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Energy Claims for the Wind Farm off Newport's South Coast

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Introduction

The energy aspect of wind farms is one of the greatest concerns when it comes to how it would positively or negatively impact the environment, the economy, and the population as a whole. Wind power is a clean and renewable energy source. Wind turbines are able to generate energy from wind alone through kinetic energy. Compared to other energy sources, they are a stronger source as it is more reliable and cost efficient. Despite this, there is a great amount of fear mongering and myths surrounding wind turbines, much of it having to do with their emissions, health impacts, and the cost. While completing research for this project, plenty of information was found on how beneficial wind turbines and wind farms are when it comes to helping improve the environment, the financial benefits, and how much better it can be for everyone, including communities that are often overlooked.

Overview of Wind Turbines

The wind turns the propellers (blades) around the rotor. The rotor then spins the generator inside the turbine, which generates electricity. Wind farms are effective because they utilize multiple turbines for optimal energy output. The electricity produced by the turbines will find its way to a substation which transfers the electricity to the grid, and eventually to consumers' homes and communities. Turbines are constructed in three parts, then assembled on site. The towers are typically taller than thirty meters (100ft) because the higher the turbine blades, the less turbulent the air passing through will be. Most turbine blades are constructed from fiberglass. Most turbines are built with something called a "pitch system" which is responsible for adjusting the angle of the blades in accordance with the wind speed and direction.

Offshore wind turbines are manufactured differently than onshore wind turbines. The blades and rotor are connected directly to the generator. This helps avoid unnecessary issues and it proves far more efficient than onshore turbines. Offshore turbine blades have been known to reach over

one hundred meters. Roughly the size of a football field. As a comparison, to produce one gigawatt from solar energy, it would take 2.469 million solar panels. One million LED light bulbs to make one gigawatt. However, it takes an average of 310 large-scale turbines to produce one gigawatt. Significantly less than its competitors.

The Block Island was one of the first successful offshore wind farms in the United States. The farm consists of five turbines. Block Island was compensated $2.5 million for the visual impacts of the wind farm. The proposed wind farms off Newport's southern coast will consist of one hundred turbines. If they were compensated the same as Block Island for visual impacts of the farm, Newport would make about $50 million. That is hard to argue with. This proposed wind farm will provide over 300,000 homes with electricity between Rhode Island and Connecticut.

Emissions

While wind turbines certainly produce far less emissions than almost any other renewable or non-renewable energy source, there are some emissions of greenhouse gases like carbon dioxide and methane during the life cycle of a wind turbine. This is mostly due to the production and installation of the turbines. Obviously, factory production of materials such as steel produce as emissions, as does to process of installation due to machinery necessary to place the turbines. The importation of components and materials must also be considered. Dugan Becker, Southwest Wind's community liaison, mentioning importation being matter of consideration in this offshore project, as Southwest Wind will be obtaining pieces from Europe and Asia. There are also minor emissions in the maintenance of wind turbines. For example, boats and machinery moving out to the turbines will emit gases due to fuel usage. However, from creation to disassembly, most wind turbines create between 5-26 grams of CO2 per kilowatt-hour. Comparatively, power plants that burn natural gas create 437-758 grams of CO2 per kilowatt hour, and coal-fire power plants

produce about 675-1,689 grams per kilowatt hour (yaleclimateconnections.org). Furthermore, once installed, turbines create almost zero pollution other than the aforementioned maintenance emissions. This means that most turbines offset their lifecycle emissions rather quickly, meaning they produce more energy and prevent more emissions than they consume and create. Southwest Wind estimates that this offshore wind farm will offset its entire lifecycle emissions in only 8-10 months (Becker). Considering the farm will remain installed for at least 30 years (and likely longer), and the emissions that the farm will prevent, the emissions created during its inception are not alarming. It's also worth noting that investing in projects such as this and driving the market for wind turbines will likely motivate greater innovation in the production process. Ideally, this means even less emissions during production and installation.

Comparisons to Other Energy Options

The term "fossil fuels" refers to coal, oil, and natural gas which are non-renewable resources used for energy production. The production of energy using fossil fuels is highly polluting, and emits toxins including carbon dioxide, mercury, particulate matter, volatile organic compounds, and more, into the air and places high demands on resources such as freshwater (Trillium, 2024). The U.S. Environmental Protection Agency found that "coal generation creates 0.9kg of carbon per kilowatt hour of electricity produced (Trillium, 2024). The Harvard School of Public Health reported that the total cost of damage from just the generation of energy from coal, including mining, burning, and waste disposal, "approaches $523 Billion per year, which would add as much as 27 cents per kilowatt-hour to coal's cost if plant owners had to pay for damage, making it far more expensive than wind" (Trillium, 2024). When these numbers are added up, the cost both economically and environmentally is massive. Under the Biden Administration, three fossil fuel lease sales in 2022 were canceled, "due to a lack of industry interest" (Eversource, 2022). While it has been one of the leading sources of energy, this shows that people are beginning

to understand the negatives that come with it and are moving away from it. Another risk that occurs with fossil fuels is oil spills. Though it is true that catastrophic oil spills do not happen frequently, smaller spills happen more often and still "require multiple orders of magnitude more time and money for remediation" (Freeman, 2022), especially when compared to offshore wind farms. It is also important to consider that fossil fuels need to be transported, and often over far distances "emitting even more carbon throughout that shipping process" (Freeman, 2022).

As fossil fuels are non-renewable sources, "it is estimated that by 2050 it will only remain approximately 14% of oil proven reserves, 72% of coal proven reserves, and 18% of gas proven reserves" (Martins et al., 2019), so these resources are running out quickly, and polluting at the same time. Beyond the environmental and health concerns that come with the use of fossil fuels, they are also "unevenly distributed, which increases the concerns about energy security due to their key role in today's energy production systems" (Martins et al., 2019). Fossil fuels, as discussed, are dangerous for a multitude of reasons, including being a "major contributor to local air pollution, which is estimated to be linked to millions of premature deaths each year" (Ritchie and Rosado, 2022). For example, coal produces more carbon dioxide and local air pollution per unit of energy, and "around four-fifths of global primary energy comes from coal, oil, or gas" (Ritchie and Rosado, 2022). Coal has proven to be the most polluting energy source in terms of both air pollution and the production of carbon dioxide, and oil has now become the largest energy source in the world, with natural gas consumption growing rapidly, "often as a replacement for coal in the energy mix" (Ritchie and Rosado, 2022). While in some ways this transition from coal to gas has been beneficial because it produces less carbon dioxide, it is important to continue to move towards the energy sources with far less emissions. These fossil fuels, also referred to as "primary energy sources" are important to many industries. The "transportation, industrial, residential, and commercial sectors are called end-use sectors because

they consume primary energy and electricity produced by the electric power sector" (U.S. EIA, 2022). According to the same study, fossil fuels accounted for "about 81% of total U.S. primary energy use" (U.S. EIA, 2022).

Nuclear energy is the most expensive, and risky, non-carbon based source. While it did show promise in energy production, "Fukushima has demonstrated the tremendous risks that are inherent in any nuclear power generation" (Trillium, 2024), and other disasters provide support that the risks outweigh the benefits in terms of using it as an energy source. Many factors, such as cost overruns, hidden charges, and more make "any nuclear power generation far too risky for any jurisdiction" (Trillium, 2024). Wind energy is clearly more viable and environmentally friendly, especially when considering "the fact that nuclear fission produces highly radioactive waste that requires storage for tens of thousands or millions of years" (Trillium, 2024). While nuclear energy is low-carbon energy, the risks are far too high.

The use of nuclear energy had quite a rapid growth, and a rapid downfall. The "Nuclear energy production in commercial nuclear power plants in the United States began in 1957, and grew each year through 1990, before leveling off from 2001 through 2019. In 2020 through 2022, total annual nuclear electricity generation declined after two nuclear plants retired in 2020, one plant in 2021, and another plant in 2022. In 2022, nuclear energy's share of total U.S. energy consumption was about 8%" (US EIA, 2022). While nuclear energy did show potential in being a useful, low-carbon energy source, they are overall far too dangerous to the environment as well as human lives to be used in any large capacity.

Wind energy "offers a decentralized energy source," and while a single nuclear plant needing unscheduled maintenance can "take 1,200 MW from the grid", this is highly unlikely to occur in wind farms, as each turbine "generates no more than 5 MW of energy" (Trillium, 2024). One of the most important factors of renewable energy is how much maintenance is needed, and

how this maintenance may impact the environment. However, “Wind turbines, especially offshore turbines, are built to last. Designed to withstand extreme environmental conditions, they have an average lifespan of 20-25 years” (Freeman, 2022). Another important element of the production of offshore wind farms is that “More than 80% of turbine components can already be recycled or reused” (Freeman, 2022), with research being done to increase this percentage. So, end of life recycling of these materials further demonstrates the environmentally friendly process of using wind farms. This assessment found that “offshore wind energy stands to be one of the best tools in the clean energy transition, moving the United States away from carbon-intensive energy generation” (Freeman, 2022).

There are plenty of examples of successful offshore wind farms, mostly in Europe, but also within the United States. In New England specifically “At the end of 2023, South Fork Wind started delivering power to the local grid in East Hampton…Once complete, the 130 MW of clean energy will power approximately 70,000 homes. Sunrise wind, when complete, will deliver 924 MW of offshore wind energy to power nearly 600,000 New York homes. Revolution Wind is expected to be completed in 2025. Once complete, it will power more than 350,000 homes in Connecticut and Rhode Island” (Eversource, 2022). These numbers help to demonstrate the capabilities of offshore wind farms, and how the energy produced can continue to increase.

Under the Biden administration there “are currently 18 active offshore wind leases, with 14 new site assessment plans approved” (Freeman, 2022). Offshore wind is also a powerful energy resource because “The average acre from an offshore wind lease sale brings in nearly 12,500 percent more revenue for taxpayers than 1 acre of oil while providing enough electricity to drive an electric vehicle almost 65 times farther than a gasoline-powered vehicle” and found that “1 acre of offshore wind leasing produces more usable energy for less” (Freeman, 2022). In

fact, according to the U.S. Department of Energy, “the health and benefits of offshore wind energy were estimated to be $76 per MWh for installations in 2020 - or $3,101 per acre” (Freeman, 2022). Offshore wind farms have had a growth in capacity of around 30% per year between 2000 and 2018, and now have “permanent magnet (PM) - based technology” which allows wind turbines to “operate at lower speeds and thus have higher efficiencies and energy yields” (Li et al., 2022). The use of offshore wind energy is the best renewable energy source discussed and should be implemented as much as possible.

According to a report done, offshore wind lease sales are a significantly better use of ocean acreage than oil and gas. As stated by Freeman (2022) “One average productive acre of natural gas leasing produces just 34 MWh, while offshore wind exceeds this at 40.8 MWh per acre. For offshore wind, that is enough power to drive an average electric car nearly 118,000 miles, the equivalent of driving from coast-to-coast in the United States 42 times - and notably, 18,000 miles farther than the distance achievable using the power generated from natural gas. One acre's annual output of consumer-grade gasoline is only enough to drive 1,917 miles, or about the distance from New York City to Albuquerque, New Mexico”. In the same report, Freeman (2022) states that “By 2030, wind energy is estimated to be nearly 28 percent cheaper to produce over a project lifetime than the current LCOE (levelized cost of energy) for gas, which is projected to increase over the next decade”. Additionally, Freeman (2022) states “On average 201 barrels of crude oil are produced annually in 1 actively productive acre in the Gulf of Mexico, which has the potential to emit 87 metric tons of carbon dioxide…One acre of offshore wind, meanwhile, avoids emissions equivalent to nearly 30 metric tons of carbon dioxide each year”.

The use of fossil fuels is inherently bad for the environment as they release massive amounts of carbon dioxide each year, and release particles into the environment. While nuclear

energy is a low-carbon energy source, it is highly dangerous to use as it has the potential for major damage from spills, explosions, and leaks. Due to reactor events such as Fukushima, it has become clear that the use of nuclear energy is unstable and unsafe for human use. Offshore wind farms emit very small amounts of carbon dioxide while in production and offset this production with end-of-life recycling. The amount of energy that can be produced outcompetes other sources as well, and it is renewable, meaning we will not need to worry about losing the ability to harness the energy.

Cost and Savings

The average wind turbine can cost anywhere between 2.18 to 4.13 million dollars. This includes the cost of the overall purchase of the wind turbine, grid connection, site preparation, shipping, insurance, installation, and engineering of the product. Costs may differ depending on location and any unforeseen challenges, but this is the approximate cost of a wind turbine (Kamkwamba 2024). Although the cost of a wind turbine is expensive, they are able to pay themselves back after a few years and remain more cost-efficient than fossil fuels. The biggest competitor in terms of price for energy would remain solar energy, which also has excessive costs when it comes to the engineering, manufacturing, materials needed, and the installation process. According to a report completed by the United Nations, “Renewables are the cheapest form of power today, confirms a new report from the International Renewable Energy Agency. Amid climbing fossil fuel prices, investments in renewables in 2021 saves US $55 billion in global energy generation costs in 2022” (UN, 2022).

Wind energy can offset certain costs and is a much more affordable option for certain areas. For example, certain rural areas in the US states such as Alaska would require further transportation of fossil fuels. Further distance for transportation means there is a higher cost for the overall product. Further transportation is also more expensive due to the weight of the fuels

that are being transported, because of the heavier weight and distance that is being traveled, there is greater pollution. In turn, since more fossil fuels are being used this makes the transportation cost more expensive for the consumers, so fossil fuels are much more expensive for rural communities. Wind turbines and wind farms would be able to save rural areas more money in the long run, and there is less pollution being put out into the environment. In scenarios such as this, wind power is not only able to benefit the environment, but it is also able to help the consumer who would have to pay for this energy.

Wind power also contributes approximately 2 billion in revenue for state and local tax payments and land-lease payments each year (US Department of Energy). Communities that use wind energy would then be able to use this money for subjects of their choosing. This can include extra revenue towards school budgets, reducing tax burdens on homeowners, addressing local community projects, and more.

Furthermore, there are benefits for communities and individuals who live in areas where there have been coal plants and power plants. This is called the Energy Community Tax Credit Bonus. This tax bonus would revitalize many communities, but it would especially help lower income communities and communities of color. This would also benefit brownfields, which are lands where coal and power plants were previously established but have been demolished or removed. Despite the plants being gone, the ground remains extremely toxic and polluted, so the land is seen as having no value. This makes the land difficult to sell, so the price is then lowered, and it is usually sold off and schools, parks, or community gardens are typically built on them after the top soil layer is replaced. Brownfields tend to exist in communities of color or low-income communities, so having the opportunity for a tax bonus would allow them to reinvest into their own communities which are already so often ignored and overlooked.

According to the Department of Energy, wind turbines and wind farms would not only be able to benefit in terms of saving money and being a better resource for energy, but it would also be able to create direct or indirect employment, benefit local tax revenues, land-leases, and it would lower electricity rates. By lowering these electricity rates, individuals, businesses, and the population will be able to save money and increase energy security while reducing pollution from currently used non-renewable energy resources.

Health Impacts

One major concern surrounding wind energy is possible health effects. Over the years, some people who live near wind turbines have reported an increase in headaches, vertigo, and sleep disturbances, unofficially coined "wind turbine syndrome" (Farboud, A., Crunkhorn, R., & Trinidade, A., 2013, p. 222). It is proposed that these symptoms could be linked to exposure to infrasound from the turbines. Studies have shown that the outer hair cells of the cochlea can be affected by infrasound, but there is no evidence to conclude this causes the reported symptoms (p. 224). The strongest evidence to support that wind turbines have an effect on health pertains to annoyance. Depending on proximity to the turbine and weather conditions, the sound can cause annoyance and sometimes trigger stress (p. 225).

When comparing health effects caused by wind energy to health effects caused by other energy sources such as oil and natural gas, wind clearly proves itself to be safer. Pollution created by the extracting and using of non-renewable resources is linked to asthma and other respiratory diseases, cancer, and endocrine disruptors (Susanto, A. D., 2020, p. 8). Those who live in densely populated industrial areas are at a far higher risk of these effects, while offshore wind energy has not been found to cause any ailments of this caliber (p. 9).

One key factor to consider is that the proposed wind turbines for Newport will be between five and fifteen miles offshore, while most of the reports of health disturbances and research done about them are from turbines located onshore and close to residents. The distance of the wind turbines from the island will aid in reducing the noise complaints and annoyance. A local example of a successful wind energy project is the Block Island wind turbine farm. While residents were initially skeptical and concerned about negative effects on their health, the results have been overwhelmingly positive. Many living on the island have noted that the switch to wind energy has reduced noise, as it replaced a previous system of loud gas generators (Ackerman, Hoffman, King, & Keefe, 2019). Overall, the majority of studies looking into wind turbine syndrome have concluded that there is not enough evidence to prove that infrasound directly causes reported symptoms (Farboud, A., Crunkhorn, R., & Trinidade, A., 2013, p. 225).

Conclusion

Overall, wind energy is a better energy choice when compared to non-renewable options and in terms of emissions, costs and savings, and health impacts. Non-renewable sources such as oil and coal pollute the air and water while also creating a greenhouse effect, harming all life forms, and negatively impacting the global climate (Freeman, 2022). While the production and installation of wind turbines does release pollutants, the turbines ultimately offset the entirety of their lifecycle emissions rather quickly (yaleclimateconnection.org). In terms of cost, wind farms are significantly more cost-efficient than non-renewable resources. Through the Energy Community Tax Credit, there will be a 10% bonus in revenue for schools and communities that have been previously inhabited by coal and power plants. Lastly, there is not enough solid evidence to conclude that wind turbines cause significant health effects, unlike the serious impacts resulting from fossil fuel exposure such as respiratory illness and cancer (Susanto 2020,

p. 8). The benefits of wind energy outweigh the costs and could hold the answer to a greener future.

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