

Assessing the Potential for Renewable Energy Development in Appalachia
Investigating Appalachian Cultural Involvement in Renewable Energy Initiatives

A Thesis Prospectus
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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

The region of Appalachia has historically found itself in the epicenter of energy production on the East Coast of the United States. Coal mining is deeply entrenched in the history of this part of the country, but with the decrease in coal usage due to the rise of renewable alternatives, as well as the global focus of achieving “Net Zero Emissions by 2050” (IEA, 2023), Appalachians are finding themselves in a position requiring evolution. According to findings presented to the Appalachian Regional Commission by Pennsylvania State University’s Dr. Amy Glassimer and colleagues, the problem lies in the fact that “an almost singular reliance on fossil fuels has stunted the growth of renewable energy industries in the US” (2007).

My team’s capstone project aims to help expedite this transition from fossil fuels to cleaner sources of energy by assessing sites within Appalachia, specifically south-western Virginia, where a variety of factors come together to make renewable energy development, specifically wind, solar, and pumped storage hydropower, not only feasible but appealing to local parties. We intend to provide scenarios for different user groups, each with varying requirements, to be able to recommend different sites for different users. The technical aspects of this project involving utilizing computer models to simulate the energy generating abilities of solar, hydro and wind power in different locations throughout the Appalachian region to determine the most efficient locations to implement these renewable sources. Additionally, sites will be ranked via weighted optimization, reflecting the different values of different groups.

This technical study corresponds with the sociotechnical question I plan to research in my thesis: How do Appalachian cultural and political ideologies influence the acceptance of renewable energy development within the region? The deeply entrenched history of fossil fuel development in the region, as well as a distinct conservative political leaning, both could prove

difficult to contend with when garnering community support for renewable projects. So, while I will be conducting more in-depth research into the effects of society within Appalachia on this technological development, these factors will be considered to some degree within the modeling and optimization process of the capstone. A process utilized in an environmental case study in Greece provides inspiration for our optimization; the authors argue that stakeholders and community members “have the legitimate responsibility to participate in the process, and/or add a socio-political dimension to the process” (Haralambopoulos et al., 2003). It is evident that there is an intrinsic connection between the socio-technical and socio-political aspects of this work. Thus, I have elected to utilize the Social Construction of Technology (SCOT) STS theory to attempt to discern how the Appalachian culture has influenced the renewable development process, as well as how future development can be shaped by the culture of the region. The SCOT framework is a response to technological determinism, and proponents “argue that technology does not determine human action, but that rather, human action shapes technology” (Klett 2018). This theory is evident in Appalachia, as the future success or failure of renewable energy sources within the region is dependent upon the support of the people.

In this prospectus, I will further explain my technical project, regarding the feasibility assessment of Appalachian renewable energy development, my STS project, regarding the socio-political influences on the acceptance of renewable energy within the region, as well as sources I will use to further investigate these questions.

Technical Project: Assessing the Potential for Renewable Energy Development in Appalachia

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. This region experienced economic prosperity and opportunity through the coal industry, an industry that continues to decline in size. Between 2005 and 2020, coal industry employment fell by 54% (Bowen et al., 2021). Additionally, with growing awareness of climate change, fossil fuel development and utilization will continue to fall. Transitioning to cleaner sources is imperative to help mitigate the effects of climate change and to reach NZE (IEA, 2023). Applications for cleaner energy sources present themselves in Appalachia, taking advantage of the reclamation of mined lands, as an opportunity to reinvigorate the energy industry. In this project, our team of students aims to conduct a feasibility assessment of renewable energy sources in Appalachia, ultimately finding potential locations for specific projects and developing detailed proposals for said projects. 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.

Our project features multiple goals that will lead us to proposals for potential renewable energy sites in the Appalachian region. First, we aim to gain a complete understanding of the renewable energy industry, including types of technologies (wind, solar, hydro, etc.) and barriers to renewable development in Appalachia. Second, we will assess the economic and social implications of the development of renewable energy projects in the region. Then, we will visualize datasets and identify potential site locations for renewable energy projects. Finally, we aim to develop project proposals for the sites with the most positive attributes, including the predicted economic and social impacts of the project.

Our research into the renewable energy industry led us to focus on 3 clean energy sources: Solar, Wind, and Pumped Storage Hydropower. With the prevalence of abandoned coal mines in the region, there lies potential for development of these unused mining lands (Skousen et al., 2021). Pumped storage hydropower requires two reservoirs, frequently miles apart, with considerable elevation change between the two. Additionally, underground piping is required to link the two reservoirs, so considerable amounts of land are necessary for the completion of these types of projects. Unused mines could be the perfect opportunity for either creating new reservoirs or connecting existing ones with piping through the mines. Above ground, solar and wind fields can be created on the mining lands. We additionally have considered brownfields, which “are properties in which redevelopment or reuse is complicated by the presence of hazardous materials, pollution, or contaminants” (Virginia DEQ, 2023). By utilizing brownfields, we can sidestep the problems associated with private land ownership and eminent domain that arise when trying to acquire land for development.

The datasets we use to compare different locations in the region are found in ArcGIS and they describe relevant metrics for renewable development such as wind speeds, days of sun, average solar irradiance, current dams and reservoirs, brownfields, and abandoned mines. We can use these datasets to create maps coinciding with user-group based scenarios. These maps will be utilized to determine potential locations for renewable energy development projects. Sites within these specific user-groups will then be compared using various weighting schemes, intending to provide the optimal location where a variety of metrics are favorable for energy development. Once locations have been decided upon, we will develop technical proposals for the sites.

STS Project: Investigating Appalachian Cultural Involvement in Renewable Energy

Initiatives

The question I aim to research is *how do Appalachian culture and political ideology affect the acceptance of renewable energy development?* I am working on the topic of assessing the potential for renewable energy development in Appalachia because I want to find out how the implementation of hydro, solar, and wind power sources within Appalachia will affect the native communities. There is a deep cultural history in the region, specifically in regards to the fossil fuel and coal mining industries. Additionally, there has been a political realignment within Appalachia, from Democratic to Republican, over the past 30 years (Graham, 2023). According to Graham, one reason for the realignment was that “Environmentalism as an issue was adopted by the Democratic party, which isolated Appalachians and drove them to withdraw their support for the party” (2023). These factors combine to create what I hypothesize to be a hesitation regarding the transition to clean energy. Understanding the regional attitudes towards clean energy sources is important because as the need for renewable energy increases, accessing the untapped potential of hydropower and wind power in mountainous regions will become necessary, however realizing this potential will require navigating the cultural and traditional landscapes of these areas.

I plan to analyze this problem through the SCOT framework. This framework argues that rather than technology shaping society, the opposite is true. The Appalachian region’s lagging acceptance of clean energy sources follows this logical system. The clean energy technologies are not successful within the region because the Appalachian society is shaping them through their opinions on environmentalism, and their loyalty to coal. This loyalty and resistance to

change can be seen in the voting records of Congress members from West Virginia during the Obama administration, in which pro-coal policies were pursued, and climate change was neglected (Van Nostrand, 2022). These decisions have a tangible negative impact on the efficacy of both current and emerging clean energy technologies, and as Congress members are elected to a voice for the views of their constituents, it follows that Appalachian society's opinions on renewables are shaping these technologies.

To collect evidence, I intend to break the question into multiple distinct topics to be researched. First, I will do more in depth research on Appalachian culture, followed by the political ideologies of the region. Then, I will research the history of energy development within the region, investigating both renewable and non-renewable sources. I intend to follow this with research on the views of the Appalachian people on renewable energy, as well as government programs and incentives. Finally, I will research STS scholars' writings on renewable energy, to see how my research can build upon what has already been discussed. One such document I plan to build upon describes how mainstream acceptance of renewables has led to further marginalization of Appalachian communities (Owen, 2021). I intend to find most of my sources through the UVA library system; I have already found documents from the Appalachian Regional Commission discussing goals for clean energy development. The views of the people may be harder to come by, and survey data would be useful to acquire to get a better finger on the pulse of the people when it comes to their individual views on the subject. However, if I cannot find survey data, I can substitute local, state, and federal representatives voting records on these topics to represent the views of the region. All of this evidence will be assessed together in order to develop a fuller picture of the region's history with energy, as well as their current propensity for or against cleaner energy sources being developed in their communities.

Conclusion

In summary, I plan to deliver a technical proposal for sites that present strong opportunities for renewable energy development in the southwestern Virginia portion of Appalachia. These sites will be chosen through a weighted optimization of a variety of variables, with weights varied to reflect differing values of certain stakeholder groups. I also intend to provide a thesis researching the question of *how Appalachian culture and political ideology affect the acceptance of renewable energy development within the region?* Due to the global crisis of climate change, and the goals of achieving Net Zero Emissions by 2050, renewable energy sources must be advocated for, accepted, and implemented on a much larger scale than they currently are. Appalachia is ripe for renewable development, yet I hypothesize I will find that the political climate and cultural views of the region will act as barriers to this development, which in turn shapes these clean energy technologies.

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