Analyzing the Influence of Societal Standards on Renewable Energy Projects in Appalachia

A Research Paper submitted to the Department of Engineering and Society

Presented to the Faculty of the School of Engineering and Applied Science
University of Virginia | Charlottesville, VA

In Partial Fulfillment of the Requirements of the Degree
Bachelor of Science, School of Engineering

Conor Murphy

Spring, 2024

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.

Advisors

William F. Stafford, Jr., Department of Engineering and Society

I. 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 both Appalachia and across the United States.

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). And yet, the number of failed renewable projects has been on the rise since 2013 (Bryce, 2023). 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 utility scale renewable energy development to meet their power consumption (Weilbaker, 2022). In Appalachia, FreedomWorks LLC has tried and been rejected three times in their efforts to install a pumped storage hydropower plant (PSH) due to local stakeholders vetoing the proposed projects (Steelhammer, 2020).

Sociotechnical factors such as politics, land use, and regulations are slowing Appalachia'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 roadblocks to renewable energy projects will provide key insights to planning the most effective and successful future projects in Appalachia.

In an effort to analyze the sociotechnical factors affecting renewable energy development, prior cases will be considered. These cases will include evidence of 1) A number of failed or rejected utility scale renewable projects, 2) Restrictive governance around renewables at a local level through ordinances and county legislation, and 3) The influence of lobbyists and big oil companies on opinions surrounding renewable energy.

II. Case Discussion

In Grant County, plans proposed for a pumped storage hydroelectric plant were abandoned after overwhelming community opposition (Steelhammer, 2020). The proposed plan would utilize private land and would create two reservoirs of 1100 to 1300 acres each. The reservoirs would be connected through 7 mile long underground penstocks. In a pumped storage hydropower facility, water is pumped to the upper reservoir during times of energy excess and off-peak hours. When energy is needed, water flows through the penstocks and an electric generating station at the lower reservoir. Pumped Storage Hydropower (PSH) accounts for 95% of utility scale energy storage in the United States. It is 70-85% efficient, which is comparable to other popular energy storage technologies being implemented today, such as compressed air, molten salt, flywheel, li-ion, and lead acid technologies (Zablocki, 2019). From a technological standpoint, the proposed Grant County project was sound. The PSH project would bring an estimated 22MWH of storage to an area that needs it.

The principal of FreedomWorks LLC, the company behind the proposals, agreed to withdraw the project's Federal Energy Regulatory Commision (FERC) permit application after various stages of community pushback of the project. Initially published plans showed a number of inconsistencies between what was promised and what was planned. A closed-loop system was guaranteed, in order to minimize the hydrological impact of the reservoirs on the local

watershed. However, when plans were released, inflow and outflow channels from existing waterways were integral to the PSH plant's function. This was not soon forgotten by the grant county community who would be most directly affected by the development of the plant. The Grant County Commission indicated support for the project based on potential economic benefits, although they also indicated that eminent domain would not be considered in the development of the project. This is where FreedomWorks LLC ran into their biggest roadblock. The project would need to proceed with the cooperation of the affected landowners, something that would be hard to receive, especially after publishing inconsistent plans. Tim Williamson, FreedomWorks LLC principal, attended a public meeting sponsored by the Grant County Development Authority. The meeting was packed with residents, with no standing room left, who recounted the environment, hydrological, and personal impacts they believed would come from the completion of the project. Williamson reiterated the project plans and benefits. However, when it came to a straw poll of those who would never consider selling or leasing their land to the project under any circumstances, nearly every hand in the room went up. Various concerns were cited, ranging from the destruction of farms to the intrusion of cemeteries and historical family touchstones. In the days following the meeting, the FERC permit application was withdrawn and the project abandoned.

In Henry County, the board of supervisors recently approved an amendment to the county zoning ordinance. The approved amendment enforces a cap on the acreage allowed for solar farm development. Specifically, the zoning ordinance amendment limits the total amount of acreage that can be permitted for solar farm development to one percent of the total land mass of the county (Frolo, 2023). In Henry, this brings the total acreage allowed for solar farm development to 2,445 acres. Currently, there are 10 approved solar projects in various stages of

development that span approximately 1,800 acres. In the Henry County Planning Commision minutes of meeting on June 4, 2023- the day of implementation for the zoning amendment- a proponent for the amendment stated the board's objective:

> "Encourage the use of residential, commercial, and utility-scale renewable energy projects while also minimizing the impact on Henry County's view shed, natural resources, and rural character. It's not the County's intention to affect local industries' ability to produce solar energy for their own consumption."

Questions were raised by one individual on the board, Jeff Prillman, who argued that putting a cap on something may limit its usefulness. At the time of the amendments approval, 75% of the acreage allowed for solar had already been allotted to existing approved projects. In actuality, Prillman argued, the cap greatly discourages future utility sized solar projects from being developed in their county. He asked what the value of this amendment is to the County, to which the board replied "The value to the County is we know where we stand, and not an infinite amount of solar farms in Henry County."

The prevalence of restrictive governance around renewables and ordinances like the one seen in Henry County is likely exacerbated by Big Oil and Big Coal and their efforts to suppress information surrounding the negative impacts of fossil fuel consumption from the public and policymakers. In a 2023 case: "People of the State of California V Big Oil", the state of California sued Big Oil "... for more than 50 years of deception, cover-up, and damage that have cost California taxpayers billions of dollars in health and environmental impacts (California, 2023)." Energy is something that people rely on to survive- a necessary good- so it comes as no surprise that the market for energy is one of the most lucrative in the world. The companies that

stand to profit from this energy market, namely Exxon, Shell, Chevron, ConocoPhillips, and BP in the California lawsuit, have extreme incentive to prolong their control of the energy market.

California stated that oil industry-funded research projects reported direct links between fossil fuel consumption and rising global temperatures, and damage to our air, land, and water. In efforts to protect their total control of the energy market, Big Oil "intentionally suppressed [negative] information from the public and policymakers to protect their profits, and spent billions of dollars to spread disinformation on climate change and delay our transition away from fossil fuels (California, 2023)." The influence of Big Oil is not limited to California. Since the industrial revolution, fossil fuels have played a necessary role in every American's life, and with that came a major increase in the influence and power those companies have over the American public. This influence was especially well received by those who wanted to hear it, notably the millions employed by the coal industry in Appalachia.

Now that the public is more aware of the detrimental effects of fossil fuels, companies have found a new way of swaying opinion. "Oil companies promote fossil fuel products as "clean" or "green" or "low-emissions" that still produce carbon pollution, and they tout their renewable fuel products that actually make up a fraction of a percent of their earnings (California, 2023)." This concept has come to be known as "green-washing"; companies exaggerate their sustainability with green marketing campaigns that make claims about low carbon emissions, environmental impacts, etc.

The California Lawsuit showcases how policy can be heavily influenced by fossil fuel companies and their ability to change narratives through both suppressing information and spreading misinformation on "green energy" and their impact on our environment.

III. Analysis

A transition to renewable energy is not a new phenomenon. In 1979, President Jimmy Carter confided to his friends that he believed the widespread use of renewable energy was inevitable. In fact, he expected renewable power technologies such as solar panels and wind turbines to reach 10% of national electricity capacity by 1985 (Sovacool, 2018). Today, in 2024, we have hardly surpassed that number. 21.5% of the US energy capacity can be attributed to renewables, and still the country has lofty goals for the future. The White House has set the goal of generating 80% renewable energy by 2030, and 100% carbon-free electricity by 2035 (Mai, 2023). Sovacool explores the disconnect between these goals and reality, and after extensive interviews of public utility commissioners, utility managers, system operators, manufacturers, researchers, business owners, and ordinary consumers, found that the disconnect can be attributed to socio-technical barriers. These barriers include social, political, regulatory, and cultural aspects of electricity supply and use. As a result, newer and cleaner technologies that may offer clear social and environmental benefits continue to be rejected at some point in development. Whether it is problems with regulators, jumping through hoops to acquire the necessary permits, or cultures, facing public backlash for proposed projects- these socio-technical factors make it extremely difficult to successfully implement a utility scale renewable energy development.

Renewable energy development is essential to the future success of Appalachia as a socioeconomic region. Understanding the complex sociotechnical factors that influence the adoption of renewable energy is key to successfully implementing new projects. The factors identified in this paper 1) A number of uncompleted or rejected utility scale renewable projects due to land acquisition, 2) Restrictive governance around renewables at a local level through ordinances and county legislation, and 3) The political influence of lobbyists and big oil

companies have on opinions surrounding renewable energy have shown to impede renewable production. These socio-technical factors are slowing Appalachia's transition to fully renewable energy usage.

Appalachia is not unique in having rich historical ties to land. It is not uncommon for a home, farm, or cemetery to remain in a family for generation after generation. This alone can bring a renewable project to a halt; however, in Appalachia, there is also the historical coal mining narrative in play that influences attitudes towards renewable energy. Generational reliance on the coal industry makes it extra difficult for a renewable project to gain the necessary support. This reluctance to give up land for a renewable development project is a phenomenon coined Not In My Backyard, or NIMBY. NIMBY describes the phenomenon of when individuals are supportive of renewable energy, just not in their town due to a perceived disruption that comes with any development. The NIMBY mindset plagues renewable projects and is frequently the reason for an uncompleted project. To successfully transition Appalachia's energy source to fully renewable energy, the proliferation of this mindset will need to stop.

In addition to the various obstacles around land use, regulatory obstacles present themselves with the Henry County Solar ordinance. The county has limited the amount of solar energy they can produce, a regulation that seems to contradict the goals set forth around renewable energy by multiple governing bodies. The ordinance relates directly to NIMBY- the motivation described by the county board for this ordinance is to prevent "an infinite amount of solar farms". While Henry might support a transition to fully sustainable energy sources, they don't want it happening in their county. An important step to reaching the goal of fully sustainable energy is changing the attitudes towards these technologies in the first place.

While regulations and policies may inhibit or promote clean energy, there is another factor at play that influences those regulations and policies in the first place. As seen in California, Big Oil has been documented in suppressing harmful information and over-exaggerating their own efforts to provide clean and sustainable energy. Fossil fuel companies have a direct stake and influence in how the public thinks about renewables, and are motivated by profits. Renewable energy technologies and companies take a portion of the fossil fuel market share, and thus fossil fuel companies are inherently motivated to restrict renewables' entry to the industry.

IV. Conclusion

In conclusion, Appalachia's transition to renewable energy is not just a matter of technological advancement; there is a complex interplay of sociotechnical factors rooted in the region's history, politics, and societal norms. The case studies introduced and discussed shed light on challenges faced by renewable energy projects, ranging from regulatory hurdles to community opposition driven by historical narratives. Despite the urgent need to combat climate change and transition to sustainable energy sources, Appalachia's journey to this end is hindered by a multitude of barriers. Restrictive governance seen in local ordinances and zoning regulations, showcased by the solar ordinance in Henry County, reveals a struggle to balance the progressive energy transition movement with the preservation of Appalachian culture and natural resources.

Moreover, the legacy of coal mining and the NIMBY mindset pose significant challenges to renewable energy development in the Appalachian region. Generational ties to the coal industry fuel apprehensions about the perceived disruptions associated with renewable projects. With this comes the need for nuanced approaches to community engagement and education.

Land acquisition is consistently a hurdle for renewable development proposals, and finding a way to get communities on board with projects is imperative to realize the energy goals set forth by both the US and the UN.

The influence fossil fuel corporations have on the public and our nation's transition to fossil fuels is not something to be overlooked- policy makers need to consider motivations behind different stakeholders actions and the further implications of the policies they put in place.

In future renewable endeavors, we must address these socio-technical barriers through collaborative efforts involving policymakers, energy companies and other industry stakeholders, and local communities. Fostering dialogue, promoting transparency, and incentivizing renewable energy initiatives will help Appalachia unlock its potential for sustainable energy while conserving its unique cultural and environmental history.

References

Bijker, W. E. (2009). Social construction of technology.

Bowen, E., Deskins, J., & Lego, B. (2021). An Overview of Coal and the Economy in Appalachia: Fourth Quarter 2020 Update. *Appalachian Regional Commission*.

Bryce, R. (2023). Renewable Rejection Database. Retrieved from https://robertbryce.com/renewable-rejection-database/

California, S. of. (2023, September 16). *People of the state of California v. big oil*. California Governor. https://www.gov.ca.gov/2023/09/16/people-of-the-state-of-california-v-big-oil/

Drew, R. (2016). Technological determinism. *A companion to popular culture*, 165-183.

Frolo, Caitlyn. "Board Approves Amendment Placing a Cap on Approved Solar Panels in Henry County." *WSET*, 26 July 2023, wset.com/news/local/board-approves-amendment-placing-cap-approved-solar-panels-henry-county-virginia-acreage-electricity-farm-development-ordinance-july-2023.

Kinder, P. D. (2023). NIMBY. Encyclopedia Britannica. Retrieved from https://www.britannica.com/topic/NIMBY

Mai, H. J. (2023). Energy experts share how the U.S. can reach Biden's energy goals. Retrieved from https://www.npr.org/2023/02/02/1148370220/biden-renewable-energy-goals#:~:text=The%20White%20House%20set%20out,billions%20of%20dollars%20in%20investments.

Sovacool, B. K. (2018). Rejecting renewables: The socio-technical impediments to renewable electricity in the United States. In *Renewable Energy* (pp. Vol4_458-Vol4_485). Routledge.

Steelhammer, R. (2020). Lack of Public Support Kills Pumped Storage Hydropower Project Planned for Grant County. Retrieved from https://www.wvgazettemail.com/news/lack-of-public-support-kills-pumped-storage-hydropower-project-planned/article_88afc92d-8a42-5b13-9bdb-597d84447182.html

Susskind, L., Chun, J., Gant, A., Hodgkins, C., Cohen, J., & Lohmar, S. (2022). Sources of opposition to renewable energy projects in the United States. *Energy Policy*, *165*, 112922.

Weilbacker, S. (2022). For Burlington, Vermont, Going 100% Renewable Was Just the Start.

Retrieved from
https://nextcity.org/urbanist-news/for-burlington-vermont-going-100-renewable-energy-was-just-the-start