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The Answer is Blowin' in the Wind: The History and Practical Future of Wind Power

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Abstract

Our energy practices have caused damage to the ecosystems of our planet. It is important that we move away from our current practices and towards more renewable and clean energy sources. Oil and coal both have incredibly harmful effects on the environment, including the emission of chemicals into the atmosphere leading to climate change and rising temperatures. Wind power may be the path that we need to take; it is a technology that has been around for thousands of years. In the recent years, technology has jumped forward in the turbine field. That being said, wind farms still face opposition from the public and from governmental departments. It is true that wind power does have some flaws, but overall it can be improved upon if research continues. We are living in the 21st century, it is time that we turn to more sustainable energy technology that will keep the environment from an irreversible degradation.

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Yes, how many years can a mountain exist, before it's washed to the sea?
Yes, how many years can some people exist before they're allowed to be free?
Yes, how many times can a man turn his head pretending he just doesn't see?
The answer my friend is blowin' in the wind
The answer is blowin' in the wind.
-Bob Dylan

Introduction

In the seventh grade, I saw Al Gore's *The Inconvenient Truth* and it scared the shit out of me. I grew up in a rural farm town and spent my days exploring the woods, catching frogs, and climbing trees. Never had it occurred to me in my young life that my home was in danger, I had assumed that it was a permanent installation in everyone's life and that it always would be. This illusion was shattered thanks to Mr. Detleich's seventh grade Earth Science class. The film influenced me to start truly caring for the environment, keep tabs on what was happening, and eventually become an environmental policy major. However, this is not the normal behavior of our society. For the most part, environmental issues do not make it into the spotlight or the front page; rather a frivolous scandal or high profile event draws the attention of media watchers. Environmental issues are thrown into commercials, "buy this car it has great gas mileage, it will save the planet" or "you should buy sun chips, our bag is degradable!" Real environmental issues are not the focus of our attention, the staggering statistics I saw in my seventh grade experience couldn't be found on any news network. To be blunt: we do not seem to care about the environment. Recently there has been an environmental movement, an increase of green living practices, a surge in recycling and reusing, and reducing our carbon footprint. But these things happen on a small scale, in the forefront our consumer lifestyle rages on and it is slowly killing us.

Our current population stands at 7 billion people, that is 7 billion people that require food, water, shelter, healthcare, services, transportation, and more. This requires a lot of energy, energy produced mostly by natural gas, coal, and oil. Burning these energy sources releases multiple gases into the atmosphere including carbon dioxide, which have led to *global warming.* The most common analogy of this phenomenon is a green house, but I myself prefer a car left in the sun. We all know what it is like to climb into our car in the summer, the stifling heat that chokes us as we wait for the air conditioning to cool you. The heat from the sun comes through our atmosphere to warm our planet, continuing our life here, but due to the rising levels of certain gases in our atmosphere, the heat cannot escape; instead it is slowly raising the temperature of our planet leading to a host of issues that are incredibly dangerous.

Underneath this cynicism, I hope that there is a way to crawl out of this hole. In this paper, I will analyze wind turbine technology and determine whether it has a place in America's future. Technically, the amount of wind power available in the United States could provide 10 times the amount of electricity the country consumes annually. Wind power has surpassed the net additional capacity from coal-fired, gas-fired, and nuclear power plants combined and yet this resource is vastly underused. Wind causes the large blades to move, spinning a turbine within the tower of the windmill producing energy; it's simple and clean. Unfortunately some people are against windmills strictly because they believe them to be an eyesore. They would prefer not to see windmills when they look upon the horizon, but some, such as Al Gore, find this sight to be one of beauty and proof that we are moving forward as a society [1]. While windmills can reach up to 345 feet tall, the area it needs on the ground is relatively small. Farmers in European countries such as Denmark and Austria

have fields full of both mills and livestock, since the mills reach upwards into the sky and not covering the ground. Another argument against windmills is the noise that they make, but due to recent developments, the mills no longer make a loud whirring noise as the blades spin, they are quiet and efficient. Modifications have even allowed this windmills to be used in residential areas, they are much smaller in height but still produce enough energy to power a house with power left over. Another push in the wind power field is off shore windmills with more mill farms forming in Denmark, Switzerland, Ireland, the Netherlands, and the UK. [2] Oil drilling technology has already provided the knowledge of building strong and long lasting platforms in the ocean using underwater cables to run the electricity back to land. The ocean is a prime spot for these windmills farms, the wind can move over the water without hindrance of mountains or skyscrapers allowing for the mills to work at top notch. Regrettably some people still refuse the development of such things, deterring the Cape Wind project in Cape Cod because they do not want to look out from the beach and see them. Residents think of this new technology as "visual pollution" and “somewhat of an irritant”[3]. Fortunately, twenty-two other states now have more than 100 megawatts of electricity production from windmills, enough to supply 30,000 homes. Texas being the home of one of the largest onshore wind farms with 421 windmills, but larger farms are under construction. [4] Given the numbers on how much energy this technology can generate, it baffles me that we do not use the resource to its fullest. It is a clean source of energy that will seriously deplete the amount of pollution flying into the atmosphere, yet people oppose it because it does not make a pretty skyline. I doubt that people enjoy looking upon smoke stakes and factories in the distance, but no one stops the construction of such things. It is oil companies that cause a major setback in the production

of alternative energy; Bill Koch, a coal and oil magnate, it the major funder and Chairman of the opposition group to Cape Wind. [5] Big corporate men such as Koch will do whatever is necessary to keep business from straying and yet some people cannot see that they are just being tricked into continuing use of oil and coal.

Chapter 1: Our Current Situation.

Natural gas, coal, and oil fuel the majority of our society; they are the big contenders amongst energy sources. These sources, however, are not without their consequences. Due to the high capacity at which we burn these, we have altered the composition of our atmosphere. Since the Industrial Revolution, our energy intake has more than tripled and so has our pollution. It is unfair to dismiss these techniques completely, they have revolutionized our way of life, but it is time to make changes. If we continue on this course, I am afraid of what our planet will turn into.

In 1959, Scientific American printed an article on climate change containing the following quote: "A current theory postulates that carbon dioxide regulates the temperature of the earth. This raises an interesting question: How do Man's activities influence the climate of the future?"[6]. This question was posed over 50 years ago, when carbon dioxide levels in the atmosphere were significantly lower, yet this thought was still of concern. Take a moment to imagine how much we have advanced in the last 50 years and the carbon emissions that accompanies such advancements. Climate change is not a new idea and yet there is not much progress made in the efforts to preventing this process. In the last 50 years the atmospheric CO2 levels have been raised from 320 ppm (parts per million) to 398.35 ppm as of April 2013[7]. The upper safety limit for atmospheric CO2 is 350 ppm, a level we have not seen since early 1988. There are natural influences on the atmosphere

such as solar irradiance changes and volcanic activity, but human impact greatly exceeds the known changes due to natural processes. Since 1750, the start of the industrial era, the overall effect of human activities on climate has been the warming or cooling of the climate system. Global greenhouse gas emissions have increased 70% between 1970 and 2004. As a society we have altered the landscape of our Earth with expansion and advancement, but at a great cost. According to the 2010 Global Carbon Budget, the burning of fossil fuels, a practice that supports day-to-day life, accounts for 91% of the carbon dioxide in our atmosphere, destruction of land such as deforestation contributes the remaining 9%[8]; 50% of these emissions end up in the atmosphere, the other half split between the land and oceans. In the 1950's it was believed that oceans would quickly absorb whatever excess carbon dioxide might come from carbon dioxide, but Roger Revelle discovered that the specific chemistry of seawater prevents such a process, instead the CO2 remains on the top layer of the ocean and "might remain there for many years"[9]. Since Revelle's discovery in 1957, CO2 has been persistently added to the ocean water, raising its Ph balance, caused temperature-induced mass coral bleaching, the threat of the starfish's extinction, mussel populations dying, and many more detrimental changes to the vast oceans. Our everyday practices of destruction and fuel burning have other consequences as well, 1995 through 2006 ranked as some of the warmest years on record for global surface temperature since 1850. [10] Due to these high temperatures, specifically at higher northern latitudes, glaciers, ice caps, and the polar ice sheets are melting causing rising sea levels. Since 1961 sea level has risen an average of 1.8 millimeters a year. However, since 1993 it has been recorded at 3.1 mm/yr, a vast and dangerous increase. Seawater is now reaching father inland, causing contamination of aquifers, and agricultural soil; it causes rising water

tables, erosion, flooding, and destroys habitats for fish, birds, and plants. Higher sea levels mean more violent and powerful storms that will devastate the coastline, flooding will become more prominent, low-laying islands and coast will be submerged completely. The coastline will have to be emptied of residents as a matter of safety.

Where does humanity's carbon dioxide emission come from exactly?

Currently, we are heavily reliant on natural gases, oil, and coal; we have been using these materials heavily for decades and it is clear that it is a detrimental practice. We use oil for more of our energy needs that any other source, it has been a main driver behind the expansion of our world; it has provided the means to travel over continents and oceans, powered our lifestyles, and has granted us the many comforts and advantages of our everyday. Oil is a cheap resource, which is why is became such a popular energy source; no other source is as powerful, ductile, adaptable, transportable, storable, and usable as oil. [11] It is used so heavily across the planet that some worry that there isn't enough oil under the surface to sustain our future. Others question the ethics of our oil use, which is a valid concern; oil will no doubt leave a burden on future generations. In 2008 alone, the United States of America produced an estimated 4.9 million barrels of crude oil per day and imported about 9.8 million barrels per day from other countries. [12] In order to extract oil from the ground, the land must be cleared, leveled, and access roads must be built disrupting the habitat. The Arctic National Wildlife Refuge has long been a spot for advocated drilling, something President Bush supported, is a prime example. Polar bears, caribou, and other animals travel across the terrain to give birth; these animal populations are already dwindling, if something were to interrupt their breeding it could be devastating. Oil is often responsible for the destruction of habitat and the mass death of

animals due to oil spills. The 2010 Gulf Oil Spill is one of the most publicized and devastating oil spills that have taken place. After the explosion and sinking of the *Deepwater Horizon* oil rig, oil rushed into the Gulf of Mexico for 87 consecutive days, an estimated 4.9 million barrels of oil rushed our of the sea-floor oil gusher. The area hosted 8,332 different species including, fish, birds, crustaceans, sea turtles, and marine mammals. Exposure to the oil led to irregular heartbeats and cardiac arrest, deformities, and mass death among the animals. Fish with oozing sores and lesions were reported by fishermen, 50% of shrimp were found lacking eyes and eye sockets, chemicals from the oil spill were found in birds as far as Minnesota. The BP oil spill has had an overwhelming effect on the environment and its occupants. And it is not over, dolphins and sea turtles have been dying in record numbers since 2010. Ongoing research shows that dolphins swimming through oiled areas are underweight, anemic, and show signs of liver and lung diseases. More than 900 bottlenose dolphins have been found dead or beached in the area since the oil spill, if you stretched the corpses lengthwise, that's 1.5 miles of dead dolphins. [13] About 500 dead sea turtles have been found in the region every year since 2011, a large increase from the average rates. The BP oil spill may be one of the worst recorded, but it was not the only occurrence. There have been over 150 oil spills all over the world, including two that are still spilling today. The Taylor energy wells platform, also in the Gulf of Mexico, has been leaking since September 2004, that's 3513 days; it has been mostly contained but not entirely. We are heavily dependent on oil and it's attributes, but at what cost? We pump millions of barrels of crude oil every day, we spill millions into the oceans, and we harm millions of animals in the process. Conventional oil has environmental casts that are not included in market price, releases carbon dioxide and other air pollutants when burned,

and leaves us reliant on foreign countries and their supply. In 2005, the Institute for the Analysis of Global Security reported that almost one-forth of the worlds crude oil is controlled by states that sponsor or condone terrorism. In a 2006 pool of 100 U.S foreign policy experts, "the highest priority in fighting terrorism must be to sharply reduce America's dependence on foreign oil"[14]. However, we do not have enough domestic oil to meet our needs, no more than about 1% of the country's current annual demand would be met, even if the United States opens up all of its public lands and coastal regions to oil exploration.

The United States is abundant in shale oil, about 72% of the world's estimated oil shale reserves are found deep under government-owned land of Colorado, Wyoming, and Utah in an area known as the Green River formation. Oily rocks contain a solid combustible mixture of hydrocarbons called kerogen, when it is extracted from the crushed oily rocks they are heated in a large container, a process that produces a distillate called oil shale. The U.S Bureau of Land Management predicts that the shale deposits found in America could provide almost four times as much heavy oil as Saudi Arabia's conventional oil reserves. These oil shales are locked up in rock and ore deep under the surface, requiring a considerable amount of energy and money to mine and convert the kerogen into oil shale. It supplies such a low net energy yield that it could not compete in the open Markey place unless the government provides large subsidies and tax breaks. Mining oil shales also requires a lot of water, about 5 barrels for each barrel of shale oil. The Western states where these reserves are found are arid areas, where water in short supply and likely to become even drier due to current and predicted drought for this area. Turning to shale oil may lead to us being independent from foreign oil providers, but is it worth the

environmental impact? Mining and processing shale oil releases 27-52% more carbon dioxide into the atmosphere per unit of energy produced than crude oil [15], it has a low net energy yield which requires larger amounts to be mined to become efficient, and it causes sever land disruption and considerable amounts of water.

Unfortunately, crude and shale oil are not the worst out there. There is no doubt that coal remains the dirtiest and most polluting of all energy sources. [16] Coal is a solid fossil fuel that was formed in several stages from the remains of land plants that were buried 300-400 million years ago and then exposed to intense heat and pressure over those millions of years [17]. It provides almost half of the electricity in the United States, it is cheap and the planet has large amounts available. These characteristics led to its popularity and durability, until recently; coal has been recently challenged by environmental protection and climate change. Ironically, coal use began in the mid 17th century as a means to reduce environmental damage. Until then, wood had been the prime source of energy and heat, but it was an obviously delectable resource, coal was used in hopes of reducing the tree loss. By switching to coal, the world was transformed into the modern era, but at a cost. Most of the focus is on the burning of coal and the emissions, but the life cycle of coal is damaging from start to finish. Extracting coal results in massive changes to the landscape, cutting the tops off mountains and hills, buries rivers, and turns fruitful and farmable land into barren wastelands. Mining underground take place from 500 to 2000 feet underground and causes thousands of deaths to the miners. In China alone, six thousand people per year have died producing oil in the last three years. Underground mining is also causes erosion, dust formation, surface water and groundwater pollution. When coal dust mixes with water it creates sulfuric acid, which

contaminates groundwater, is corrosive and caustic, and contributes to acid rain. The next step for coal is transportation, shuttled in large trucks or trains that contribute to additional environmental damage. Finally, the coal ends at a power station where it is burned, releasing harmful chemicals into the atmosphere. When burned, coal releases more carbon dioxide than either oil or natural gas does. Most of the attention is focused on the massive amounts of carbon dioxide that coal and coal powered activities are responsible for, but it isn't the only thing coal is accountable for. Coal burning power plants are the source of more than half the 2000 tonnes of mercury dispersed into the atmosphere each year. [18] The concept of "Clean Coal" has been introduced recently, although this is an oxymoron onto itself. Clean coal is as possible as a cold sun or a jumbo shrimp; *cleaner coal* is possible but it would require a lot of work. By developing new technologies, from extracting to combustion, it may be possible to reduce the environmental effect of coal but it would be highly expensive and completely reform our standing system of coal production. Synthetic natural gas is another option, when these fuels are burned they produce less air pollution then does burning coal directly. Through a process called coal gasification, sulfur and other impurities are removed from the coal producing a synfuel. These fuels, however, have a lower net energy yield and cost more to produce than conventional coal. They require mining and using much more coal to produce the same amount of energy, 50% more coal is required to produce synfuel and almost 505% more carbon dioxide is emitted into the atmosphere because of these extra amounts. Although synfuel does not directly release as many air pollutants, the larger amounts of coal necessary lead to high levels of emissions and land disruption.

We do use another sources of power like nuclear power, biomass, and other energy sources. These technologies may not have the obvious detrimental effects as oil and coal do, but there have been several documented catastrophes that come with the newer technology. Over the years there have been multiple events that have harmed the environment exponentially. Events such as Three Mile Island, Chernobyl, and Fukashima; each of these systems has had a major failure that has resulted in mass amounts of damage to the environment and its inhabitants.

The Fukashima meltdown was triggered by a massive earthquake that struck Japan in March 2011, a magnitude 9.0 that spurred a 30-foot-tall tsunami that struck the coast and killed more than 15000 people. Fukashima Dai-ichi was a nuclear power plant located on the coast, designed to survive an earthquake, but they were not prepared for a monstrous wave to slam into the building severely damaging the reactor. Due to the damage and slightly outdated cooling pumps, uncooled fuel melted its containers. Dangerous gases and radioactive chemicals leaked out of the factory and spread. Radiation damage causes both immediate and long term effects, thankfully no one at the Fukashima accident was exposed enough to feel immediate results of radiation illness, but smaller amounts of radiation can lead to future cancers. In large amounts, radiation illness is severe, essential enzymes are damaged and your chance of dying (in untreated) in 50%. [19] The reactor at Fukashima was not designed to withstand a tsunami, the damage done caused surrounding land to be contaminated and it will take years to recover. Thankfully, radiation exposure was limited due to the reactors stability, but what if it had exploded as the Chernobyl reactor did? Exposure to radiation is highly dangerous, and until nuclear plants can guarantee a system that won't break down, the threat of breakdown or explosion is a scary one.

We need to reconsider the usefulness of these energies; oil and coal are available in abundance and have moderate to high net energy yields, but these fossil fuels have high environmental impact. There are technologies available that don't come with devastating consequences. Renewable energy sources such as wind, solar, and geothermal are not paired with radioactive materials, massive carbon dioxide emissions, or frequent spills that devastate a habitat. So while we can focus on 'clean coal' and stabilizing nuclear technology, we should also push forward in other technologies.

Chapter 2: The History of Wind Power.

The presence of alternative energies seems to be a new one, cropping up after the realization that our planet is heating up due to pollution. However, this is not true. Wind power has a very long history starting with the Persians who captured wind for mechanical energy 1500 years ago. [20] The first windmills were developed in Persia about 500-900 A.D, created to aid in grinding grain and pumping water; the windmills, or *panemone*, consisted of a vertical axis with vertical sails made out of bundles of reeds or wood. The mechanism was rather simple, as the vertical shaft spun; a grinding stone fixed to the bottom would also spin grinding the grain without the hard labor usually required. This vertical axis windmill was also used in China, which some believe is the birthplace of the technology. However the earliest documentation of the windmill in China is 1219 A.D, used by the Chinese statesman Yehlu Chhu-Tshai to grind grain and pump water as well. [21] But there is a big difference between windmills used to grind grains and windmills capable of driving an electric generator. The fist windmill capable of doing so was built in 1886 by an American by the name of Charles F. Brush from Cleveland, Ohio. Just a few years prior,

John D. Rockefeller had begun what was to become the modern oil industry. As Rockefeller's oil powered future grew, Brush worked on a different energy source. Compared to today's windmills, the 1886 windmill was diminutive in size. Its tower was 59 feet high and had a rotor of 56 feet long, made up of 144 fixed vanes and a hub. It connected to a generator that could power 100 incandescent light bulbs, an impressive feat in 1886. It worked marvelously for more than fifteen years, until Cleveland set up it's first centralized electric power system [22]. A centralized system is a system of large power plants, powered mainly by hydropower systems or coal-fired plants, which produce mass amounts of electricity and distribute it to a vast area. However, Brush opened a new door in energy production and others continued his work. Poul La Cour, of Denmark, took Brush's windmill to new heights. By 1906, La Cour's research led installations of forty wind turbines across the Scandinavian country. This spread of turbines influenced Germany, who developed the technology even farther through the 1920s increasing the size of the turbines and developing the technology even farther. These new windmills grew popular, spreading through Europe and the United States into the 1930s. Wind produced energy was especially popular amongst rural farmers who did not have access to centralized electrical power systems, unfortunately this would be its downfall. In 1936, the United States passed the Rural Electrification Act, which subsidized the distribution of electricity to isolated areas that did not have access before. [23] Wind power falls under a distributed system, where energy is produced specifically where it is needed, sometimes for only a single consumer or a small cluster. The Rural Electrification Act did not include distributed systems and the foothold for windmills in the United States slipped. However, Germany and Denmark continued to thrive in wind energy, continuing research and development during

and after World War II. In the late 1950s they designed the first prototypes to the modern wind turbine. Another man from Denmark, Johannes Juul, is credited for pushing wind turbines technology to the next stage. In 1956, Juul created the three-vane system that is familiar to us today. His new system included stall regulation, which allows the power of the installation to be maintained at a constant level as the flow of wind over the vanes change. [24] But once again, problems arose.

Due to low prices, a twenty-year golden age for oil took place between 1950 and 1970. Subsequently, coal became even cheaper and thus more convenient. Paired, oil and coal fueled every aspect of modern life including the production of energy undermining the advances made in wind energy production. There was little room left for research into wind, so it faded into the background until the oil shocks of the 1970s. Denmark and Germany were still at the forefront of wind energy production, but California entered the scene in what is known as the "Wind Rush". California, a leader in environmental awareness, was rich in crude oil that was too expensive for electrical power, but it lacked cheaper alternatives such as coal or natural gas so they turned to wind energy. Technicians, scientists, and entrepreneurs from Denmark gathered in California to develop the wind power sector, funded by charitable state incentives and federal tax credits available. The technology was still new, each turbine only creating a few dozen kilowatts; to combat this issue, large wind farms were installed consisting of large arrays of mills. By 1986, California had installed 1.2 gigawatts of wind power, which was 90% of the world's production. This success did not last long, in 1985 government subsidies for alternative energy sources were terminated and soon after oil prices crashed officially ending the California Wind Rush.

Interest in wind energy surfaced once again in the 1990s when Northern Europe revamped their research regarding turbines. Wind farms were built not only on land but also offshore, where lack of obstacles yielded stronger winds and higher energy outputs. So far, this latest boom has not stopped and interest into this alternative energy source has spread to multiple countries. There have been many attempts to establish wind power in America, but it seems that wind farms can never get the necessary support. One project, the Long Island-New York Offshore Wind Project was a bold initiative to help New York reach its clean and renewable energy goals. Collaboration between Con Edison, Long Island Power Authority, and the New York Power Authority hoped to meet the goal of 45% of New York's electricity be produced through improved energy efficiency and renewable sources by 2015. [25] The project was announced in September 2008 and traction was made over the following years. In 2011, the Bureau of Ocean Energy Management (BOEM) received an unsolicited request for a commercial lease from the New York Power Authority, the appeal included the installation of up to 194 wind turbines, yielding a potential of 700 megawatts of wind energy generation- enough electricity to power an estimated 245,000 homes. [26] In 2013, BOEM issued a request for interest to assess whether there are other parties interested in the same area. In addition to inquiring about competitive interest, BOEM also asked for public comment on the proposal and its potential environmental impact. The Off Shore Project received support from the Alliance for Clean Energy New York Inc., Long Island Association, and Energy Management, Inc. However, there was one major set back to the proposal. The Fish and Wildlife Service provided a detailed account of wildlife in the area of the proposed wind farm. The area was a crucial habitat to seabirds, bats, and aquatic species. They called upon the Endangered Species Act; "the action agency is

required to make a determination of the potential direct, indirect, and cumulative effects of its proposed action on federally-listed species."[27] And the Fish and Wildlife service provided a detailed account for every species that would be deterred by the offshore wind farm. In 2013, another obstacle arose in the form of a proposed LNG station in the middle of the potential offshore wind site [28]. A LNG terminal is a facility at which liquefied natural gas is regasified, or turned back into a gaseous state, after shipment by sea from the area of production. If a LNG terminal were to be built in off the shore of New York, it would require a pipeline stretching all the way back to the coast. Although stopped once before, the Liberty Natural Gas project is now being fast-tracked once again. Some critics believe the LNG project is being pushed so hard at the moment because coastline residents are distracted by the task of rebuilding after Superstorm Sandy. If the LNG project goes through, it will demolish the chances of an offshore wind farm; fossil fuels will be chosen over the clean renewable energy source. Unfortunately, this isn't an unusual occurrence; it has been difficult to plan and construct wind farms here in the United States. There has always been public opposition against such projects due to the negative attributes of wind turbines.

Chapter 3: The Pitfalls of Wind Power Technology.

As history proves, development of turbine technology has been moving slowly over a hundred years due to multiple interruptions. Although strides have been made, we are still far from a perfect system and have issues that need to be dealt with. Those who oppose wind power harp on these shortcomings, highlighting how wind power is an insufficient technology with too many negative aspects to be continued. One such group is NIMBY or Not In My BackYard, a group that is spread wide over many countries. Members of NIMBY

tend to live near beautiful pastures, mountain ridges, and other sights they'd prefer to pass on to their children untarnished. [29] NIMBY has found alliance with coal and other power plant councils who openly oppose wind energy as well. Funny enough, they are unconcerned about losing profit to the new energy productions but instead fear the loss of subsidies from the government. The two groups have created a big opposition to the forward movement of wind power; environmental activists have even been caught in the mix. In the 1980s, the Sierra Club contested the potential wind farm of the Californian Tejon Pass, calling to attention the amount of bird deaths caused by turbines, specifically the California condor. The blades spin at close to 200 mph directly in the flight path of many birds and bats, and weigh several tons. Since then, modifications have made the turbines less of a threat: slower moving blades and sleek towers that don't promote nesting on the windmill itself. Also compared to annual bird deaths caused by high-rise buildings, windows, communication towers, and housecats, the 2.3 birds killed annually by windmills are miniscule. [30] The Sierra Club is no longer protesting wind mills instead they appreciate the progress made protecting bird habitats and that turbine related deaths "pale in comparison to the number of birds and other creatures that will be killed by catastrophic global warming". [31] However, NIMBY and corporate energy giants continue to delay wind power advancement through openly protesting through media outlets. They evoke the many remaining problems of wind energy.

Turbines are noisy, one engineering manual confirms that as the blade moves past the tower the noise can reach one hundred decibels, or about as loud as a car alarm. In a wind farm of a hundred windmills, the sound would be deafening and would travel. There is already a condition recognized as *wind turbine syndrome*, demonstrating how serious the

problem is. There is the possibility of offshore farms, distancing the noise from any population but even this faces dispute. Robert F. Kennedy Jr. declared

I wouldn't build a wind farm in Yosemite Park. Nor would I build one on Nantucket Sound… Hundreds of flashing lights to warn airplanes away from the turbines will steal the stars and nighttime views. The noise of the turbines will be audible onshore. A transformer substation rising 100 feet above the sound would house giant helicopter pads and 40,000 gallons of potential hazardous oil. [32]

The 130-turbine Nantucket Sound project, also known as the Cape Wind Project, slowed in 2009 when it was discovered turbine blades chop and distort radio, television, radar, and aviation signals in the same way a fan will distort a voice. [33] The Federal Aviation Administration (FAA) declared that the offshore wind farm would interfere with navigation signals and it would take $1.5 million to upgrade the radar system at Massachusetts Military Reservation. This new information has spurred a new round of doubts about wind farm placement and the doubts are spreading. These concerns are found all over the world, even in Europe where wind power was developed and supported. In fact, the Netherland planning departments have denied up to 75% of wind project proposals.

Wind farms are built in the windiest areas, naturally, to harness as much energy as possible. Some of the strongest winds blast across forested ridges, such as the Brazilian rainforest. To reach the high peaks of the rainforest, roads must be built for trucks to pass through with all the separate pieces that go into a turbine. Unfortunately, poachers and loggers tend to use these roads as well. It is a documented occurrence that leads to mass deforestation and illegal poaching. As you can see in the image to the right, the areas surrounding the paths are bare, the damage concentrated mostly around the established

road. The construction of wind farms would result in multiple roads, leading to unprecedented amounts of damage across the rainforest and it's species population.

The destruction of trees leads to another issue regarding carbon dioxide levels in the atmosphere. It is a common conception that wind farms and alternative energy sources will contest the rising carbon dioxide levels, possibly even reverse it. This is no the whole truth. Modern day turbines are very big, bigger than the Statue of Liberty, and heavily rely on fossil fuels and natural gas plants. The production of various turbine parts all require large mining, building, transporting, installing, clearing, maintaining, and decommissioning. And every single tower is set in a large block of carbon-intensive cement to keep them from toppling over. [34] Any calculations of turbines effect on CO_2 levels have to take these activities into consideration. The future holds more uncertainties, like how will the next generation of turbines be manufactured if we have cut out fossil fuels? Wind power supporters say that the energy produced in this generation will be sufficient; but after using the stored energy for our appliances, lighting, driving, flying, and generally living, will there be enough left to produce another fleet of turbine giants? We will most likely have to fall back on fossil fuels [35]; which is a likely scenario considering that wind is not the most reliable force.

Wind power companies employ teams of meteorologists to predict wind speeds on an hour-to-hour basis, but wind is an unpredictable force. Even with estimations of wind velocity, wind farm operators are still heavily reliant on fossil fuels as a back up system. When the wind drops, it wreaks havoc on the power grid because of the erratic electricity levels. Grid operators use power plants to fill the supply gap when such an occurrence happens, which is guaranteed to occur every day. Traditional power supplies such as coal,

natural gas, nuclear, and hydroelectric power stations provide a predictable and steady level of power that wind simple cannot match. Wind farm output cannot be depended on to fuel a power grid on its on, it is just not possible. If operators did rely on wind alone, traffic signals, hospitals, and other essential services would be cut whenever the wind stopped. [36] Scientists are working on ways to store wind energy. Electricity produced by turbines can be passed through water and used to produce hydrogen fuel, which could be though of as "stored" wind power. Another options is to pump pressurized air underground into aquifers, cavers, and abandoned natural gas wells. The stored energy in the compressed air could be released as needed to spin turbines and generate electricity when wine is not available. This process is currently being used in Germany and in Alabama. [37] There is progress being made in the field of wind technology, if it can continue without more setbacks wind turbine technology will become viable and useful energy resource.

Conclusion

Our current energy system was created many many years ago; I like to think that since the Industrial Revolution we have moved forward as a society and as a people. Our dependence on crude oil and coal is an outdated practice. There are numerous problems with our current energy systems, problems that need to be acknowledged and avoided. Pollutants mix in the air to form industrial smog, primarily as a result of burning coal, and photochemical smog, caused by emissions from motor vehicles, industrial facilities, and power plants. Acid deposition is caused mainly by coal burning power plants and motor vehicle emission, and in some regions it threatens human health, aquatic life and ecosystems, forests, and human-built structures. There has been a connection between low sulfur coals and increased CO2 emissions that contribute to atmospheric warming and

projected climate change. Low sulfur coal has a lower heat value, which means that more coal must be burned to generate a given amount of electricity. Low sulfur coal also has high levels of toxic mercury and other trace metals, so burning it emits more of these hazardous chemicals into the atmosphere. I think this is a perfect example of how we need to get rid of coal completely; there is just no way to win with coal. High sulfur coal contributes to acid rain and immense environmental damage, while low sulfur coal emits harmful chemicals into the atmosphere. Coal is one of the dirtiest energy sources that we have and I think its time that we step away from it, focus on creating more sustainable and clean energy sources.

Overall, I think these methods of energy are outdated. This is the 21st century, aren't we supposed to have flying cars being powered by hydrogen cells? Some of the technology that's being created today is unbelievable; there is not nano-communication, which I can't explain fully. But I do know that only a select few governments could even afford to use the new technology, why not spend those trillions of dollars and years of research on creating new energy systems? Our current methods were established decades ago, and I think that we could really step up the game. We have machines on Mars currently, we are entering the next generation of Earth technology, get rid of coal and oil, its almost archaic.

There needs to be a change in our lifestyle, that much is certain, if we want to continue to live on this planet. But it is not going to be an easy process; the government will have to play a role in making the transition to a more sustainable society. Through its policies, a government can help to protect environmental and public interests, and to encourage more environmentally sustainable economic development. Unfortunately democracy does not always allow for quick solutions, it takes time for a policy to be passed through congress

and the various venues, where environmental concerns don't hold the highest place for the most part. One of our greatest challenges is to place more emphasis on long-term thinking and policies and to education political leaders and the public about the need to for long-range thinking and actions. Another problem is that many political leaders, with hundreds of issues to deal with, have too little understanding of how the earth's natural systems world and how those systems support all life, economies, and societies. Again, there is an urgent need to educate politicians and voters about these vital matters. One of the main issues with getting environmental policies passed is the separate motives of the various Congressmen. One could be from the Appalachia region, coal country; how could someone expect to be supported by their communities when they instill taxes on their family and neighbors. Another congressman could be from the Northeast, where we fall victim to acid rain, a product of the coal burning factories in West Virginia and the like. How can a bill be passed when there is such a large range of background, values, and hometowns? And of course, all of these men are friendly with at least one big energy company.

The signs of our deteriorating planet are already visible, rising ocean temperatures and sea levels, melting ice caps, polar ice sheets, and glaciers. Permafrost melting in the Arctic causing forests to literally fall over, trees roots are embedding in the hard ground, which is softening. Its difficult to watch this happening when I was raised in the middle of the woods, I was surrounded by nature my entire childhood and it shaped me as a person. The next generations of our planet have to take a different approach, we cannot continue on the way we have. The next generation has to be educated about the world around them, especially how precious it is. Instead of this talk of moving off the planet once it kicks it, we should try to save this planet that has literally supported our entire existence. We need to

revolutionize how we use our resources; currently we are using an outdated system that needs to be reevaluated. Our technology is capable of amazing things; our focus should be put on revamping our lifestyles, trying to protect what little we have left on the planet.

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