable energy like wind or hydro are higher producers of energy than solar power, they may have more environmental concerns tied to them. For example, The Cape Wind Energy Project in 2001 proposed America’s first offshore wind farm capable of producing 420 megawatts of energy. However, conflicts including visual impacts, impedance to fishermen and boating, and the potential harm to birds, the project never came to fruition (Rodgers & Olmsted, 2008). I plan to investigate many cases like this for both hydro and wind power since they are the top 2 producers of renewable energy as of last year. This will work towards uncovering the underlying reason why many people prefer solar power and the political reasons why the University of Virginia in particular, chose to go with solar energy.

Conclusion

The world is running on electricity and will continue to do so for the foreseeable future. What matters is how that electricity is produced.

One option is to burn fossil fuels until there are none left, or it causes irreversible damage to the atmosphere, the oceans, and the way we live. Another is to find a way to tune down the usage of these carbon-emitting power sources in favor of renewable energy sources like solar, wind, and hydro starting small like at a single building, or a single University. I hope to draw awareness to urge other Universities to start planning their carbon neutrality goals by bringing attention to the abundant use of solar energy at many universities, UVA included.

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