

# **Analyzing Public Opinion on Wind Energy in the United States**

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, Virginia

In Partial Fulfillment of the Requirements for the Degree

Bachelor of Science, School of Engineering

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Spring, 2022

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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## STS Research Paper

### Introduction:

With the current rate of greenhouse gas emissions across the globe, irreparable climate change is not only close but getting closer (Hotz & Puko, 2021). To slow climate change and undo the damage that can still be undone, the reduction of greenhouse gas emissions will be paramount. Effectively reducing these emissions involves eliminating their primary sources. The dominant source of emissions is the burning of fossil fuels for electricity, transportation, and heat. Energy production and usage cannot be significantly reduced, so the development and implementation of minimal emission, clean energy sources is the solution. Of the clean energy sources currently used in the United States, wind energy is the largest and quickly growing (EIA, 2021). This growth is too slow to eliminate enough emissions, but the technology is still developing. Furthermore, widespread implementation of new technology is a complicated process, involving an expansive network of interacting social groups. A thorough understanding of these interactions would be accelerative towards the improvement and uptake of wind technology, helping curb climate change. Ultimately, a supportive public opinion on wind technology is crucial for its adoption given the democratic nature of energy legislation and land use. For this reason, this paper will seek to analyze what factors influence public opinion of wind energy in the US, alongside what economic and social relationships are at play. The Social Construction of Technology analytical framework will be used as the foundation of this analysis. Altogether, this paper seeks to advance knowledge of renewable energy implementation by focusing on wind energy as the leading renewable energy source.

## **Background:**

A broad scientific consensus has been reached regarding mankind's role in global climate change (NASA, 2022). Beginning at the height of the industrial revolution, Earth's climate began rapidly warming and doing so with particular speed in recent decades. The consequences of this warming are already emerging, and will only get worse as the climate warms further. These effects include hotter summers, colder winters, more frequent extreme weather events, drier droughts, and sea level rise (The National Academies of Science, Engineering, and Medicine, 2020). With each of these come associated environmental, economic, and humanitarian effects as well. Sea level rise alone will displace millions of people in the US, where 29% of people live in coastal areas (US Census, 2020). More dramatic seasons will stress infrastructure in ways it was not designed to handle. Similarly, extreme weather events like hurricanes are already a prominent source of destruction in parts of the US, and climate change will make them more common and more destructive. A final note here is that if greenhouse gas emissions are not decreased fast enough, the effects of climate change may be irreversible.

The urgency of the issue necessitates the shift away from burning fossil fuels for electricity, the most prominent sources of greenhouse gas emissions (EPA, 2014). In order to provide the electricity needed for the world's growing population, alternative energy sources need to be effective enough to replace fossil fuel sources while also being economically viable. Alongside economic factors, political, cultural, and scientific concerns must be considered surrounding the adoption of clean energy sources. One of the concerns surrounding fossil fuels is their provision of jobs and economic stimulus throughout the US, between extracting and refining raw materials like coal and oil, to transporting and distributing them for burning. There is also significant political interest in supporting fossil fuels for some of these economic reasons,

and also due to a general perception of their usage as a valuable economic asset by segments of the public. On the other hand, the adoption of renewable technology presents an initial economic risk as the newer technology. Newer technologies take money and time to develop, manufacture, install, and learn to use, presenting an obstacle compared to existing technology. Consequently, newer technologies can require further investment to make them more efficient, and they can be perceived as less reliable and effective despite their renewability. The way in which the public views these technologies, including their strengths and weaknesses, plays an instrumental role in their widespread adoption.

As previously discussed, this paper's focus is wind energy in particular. Wind energy, being the largest source of renewable energy in the US, provides an interesting example of how these social, political, and economic forces influence technological adoption. Wind energy, as of 2021, produces about 3% of the electricity used in the US (EIA, 2021). On a technological level, the advantages of wind energy include its renewable nature and versatility. In short, any place with sufficient wind could be a viable wind farm location. Additionally, as long as larger wind turbines can be designed and constructed, the turbines can be made more effective.

Unfortunately, other factors determine how viable these massive turbines can be. For example, infrastructure limitations like the size of highway tunnels and highway width limit whether a turbine part can be transported to a farm site at all. Further, public views on wind energy are also influenced by their aesthetics, from their size and common location on open vistas to their audio pollution (Office of Energy Efficiency and Renewable Energy). These factors and more play roles in the basic feasibility of the technology, and also the public support of it.

**Framework:**

To analyze the place wind energy technology holds in American society, the Social Construction of Technology (SCOT) analytical framework will be used. Its four primary components consist of interpretive flexibility, relevant social groups, closure and stabilization, and wider context (Pinch & Bijker, 1984). The first component, interpretive flexibility, suggests that different social groups can see technologies in very different lights. Relevant social groups refers to identifying all the social groups involved in defining a technology. Closure and stabilization is the process of these social groups resolving the differences in their social understanding of a technology. The last component, wider context, is about bringing the focus back to the greater significance of the technology in question.

The benefit of using the SCOT framework is that it can bring to light the dynamics between social groups involved with a given technology. It emphasizes that people and the groups they make up drive the majority of technological development, and should therefore be focused on. This framework was further developed by its critics, such as Klein and Kleinman, who emphasized that SCOT can often underestimate the importance of power dissonance between social groups (2002). To counter this, special attention will be paid to how the relevant social groups interact and what their power dynamics look like.

A modern example of SCOT being applied to the uptake of a sustainable technology can be found in a study describing the uptake of Rain Water Harvesting (RWH) technology by a community in Ghana (Damman et al., 2012). This study outlines the installation of RWH systems to households to collect and store water, alongside how successful their use was, and how satisfied the households were. Initial installation costs were generally high, and households took some time to adapt to the new systems. Given enough time, the study reports that all houses reported greater water usage and high satisfaction with the RWH systems. The authors placed the

RWH technology in the wider context of the community, considering the important social groups and how a new technology and its complexity impacted the sustainability and uptake of the technology. The more complicated systems, while more effective at collecting and keeping water clean, were harder to maintain and consequently less socially sustainable. They were also more expensive to install. The lessons learned from the trial and the SCOT analysis include the recognition that high interpretive flexibility makes adoption of a technology more difficult.

Building off the RWH study, a similar analysis can be performed on a broader level regarding wind technology in the US. Considering how the different relevant social groups perceive wind turbine technology will help determine how to improve adoption of the technology to reduce fossil fuel use.

### **Research Question & Methods:**

The overarching research question of this paper is: what factors influence public opinion of wind energy in the US? Among the research methods used was documentary research using keywords such as “wind energy,” “wind power,” “public opinion,” “perceptions,” “economic analysis,” “media analysis,” “advantages and disadvantages,” “fossil fuels,” and more. Analysis of surveys and polls conducted by national and local organizations are another important source of information for this paper. Technical and economic reports created by the US government provided reliable key information regarding the current state of wind power, as well. This paper first evaluates the current public opinion on wind energy. The current public opinion is then evaluated to see where perceptions align or diverge from reality, and discusses how misconceptions might arise.

## **Results and Discussion:**

Overall, the public in the United States broadly supports the expansion of wind power because it is perceived as a clean source of renewable energy. However, several perceived flaws motivate resistance to the development of wind power in local communities. Misconceived flaws, among some other factors, strongly impede the adoption of wind energy in the US. Many of these flaws are exaggerated or non-existent when checked with reality, suggesting that better education on wind power, how it works, and its pros and cons might help to convince local communities to allow the development of wind power in their backyards. The following portion of the paper will present current public opinion on wind power before comparing it with current research and data reflecting the reality of wind power. The differences will then be highlighted and analyzed in an effort to identify the cause of misconceptions and ways to address them.

One of the most important factors dictating public support of a technology is its economic feasibility. Economic opinions on wind energy therefore hold significant sway over relevant policies. Indeed, according to a large survey conducted by Pew Research Center (2021), 26% of Americans believe wind energy is more expensive than other energy sources, and 44% think wind energy is less reliable than other energy sources. This survey data indicates a considerable portion of Americans think wind energy is a weaker energy source than other sources. However, the same survey reported that 77% of Americans support the expansion of wind energy in the US anyway, a fact likely explained by the fact that 65% of Americans also believe wind power is better for the environment than other energy sources (Pew Research Center, 2021). American wind support despite belief it will cost more is important to consider as it indicates that Americans are willing to spend more money on power and utilities if the source is believed to be

better for the environment. Another example of wind energy support despite higher costs can be seen when the Nebraska Public Power District surveyed its customers in 2003 to determine whether the company should continue pursuing a large wind farm project at the expense of a utility rate hike. The company informed its customers that in exchange for going forward with a \$200 million wind project, customers would be charged 2.5% more. 96% of respondents said they agreed to this plan (Gray, 2003). Altogether, both of these surveys indicate that Americans believe the expansion of wind energy will cost them, but that this is a price they are willing to pay for cleaner energy.

Another category of influences are social factors, including aesthetic effects, the ideologies of portions of public, and cultural beliefs. Of particular note are the aesthetic effects, because visual and audio pollution are common criticisms of wind power. In fact, visual effects alone have been sufficient for communities to reject wind farm proposals. In Brineton, the UK, a proposed wind project was rejected by the local government because the farm would not be “in keeping with the surrounding landscape” (Lo, 2012). This rejection seems to contradict the broad public support for wind power, and highlights a common phenomenon regarding renewable energy in general. Said phenomenon involves the support of wind energy on a national scale, but the reluctance of local communities to approve wind energy projects in their communities. This phenomenon is known as NIMBYism, drawing from the phrase “not in my back yard.” For an interview with the LA Times (Roth, 2021), Josh Hohn, a community renewable energy consultant, said “People broadly support this stuff, just not near them ... It very often comes down to the aesthetics.” The foundations of these aesthetic concerns are the beliefs that wind turbines may be ugly, disturb the local landscape, and create annoying and loud noise. Resulting from these fears is the additional belief that one’s property values will decrease from the



development of nearby wind farms. Whether these ideas are true will be addressed later, but they commonly impede the approval process for wind projects at the local level, providing a major roadblock for the expansion of wind energy in the US.

Regarding ideology, political leanings and party identification have a strong correlation with support and beliefs associated with renewable energy, wind power included. The previously discussed Pew Research Center Survey (2021) found that as of 2021 91% of Democrats favored more wind farms, while only 62% of Republicans favored them. Republicans were also more likely to believe that wind energy costs more, is less reliable, and not better for the environment than other sources of energy. It is important to note however, that the majority of both parties do support expanded wind power. These beliefs could possibly be linked to trends between political leanings and news source preferences, and how these news sources frame renewable energy.

Furthermore, despite growing international concerns surrounding climate change and its effects, there remains unusually high climate change skepticism in the United States. As discussed in the article [International trends in public perceptions of climate change over the past quarter century](#) (Capstick et. al., 2015), growing political polarization and the politicization of climate change in the US likely play a large role in increasing climate change skepticism. Indeed, across most of the world, the issue of climate change is apolitical, meaning climate change is broadly accepted across political divisions. Interestingly, renewable energy support remains high even among groups climate change skeptical groups (Hamilton et. al., 2018) because enough skeptics believe in the potential economic benefits of these technologies, politics aside. This suggests playing into the local economic potential of renewable energy, wind power included, could supersede political dispositions and aesthetic grievances.

Regarding environmental factors, the degree to which a technology is viewed as renewable, clean, or environmentally friendly is also important in public opinion. While 65% of Americans believe wind energy is better for the broader environment than other energy sources (Pew, 2021), concerns about localized ecological impacts are common. These concerns can materialize as litigation from environmentalist groups or wind project rejection by local communities. One popular criticism of wind turbines is an alleged propensity for injuring and killing birds and bats. Additionally, the US Office of Energy Efficiency and Renewable Energy asserts that wind farms can have, “the potential to reduce, fragment, or degrade habitat for wildlife, fish, and plants.” These effects can, however, be minimized with careful planning and siting.

With a summary of current public opinion complete, these beliefs will now be considered in comparison with reality. The economic reality of wind energy is not entirely disjointed from the public perceptions of wind energy. Indeed, the increased electricity costs resulting from new wind projects is a direct outcome of the high barrier for entry in the wind industry. As reported in an economic analysis by David Westin (2019), a significant number of wind turbines must be sold by turbine manufacturers in order to turn a profit. This economic inefficiency must be fronted by wind farm developers and the manufacturers themselves, and these expenses will generally be passed onto the consumer by way of increased energy costs. These short-term costs could potentially be offset by long-term savings. At present, wind energy produces about 4% of global power. According to Project Drawdown (2017), were this value to increase to 20% by 2050, global saving would be nearly \$4 trillion. These savings would not be immediately felt by consumers, but would rather manifest in stronger global economies and reduced damage from climate change. Furthermore, the cost of wind energy, to both build farms and maintain them, is

expected to decline by up to 49% by 2050 (Wiser et. al., 2021). Taken together, these sources show that while there will be notable expenses to continue transitioning to wind energy, these expenses are not only shrinking but are also more than offset by long-term savings. Consumers are therefore correct to believe that they may have to pay more for electricity by switching to wind power, but also that their willingness to do so in order to protect the environment is economically founded.

Local communities are often concerned that the construction of wind farms nearby will devalue their properties and be a negative influence on the local economy. Members of the community that fear annoying noises, shadows, and general visual malaise will influence the value of their assets. However, a 2013 study conducted by the Lawrence Berkeley National Laboratory found that, “no statistical evidence that home values near turbines were affected in the post-construction or post-announcement/pre-construction periods” (Hoen et. al., 2013). The conclusions of this report are supported by the fact that aesthetic pollution concerns are largely overblown, which will be discussed in greater detail later.

Consumer expenses aside, national economic concerns are also highly influential on public opinion. The creation and elimination of jobs is among these. The US Energy and Employment Report (pp. 50-52, 2019) found that in the US, the renewable energy industry employed over 400,000 Americans, with wind power accounting for about 110,000 of those. On the other hand, the fossil fuel industry employed about 210,000 Americans. In addition, the number of renewable energy jobs was growing while the number of fossil fuel jobs was declining. Further investment in wind energy would likely increase the number of jobs in this sector, and would help make up for job losses in the fossil fuels sector.

Regarding aesthetic pollution, the public generally exaggerates the negative effects they expect to experience from nearby wind farms. As previously discussed, community members express concerns about visual blight destroying landscapes and loud noises disturbing daily life. Wind turbines are not permitted to be erected any closer than 300 meters from a house, and at this distance they can produce up to about 40 decibels of noise ([General Electric, 2021](#)). 40 dB of noise is just slightly louder than the noise produced by an average refrigerator, which most people keep in their homes already. This suggests that audio concerns are likely overblown, as the noises will be similar to that experienced everyday to begin with. In addition, a 2019 survey conducted by Berkeley Lab found that 18% of individuals living near a wind project were annoyed by the sounds of the project (Hoen et. al., 2019). The same survey found that 69% of individuals living near wind projects liked the way that they looked, and just 14% indicated they did not. These results indicate that only a small minority of people find wind project noises annoying, and many find their appearance aesthetically appealing.

The development of wind farms has a variety of environmental effects on the land in which they are built and the surrounding area. Regarding land usage, wind energy requires a relatively large land footprint compared to other energy sources (Stevens, 2017). More specifically, when compared to fossil fuels and solar power, wind power needs more land to produce the same amount of energy, which is an important consideration when choosing between renewable power sources. This fact should also be considered when analyzing the potential ecological impact a wind farm might have on the surrounding environment. One of these impacts is the death of birds and bats, a commonly criticized aspect of wind energy. However, when compared to other sources of anthropogenic bird death, wind turbines kill a miniscule portion of birds. According to the Sierra Club, wind turbines kill about 1 million birds annually, while

wind turbines kill up to 1 billion birds annually (Sierra Club, 2022). Clearly, the threat wind turbines pose to birds across the world has been dramatically exaggerated, so this is not a well-founded criticism of the technology. The reduction in greenhouse gas emissions from shifting towards wind energy and curbing climate change would likely save a significantly larger number of birds than are killed by the turbines themselves, as well. Altogether, the development of wind farms presents a utilitarian trade-off, one in which the wellbeing of a local ecosystem must be weighed with a fractional contribution to the global climate. Effective research and consultation with environmental groups can help reduce unintended environmental impacts – some are likely unavoidable, and have to be considered in the context of reducing global climate change, which will help protect the entire planet's environment.

To reiterate: public opinion of wind energy is broadly supportive yet locally reluctant. The above analysis indicates that much of the local reluctance is founded on weak arguments or misleading information. For the most powerful social group, the public, to achieve closure in its popular interpretation of wind power, the sources of these weak arguments and misinformation should be identified and the information should be corrected. To achieve this goal, the other notable social groups and their interpretations of wind power should be considered. With these groups and their interpretations identified, ways in which interpretative differences can be reconciled will be considered.

The primary social group involved in wind power adoption in the US is the public, since they hold the most influence over local and state governments who choose to approve wind power project proposals, grant siting permits, and more. As was discussed, there are some notable fractures in opinion on wind energy depending on what portion of the public is considered. One of these is political leanings, indicating that political parties and media

preferences likely hold sway over public opinion, and as a consequence, wind power in the US. It should also be noted that wind technology is not perfect, and wind farm developers and turbine manufacturers can take action to reduce costs, ecological impacts, and aesthetic shortcomings, in doing so these groups can affect public opinion by addressing popular grievances. Fossil fuel and energy companies also hold influence over public opinion, with massive resources and wide ability to reach consumers with information. There are many more groups at play, but the groups highlighted here hold particular power over the public's beliefs about wind power.

These groups are delineated by broadly holding similar interpretations of wind power. Notably, the broader public holds only a weak consensus in its support for wind power, a consensus which could be strengthened to accelerate adoption of wind power. This consensus would best be strengthened by the influential social groups aligning their interpretations of wind power with that of the public majority. Doing so would likely convince wind power skeptics to change their stance, and strengthen the resolve of those already in support of expanded wind power. For example, wind turbine developers could better advertise the fact that wind turbines are not particularly loud, do not lower property values and do not kill a significant number of birds. This would address some of the misinformation currently dissuading the public from wind power. This would provide incentive for political parties to adjust their platforms to better support wind power in order to continue appealing to their respective bases. Broader public and political support for wind power would then accelerate approval processes for wind farms and renewable energy related legislation. While this is purely a hypothetical, it demonstrates some of the potential benefits that could be seen from interpretive closure and stabilization between the social groups involved in wind power. Ultimately, most negative perceptions of wind power held by the public are founded in exaggerated information, and better education and advertising

through the government and the wind power industry members could help address this issue. As a final note, as the wind power industry grows, the technology itself will mature as well. As it does so, it will mitigate some of the perceived issues as well. As blades get more efficient, they produce more power and become quieter. As turbines get larger, they require less land to produce the same amount of energy while also reducing ecological impacts. Altogether, as the technology develops further, it will only become more effective and appealing to the public.

This project was limited in its scope to primarily considering the current state of public opinion on wind power in the United States and comparing these perceptions to reality. A more thorough analysis of why these dissonances occur was not able to be performed. Additional work into what actions could be taken to resolve interpretive differences between social groups would also be of great interest. These actions could then be used to inform public policy to promote renewable power in a well-informed way. Future work could investigate this further, as it would likely provide valuable insight on how negative aspects of a technology become exaggerated, or whether this may have a result of misinformation.

### **Conclusion:**

To conclude, better education of the public with respect to wind power's pros and cons would help to resolve many of the public's concerns surrounding the technology. Accelerated, widespread adoption of renewable energy sources like wind power is essential in reducing global greenhouse gas emissions. Reduction of these emissions is necessary and urgent to curb irreparable climate change and the associated destruction that it will bring.

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