

Prospectus

Assessing the Feasibility of Renewable Energy Development in Appalachia
(Technical Project)

Analyzing the Influence of Societal Standards on Renewable Energy Projects in Appalachia
(STS Research Paper)

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Bachelor of Science, School of Engineering

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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

Appalachia is a socio-economic region consisting of 206,000 square miles covering the central and southern sections of the Appalachian Mountains on the east coast. During the Industrial Revolution, this region experienced economic prosperity and opportunity through the coal industry, an industry that continues to decline in size (Williams, 2003). Between 2005 and 2020, coal industry employment fell by 54% (Bowen, 2021). Applications for other energy sources present themselves in Appalachia, taking advantage of the reclamation of mined lands and an opportunity to reinvigorate the energy industry. In the technical project, a group of students aims to conduct a feasibility assessment of renewable energies in Appalachia, ultimately finding potential locations for specific projects. The team is motivated to ease the transition to cleaner energy sources in an effort to mitigate climate change and to bolster local economies. The ideal location for a renewable energy project is one that brings prosperity to nearby communities, minimizes land waste and habitat destruction, and maximizes potential energy creation.

The White House has set the goal of generating 80% renewable energy by 2030, and 100% carbon-free electricity by 2035. Currently, the United States only generates 21% renewable energy (Mai, 2023). One obstacle to renewable energy projects is the backlash they often receive from the communities they plan to effect. In Appalachia, FreedomWorks LLC has tried and failed three times to install a pumped storage hydropower plant (PSH) due to local stakeholders vetoing the proposed projects (Steelhammer, 2020). In the STS research topic, societal influences on renewable energy projects will be analyzed, in hopes of exposing the negative effects our societal norms have on our transition to fully renewable energy. These two topics are intrinsically connected, and analyzing societal effects on renewables will provide insights to the feasibility of specific renewable projects in Appalachia.

Technical Topic: Assessing the Feasibility of Renewable Energy Development in Appalachia

A feasibility assessment of renewable energy resources in Appalachia will be conducted to identify potential projects. The technology, the location, and the scope of the project will be optimized for the final recommendation. The decreasing size of the mining industry has left rural counties that once flourished with coal jobless. A feasibility assessment resulting in potential renewable energy projects will take advantage of mined land to not only bring much needed jobs to these communities but also offer an entirely new industry for once coal-minded Appalachia to lean into. The positive effects of renewable energy are numerous, including economical, societal, and environmental benefits.

The team began by conducting extensive literature reviews of Appalachia and relevant technologies: wind, solar, and hydropower. The research was not only valuable in understanding Appalachia's rich history and recent economic downturn, but also in finding quantitative metrics to determine what locations are best suited for different types of renewable energy technologies.

To determine what land would be a feasible option for renewable energy development, current land use was taken into account. Conservation and easement land was excluded. Forest and agricultural land was also excluded, using data from the Virginia Department of Conservation and Recreation to filter out any land designated as category 4 and 5 forest conservation land or agricultural land. After this filtering, the group had an ArcGIS layer of all land in the Appalachian region in Virginia available for renewable energy development, shown in Figure 1. Within the available land, the team started by finding geo-spatial data that

corresponds with the identified metrics.

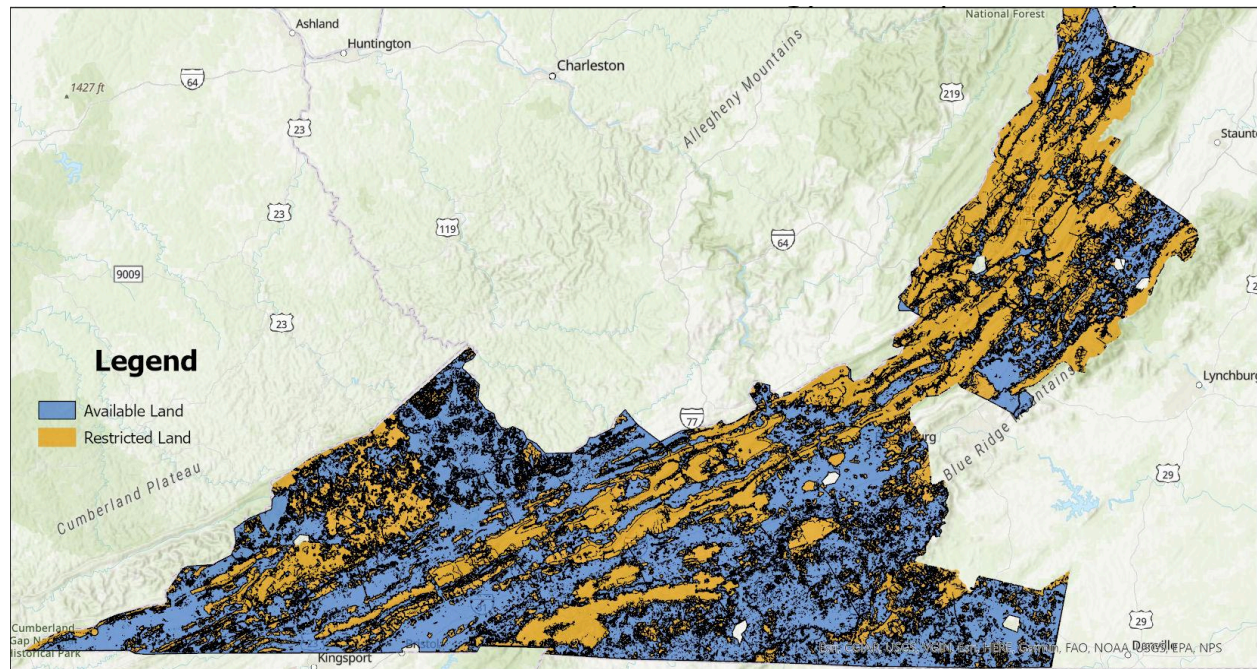


Figure 1. Available (blue) and restricted (orange) land for renewable energy development in Appalachia

Results of the data analysis conducted by the group will indicate which locations are ideal for which renewable energy development projects. Multiple locations will be determined, considering different use cases and stakeholders.

Science, Technology, and Society (STS) topic: Analyzing the Influence of Societal Standards on the Success of Renewable Energy Development Projects in Appalachia

Although some communities have successfully made the transition to using 100% renewable energy sources, societal norms are slowing the nation's transition to fully renewable energy usage. Large renewable projects frequently receive backlash from local and governmental stakeholders, making progress in the transition to renewable energy slow and difficult. Analyzing the hurdles to renewable energy projects will provide key insights to planning the most effective

and successful projects in Appalachia. To realize the goals set forth by both the UN and the US, renewable project development will need to increase in number and efficacy, which may be difficult given the current state of urgency our nation feels towards this problem.

In an effort to analyze the societal norms affecting renewable energy development, prior projects will be considered. Those projects that failed will be valuable to consider the aspects of the project that caused failure. Those projects that were successfully developed will be valuable to consider the aspects of the project that made development feasible. While analyzing, the Social Construction of Technology, an STS framework, will be used to organize conclusions made. This framework states that technology is the product of the societal influences it is surrounded by (Bijker, 2009).

In today's society, renewable energies are something that need to be pushed for in order to be accepted. This is due to the fact that fossil fuels and coal are simply too good. They are cheap, reliable, and for the last 50 years society has been optimizing how we turn these products into energy. The Social Construction of Technology is a perfect framework for this topic,

In Appalachia, FreedomWorks LLC has tried and failed three times to install a pumped storage hydropower plant. In this case, local stakeholders are the main cause of the failed projects (Steelhammer, 2020). A mindset identified as Not In My Backyard, or NIMBY, explains a phenomenon in which local residents decide a certain project or development is not suitable for their area (Kinder, 2023). In the failed Freedomworks LLC projects, residents attended public meetings and voiced their concerns over the proposed projects, specifically the land use. A compromise could not be reached, and the projects failed.

Successful renewable development, while difficult, has proven to be possible and worthwhile. Burlington, VT, realized 100% renewable energy after efforts made by the city were successful in bringing in sufficient renewable energy development (Weilbaker, 2022).

The number of failed renewable projects has been on the rise since 2013 (Bryce, 2023). Research will aim to show that societal norms and opinions are one reason for this increase in failed or rejected projects. Further research on governmental influences such as permitting, restrictions, and funding, as well as local influences such as land use, usability, and safety will be conducted to illustrate society's impact on the development of renewable energy technologies.

A contrasting framework can be considered, technological determinism, which states that new technologies are the driving force in social norms and standards (Drew, 2016). This framework will be used to consider the merit of potential counter arguments to the ideas presented after research.

Conclusion

Identifying socio technical roadblocks to renewable energy projects will help the efficacy of proposed developments that come from the technical project. Fully understanding these hurdles means avoiding them in the future, and eventually providing an outline for all proposed renewable development projects, which has positive implications for the state of our country and world. More effective development plans means realizing the goal of using 100% renewable energy, and gives a greater chance of avoiding the climate crisis that becomes more pressing by the day.

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