The Round-A-Bouts of Wind Energy

By Kathleen Kiely

PORTSMOUTH, R.I. ___ Three hundred and fifty boarding and day students walk from one dark wooden building to another while they laugh and joke with their friends. Boys wearing blazers and ties jokingly punch each other and laugh as they watch a pretty group of girls walk by in bright blouses, skirts, and boots -- the girls are more concerned about their hair blowing in the wind than the boys watching them. Faculty and staff smile and create pleasant small talk with students as they pass each other. Not one person seems to notice the gleaming white wind turbine towering over the Portsmouth Abbey & School campus.

Sun bounces off of the 164 foot tapered tubular steel tower and reflects onto the cars and trucks sitting idle in an adjacent parking lot. The three 77 foot carbon fiber blades gyrate atop the tower as the rotor turns them at a constant 28.5 revolutions per minute. The blades slice past the tower creating a shadow and a loud whooshing noise with each pass.

The Administration Building at Portsmouth Abbey has dark wood paneling lining the walls inside. A fountain bubbles in the lobby as you head into the building. Lining the walls are paintings of the school and framed signatures of students who have graduated in years past. Current students walk in and out collecting their packages and letters from home. Some students head up the dark stairs to meet with the staff whose offices run around the edges of the second floor. Three conference rooms sit idle and dark on the first floor as everyone walks up the stairs. Some students meander up the stairs, lean against the dark wooden railing that edges the halls, and stare down at the first floor with their eyes glazed over, preoccupied by something else, and hardly notice the people downstairs bustling by, saying a quick hello to every person they pass. Outside of the glass windows, no one notices the flicker of a shadow in the trees, the tip of a white blade poking out from behind a building. The turbine is still spinning.

Through the window, a short man in a red jacket, blue jeans, and brown shoes is jogging through the campus. He is heading for the Administration Building, but he occasionally whips his head over his shoulder, looking in the direction of the turbine. The 56-year-old man knows he is late for our meeting and the lines on his forehead show he is generally concerned that I was kept waiting for 24 minutes. One can't help but notice Paul Jestings. There is no blazer or vest, he is casual wearing blue jeans, and his hands are caked in dirt. The only thing that seems to match every other person and building on

campus are his brown shoes. It seems as though every building on campus is dark and brown, except for the wind turbine.

Paul extends a hand and chooses to sit in one of the vacant conference rooms on the first floor. He walks around the brown coffee table, past a hard wooden chair, and sits on a tan couch. Across sits a printed floral armchair; the pillows on the couch match the chair. The Abbey's 86-year history is on display in this outdated room. There are old pictures, paintings, and statues on every desk, shelf, and wall.

Paul understands that the time has come for renewable energy and he has led the Portsmouth Abbey & School to be an example of what others should strive for. Looking at the Abbey and its old buildings, one would never think that sustainability was of much importance to the school. This is a place of history and tradition, not for innovative technology.

Paul, the Director of Operations at the Abbey, searched for a technology that created energy that would work for the entire campus. Solar energy, geothermal energy, and wind power were all explored. The Vestas wind turbine that they chose sits atop a small hill adjacent to the Abbey's hockey rink. There is also a solar house on campus, but the majority of renewable energy produced comes from the wind turbine. The turbine has been spinning since March 31, 2006 at 10 am. Although the turbine has not had any major problems, installing a wind turbine and maintaining it is not an easy task. Paul Jestings knows this first hand.

"Mother Nature is what it is," said Paul. "The turbine story is a complicated one because there are a lot of ways to look at it. There are a lot of pros and cons in the story. Turbines are not for everyone."

The turbine at Portsmouth Abbey & School has been a success since its debut in 2006, yet Paul is a realistic man. He appreciates that his turbine has been running and producing electricity for six years so far, but he understands that some communities are not as lucky with their turbines and as his turbine ages, it's going to cost the Abbey more money. As of 2012, the turbine at the Abbey is past its warranty.

"We have to pay for a service contract and that's really expensive," said Paul. "We're not making anywhere near the money we used to make on the turbine, but it's still the right thing to do. It's still ahead of the game and it's still making some revenue, but we're putting the revenue into replacing it when it wears out, into insurance, maintenance on the thing, so it's not like it's a huge cash cow."

Wind turbines are not a technology you can simply install, plug in, and walk away while it creates electricity. Some media and television shows such as “Turbine Cowboys” on the Weather Channel, would suggest that wind turbines are relatively easy to deal with, but that is not the case. Permits need to be obtained, service contracts need to be reviewed, financial models must be created, and safety factors must be looked at. Installing a wind turbine sounds like an expensive hassle because it is. Why bother with one then?

“I strongly believe we’re gonna run out of fossil fuels in our lifetime or a generation soon after,” said Paul. “It’s about reducing your carbon footprint. People think that just because they are driving electric vehicles they are reducing their carbon footprint, but they are only shifting their energy load. They are moving from fuel to electricity and how is that electricity produced? Coal.”

To be fair to the coal industry, they have cleaned up their act in recent years. Literally. There was coal in Fall River, Mass. at Montaup and with the installation of scrubbers, the coal was much cleaner and the area surrounding Montaup benefited greatly once the scrubbers were installed. Despite these efforts, energy produced by coal still has a large carbon footprint.

As the Director of Operations, Paul oversees every major project at Portsmouth Abbey & School. The Abbey has two electric vehicles and they are not simply “shifting their load.” The turbine produces clean and affordable electricity that can power the electric vehicles, therefore reducing the carbon footprint of the Abbey. They do not have to rely on coal to power the electric vehicles.

As a former member of the Governor’s Task Force for Renewable Energy in the State of Rhode Island and a former member of the East Bay Energy Consortium, Paul Jestings is more than qualified to make decisions about the Abbey’s sustainable future.

“I go, I dig, I like to find out what the real story is.” said Paul.

Paul is sometimes called upon to give advice about turbines to different communities because he has been operating a successful wind turbine since 2006. Many people thinking about installing a turbine do not think the project the entire way through and end up regretting it. Paul likes to share his story and his view on wind turbines with other people so they will make the right decision.

“I went into one town to talk to someone in engineering about a turbine and they said the issue came up with the town’s people about a safety zone around the turbine,” said Paul. “I told them it should be 125 percent of the height. You have the height of the

turbine, plus another 25 percent as a safety factor, so if it ever fell over or blew over, it wouldn't crush anybody's home or whatever. The town I went to was pushing for a 75 percent safety zone. I thought, how did you come up with that? I couldn't figure it out. I guess the town only had 75 feet so they were just working with what they had."

There are other methods of creating clean, affordable energy and if people are stretching the rules or the project has the potential to injure someone, then perhaps wind energy is not the right way to go. While Paul was on the Governor's Task Force for Renewable Energy in the State of Rhode Island he discussed making regulations to stop small towns from making their own rules when it came to wind turbines. He was striving for a set of basic regulations that everyone could follow. Some towns oppose wind turbines and make regulations so difficult that it is nearly impossible to install a turbine. Other towns are so desperate for money that they will have hardly any regulations when it comes to installing a turbine. There needs to be a middle ground.

"Does your town hate wind turbines because you've got a bunch of snooty people that don't want to block their view of the bay? Or the other way around where towns skip regulations and lower the safety zone range. You should not have a 75-foot fall range. I mean that is the most absurd thing," said Paul.

The regulations that Paul would have created with the Governor's Task Force would have created statewide regulations for wind turbines. This way towns would not be ignoring major safety issues or adding impossible regulations to stop the production of wind turbines.

When Portsmouth Abbey & School installed their Vestas turbine they understood that they were purchasing a turbine from one of the best wind turbine companies in the world. The Abbey had to submit and entire plan to Vestas outlining what they were planning.

"We had to give Vestas a plan to show them our property, our interconnection study, how we were going to run our campus, our campus loads, our financial model, our insurance, and all of these things they wanted to see," said Paul. "They could easily say 'I'm going to sell turbines to anyone who's got the million dollar to buy one.' Well you get three people putting them up there with a shoestring and a prayer and throwing them up on a farm saying, 'Throw a little bit of sand in the ground because we don't need cement or a real foundation. We're just gonna put it up there because there's no regulation. We're just gonna put it up because we're gonna make it work and we're gonna make money!' Vestas doesn't allow that. They want to see a good project and they make sure it's a good project."

An important part of making the turbine successful is National Grid and a solid maintenance contract. National Grid is important because the Grid distributes the electricity that the turbine creates. You can buy electricity from anywhere in the world and that company could make the electricity from various different methods. National Grid is the company that transmits the power. Another variable to consider is when the wind is not blowing. National Grid still needs to provide the area with power. So far, renewable energy technologies are not reliable 100 percent of the time because you never know when the wind will stop blowing for a day or two. Also, using solar panels in New England does not always work because it is dark and cloudy for most of the winter. When someone is planning on installing a renewable energy technology, they need to think the entire project through.

“There are a lot of days where there’s no wind happening so you have to manage that load,” said Paul. “In which case it is a really big challenge for the power company because now on a windy day all of a sudden they have no load and on a calm day you have a ton of load. A lot of people are very negative with the power companies, and it’s not like they’re my heroes, but to be honest, you have to appreciate the situation they’re in.”

The Abbey uses National Grid to distribute the electricity made by their turbine, but they also use the Grid on calm days where there is no wind. The ultimate goal for the Abbey is to reduce their carbon footprint and that requires relying less on National Grid. The wind turbine helps them achieve this goal.

“Basically what happens, the power comes in, goes to the turbine, and then it goes to the rest of the campus,” said Paul. “So most of what we make stays right here. It doesn’t go out to the Grid much. We do put excess back into the Grid, but most of everything we make, we eat up. So what we’re trying to do is lower our carbon footprint and lower our dependence on the grid.”

Maintenance contracts or service contracts are also valuable and required when installing a turbine. The International Brotherhood of Electrical Workers Local 103 knows a thing or two about wind turbines. The IBEW Local 103 has a small turbine on their training site and they make sure that each and every electrician that is trained there understands wind turbines.

“It [wind turbine] has to be properly maintained,” said Callaghan. “It’s a mechanical device and it has moving parts. I think a lot of people get confused by that. It’s not like something you can put up and forget about. The wind turbine is constantly spinning so it needs to be oiled, kind of like the oil on your car. You can drive your car for 100,000 miles and not change the oil on it, but it’s going to break down. You should get the oil

changed every 5,000 miles. It's the same thing with the wind turbine. It needs to be maintained and I think that people are not told that when they're buying them. There is an annual maintenance cost to them that you should keep in mind when you're purchasing one."

The Facts

According to the U.S. Department of Energy, as of June 2012 there was 49,802 megawatts of wind power produced by the United States. Most of the wind power comes from Texas and other midwestern states, while Alabama, Arkansas, Florida, Georgia, Kentucky, Louisiana, Mississippi, Nevada, North Carolina, South Carolina, and Virginia were producing none. Each year the United States produces more and more energy from wind power.

Here in Rhode Island, the state has 14 wind turbines. Rhode Island is currently planning an offshore wind project that will place them as the first state in the nation to have an offshore wind farm.

According to Dr. Loren Byrne, Assistant Professor of Biology and Environmental Science, at Roger Williams University, sustainability is "The pursuit towards making long lasting, healthy societies that are supported by resource rich environments that provide valuable ecosystem services."

Prof. Byrne went on to say that the general consensus is that we want to increase human well-being around the planet.

"If we agree we want there to be that sort of future, and don't want the human species to go extinct, or have widespread famine, or war, or whatever other problems are emerging -- energy use being a big one -- then we need to start changing the way we do business."

"Cape Spin! An American Power Struggle" is a film about the Cape Wind Project discusses both sides of the Cape Wind story. At the end of the film they offer a potential solution called the "third way."

"The third way is a small scale community of renewables," said Producer Libby Handros.

Prof. Loren Byrne thinks that perhaps small-scale renewables is a solution worth investigating:

"Building small-scale turbines, or other wind generated electricity -- it doesn't have to be turbines, there are other designs like vertical access turbines -- put those in people's backyards, or one per community, or whatever scale it needs to be at. It is a brilliant

solution to get people off the grid and generating electricity on their own properties. Coupled with local solar power, maybe some people could do geothermal, and we would be on the right path."

According to the DOE, wind energy is the fastest growing source of electricity generation in the world. In 2009, the United States' primary energy consumption was 95 quadrillion British thermal units. The entire world's primary energy consumption was 483 quadrillion Btu. By using fossil fuels carbon dioxide and other emissions are released into the air. These "greenhouse gasses" are important to the environment because they are what keep the planet warm. Over-consumption of these fossil fuels creates a problem where the Earth begins to heat up. Wind energy is a power source that creates zero emissions and is infinitely renewable.

Although wind energy sounds like the perfect solution for the world's energy consumption, wind energy is not a perfect source. Not every day is a windy day, energy that wind turbines produce is difficult to store, and people who live close to these turbines are not always happy with the noise. Wind turbines are not for everyone.

Carbon Footprint

Carbon footprint is a phrase that many people misuse. The word carbon is used to represent the greenhouse gasses emitted into the atmosphere, such as carbon dioxide, methane, and nitrous oxide. The word footprint is used to represent the impact that something has on the environment.

"Carbon footprint is a number," says Prof. Charles Thomas, Associate Professor of Engineering at Roger Williams University. "Usually carbon footprint is the total amount of equivalent carbon dioxide that is released by a person, organization, or a process."

Because everything emits energy, carbon footprint is usually expressed in carbon dioxide equivalent. According to "How Bad Are Bananas? The Carbon Footprint of Everything," this means that the "total climate change impact of all the greenhouse gases cause by an item or activity are rolled into one and are expressed in terms of the amount of carbon dioxide that would have the same impact."

During combustion, carbon dioxide, methane, and nitrous oxide gases are all released into the atmosphere. Methane and nitrous oxide are more potent than carbon dioxide, leaving a greater effect on the atmosphere. Methane is mostly released by agriculture and landfill sites. Methane is 25 times more potent than carbon dioxide. Nitrous oxide is emitted in smaller quantities, but it is 300 times more potent than carbon dioxide. Industrial processes and farming mainly release nitrous oxide. Refrigerant gases can

also be emitted which can be several thousand times more potent than carbon dioxide. When someone is going to calculate a carbon footprint they are looking at carbon dioxide, methane, nitrous oxide and perhaps other gasses depending on what process they look at.

According to "How Bad Are Bananas? The Carbon Footprint of Everything," the total impact on climate in the United States is carbon dioxide (85 percent), methane (8 percent), nitrous oxide (5 percent), refrigerant gases (2 percent).

"Everything we do requires energy," says Prof. Thomas. Carbon footprint usually looks at the big picture, but there are also ways to calculate a carbon footprint for specific tasks, like electricity use. There are emission rates related to the total amount of energy used by something. Emission rates tell you how many pounds of carbon dioxide, methane, and nitrous oxide were emitted during a specific activity.

It is important to look at the big picture when calculating a carbon footprint. Not only is it important to look at your home energy as well as your personal energy use, but people need to consider the goods and services they purchase and what went into making that good or service happen. It is possible to calculate certain parts of a carbon footprint, but to get the whole footprint, you need to look at everything you consume.

There are direct and indirect emissions that people deal with every day. For example look at a cup of coffee made from a Keurig machine. The machine used electricity to produce the coffee, but the bigger picture needs to be looked at. How was the Keurig made? What energy went into making the machine? How was the K-Cup made? The filter in the cup, the glue to hold it all together? How was the coffee mug made? What energy went into crafting the mug? Is there milk, cream, or sugar that goes into the coffee? How did those products get to your home?

There is more to carbon footprint than just the electricity used at a specific moment in time.

"The way that we calculate a footprint based on electricity use is to know how much energy you used, multiply it by the emission rate, and you get the number of pounds of carbon dioxide, methane, or nitrous oxide that you're looking for," said Prof. Thomas.

If you reduce any activity that was created by releasing carbon dioxide, methane, and nitrous oxide, then you are reducing your carbon footprint because there are less gases being released into the atmosphere.

If someone were to look at the emission rates for the western part of the country, such as Washington and Oregon, they would notice that they are significantly lower than the

emission rates for the eastern part of the country. This is because those states have a high activity of hydroelectric power. In the east, most of the energy is produced by coal, which has a larger carbon footprint.

“Any time you can not use electricity that is produced by coal, in theory, it will reduce your carbon footprint because it’s a process that releases a lot of gasses into the environment,” said Prof. Thomas.

The problem with relying on wind turbines to produce energy is that it is not always windy. There is not a completely efficient way to store excess energy when turbines create “wrong-time” electricity.

The Institution of Mechanical Engineers has been looking into a new way to store “wrong-time” electricity by means of liquid air. Batteries are produced and have acid and lead in them, making them a dangerous item for the environment. Liquid air provides a safer, more efficient method of storing energy.

Wind farms would produce energy as they have been and when that “wrong-time” energy is produced it would be used to chill air to a cryogenic state at another location. When the demand for wind energy increases, the liquid air would be warmed up and would power the turbines. This process can achieve an efficiency of up to 70 percent according to BBC article, “Liquid air ‘offers energy storage hope.’”

Another process is happening in Norway where excess energy created on windy days is used to pump water from a low point to a high point. On days where there is not much wind, that water would be released from the high point and as it travels to the low point, the energy would be used to power the wind turbine. Engineers and scientists are trying to use all of the energy that is created during this process. By making sure little energy goes to waste, the process is more efficient.

“It all comes down to energy storage and finding a way to store the energy so you can use it when you need it,” said Prof. Thomas. “Everything gives off energy and it’s about picking your battles.”

Kyoto Protocol

The United Nations Framework Convention on Climate Change created the Kyoto Protocol in 1997 and it became active in 2005. The Kyoto Protocol sets a limit on 37 industrialized countries to reduce their emissions of greenhouse gases, such as carbon dioxide, methane, nitrous oxide, and refrigerate gases. While the Convention encouraged the industrialized countries to reduce emissions of greenhouse gases, the Protocol commits the countries to reducing their greenhouse gas emissions.

The Protocol places a heavy emphasis on developed nations and fails to include developing nations. The world's leader in producing greenhouse gases are China, the United States, and Russia. In 2012, Japan rejected the treaty in an attempt to pressure China and the United States to come up with a new climate treaty that would include developed countries as well as developing countries.

Also in December of 2012, New Zealand's climate minister, Tim Groser, defended the country's decision to drop out of the emissions pact because it is an, "outdated and insufficient response to global warming."

According to The Associated Press, Australia and other European countries are willing to extend the pact until a new treaty is created, but Groser does not see the point because those countries make up less than 15 percent of global emissions.

Developing countries are not included in the pact and 85 percent of emissions released into the atmosphere are not included in the Kyoto Protocol. China is now the world's top emitter of greenhouse gasses, but the United States and European nations were releasing into the atmosphere well before China.
According to "BusinessWeek," Japan, Russia, Canada, and New Zealand are not planning to adopt the new goals of the Protocol after the first period expires at the end of 2012. The United States never ratified the treaty because it does not set goals for developing nations.

How Wind Works

The Earth is comprised of many different types of land masses and water. During the day, the sun emits energy, which the earth then absorbs. The air over land heats up much faster than the air over water. The air over land quickly expands and rises, and the cooler air, which is much heavier, takes its place -- this creates wind. At night the cycle is reversed because the air cools at a greater rate over land than over water.

Windmill History

Before the days of engines and electricity, wind was treated as a valuable energy source. Wind filled the sails of the ships that brought goods and services to different lands to be traded. Wind filled the sails to power Christopher Columbus across the Atlantic Ocean to discover a new continent. Wind filled the sails that allowed cultures to travel somewhere new and explore new lands and the people that inhabited those lands.

Windmills were developed in Persia during the 7th century. The windmills were not stable and were easily damaged during periods of high wind speeds. The Persian windmills were horizontal windmills, they had a horizontal axis and the blades rotated on a vertical plane. During the Middle Ages, people started utilizing wind power and began using windmills for mechanical tasks such as, water pumping, grinding grain, sawing wood, and powering tools. The Dutch are still famous for their windmills and the windmill is still considered a national icon. At a point in Dutch history, 800 to 1,000 windmills were serving the power needs of the people in Amsterdam. Windmills during the time had four blades and were built on posts so the entire windmill could be turned when the direction of the wind changed.

Similar to wind turbines in the 21st century, windmills also came with controversy when they started spreading in Europe. For the first time the working class citizens in Europe were realizing that they could produce work without manpower. This idea frightened many in the upper class society because the working class would no longer be at their mercy for jobs and money. The working class could produce goods and services much easier and the upper class would have a more difficult time controlling them. The upper class was not in support of the change, but regardless windmills spread from country to country until there were thousands across Europe.

Once the Industrial Revolution began, the need for wind power decreased. Fossil fuels were cheap to extract, easy to transport, and easy to use. Wind power was temperamental and could not always be a reliable source for powering tools, let alone a home. Wind was no longer used to power sails on a boat; engines took over offering people a quicker method to travel and trade. This is still true today.

There is a difference between windmills and wind turbines. A windmill is used as a “mill.” There are more blades on a windmill because they are needed to produce more torque to grind grain or pump water. Wind turbines are much larger and have fewer blades so they can reach the wind that is unobstructed in the sky. They also spin much faster to produce electricity.

During the 1960s the book “Silent Spring” made people aware of the consequences of environmental development. Fossil fuels were to blame and the book warned of disaster if the earth was stripped of its natural resources. Nuclear energy was also considered a danger and thus the beginnings of an environmental movement began.

The United States of America is notorious for being concerned about environmental issues, but never actually taking any actions to create sustainable energy. Under the Carter Administration, the U.S. finally began to develop “alternative energy resources.” California began to lead the country with wind power due to investment tax credits to

those who installed turbines. The “California wind rush” brought thousands of wind turbines to the state, particularly in the Altamont Pass, San Gorgonio Pass, and Tehachipi. With the rise of the Reagan administration came the collapse of the wind rush as the Reagan administration withdrew federal tax credits in the early 1980s.

Since the 1980s wind power technology has evolved into a technology that is much more reliable. Wind power is considered cost efficient by most, but some critics argue that without government incentives, wind power would not generate enough power to make a significant financial gain. Wind turbines are also considered much quieter than they were during the wind rush and studies are now completed before erecting a wind turbine to ensure that the area around the turbine will not be affected.

As of 2012, a 50 kilowatt wind turbine has a tower that stands about 25 meters high and a rotor diameter of about 15 meters. A 1,000 kilowatt wind turbine has a tower of about 70 meters high and a rotor diameter of about 60 meters. A 5,000 kilowatt turbine has a tower of about 100 meters and a rotor diameter of about 112 meters. To put the size of the turbines into perspective, the Washington Monument stands at 170 meters.

Aquidneck Island Windmill History

Among the three islands located in Narragansett Bay is Aquidneck Island -- this is the largest of the group and it was actually originally known as Rhode Island. Today, the modern island is divided into three towns including Portsmouth, Middletown and Newport. When settlers first came to Aquidneck Island, the only means of power were manual labor, animals, tide mills, watermills, and windmills. The island was known for its use of windmills. As of 2012, there are still two of the old windmills standing.

Boyd’s Mill was built in 1810 by John Peterson. Peterson was a retired sea captain. The mill is 38 feet high and there are eight blades that are 31.5 feet long from the center. Each blade has a sail attached to it that is 28 feet long and seven feet and four inches wide. The windmill spins at the top to keep the blades facing the wind at all times. When the windmill runs at 20 revolutions per minute, it is estimated to develop 30 horsepower in a 30 mile per hour wind -- that translates to about 22 kilowatts.

The Portsmouth wind turbine that was erected in 2009 generates about 3.2 million kilowatts a year as of 2011.

The Town of Portsmouth installed a 336-foot-tall, 1.5 megawatt wind turbine in March of 2009. All of the power the turbine generates is sent to National Grid, and they pay the Town of Portsmouth for that energy per kilowatt. According to Gary Crosby, the Town Planner for the Town of Portsmouth, they were going to install the wind turbine similar

to the Portsmouth Abbey turbine and have the power generated by the turbine go directly back to the town. At the end of the planning process, the town decided to sell all of the power generated by the turbine back to National Grid.

"The state [Rhode Island] wants to be at 16 percent renewable energy by 2020 and this is contributing to it," said Crosby. "I think it's the future for all of us."

FAA

There are many permitting processes that need to happen before a wind turbine is erected. The Federal Aviation Administration controls all structures greater than 200 feet high. The FAA works with individuals to complete a study that tests potential turbine sites. The FAA has a job to "ensure the safety of aircrafts and efficient use of the airspace."

Nancy Kalinowski said in an address before the House Armed Services Committee:

> "The number of wind turbine cases handled by the FAA has increased from 3,030 in 2004 to 25,618 last year. To date in 2010, we have 18,685 wind turbine cases. One concern that the wind turbines raise is that the blade tips rotate above the radar, thus affecting the capability of the target to be received on the radar equipment. Additionally, they reflect radio waves, and exceed the line of sight protection criteria. To give you an idea of the impact of wind turbines on long range radar, there is a radar cross section spectrum that identifies how clearly a range of objects are picked up on the radar. Insects and birds are at the low end. Conventional cruise missiles are in the mid range. Most aircraft are a little higher in the spectrum, with large aircraft (e.g., a Boeing 747) and the space shuttle at the highest end of the spectrum. Wind turbine blades spinning, in some instances, at more than 200 miles per hour are picked up by radars with a signal strength greater than a Boeing 747. Because the radar repeatedly sees this large return, the radar will not pick up actual aircraft in the same area."

Because of wind turbines spinning at such a fast rate, it is important that the FAA accurately completes their wind turbine studies so radar equipment can accurately detect everything in the area.

The Portsmouth Wind Turbine

The Town of Portsmouth wind turbine is located behind the tennis courts of Portsmouth High School on top of Butts Hill. The turbine is relatively close to the high school and to residential homes. The turbine was installed for "economic benefit," according to Rich Talipsky, Chairman of the Portsmouth Economic Development Committee.

“We weren’t going to do this as a science project,” said Talipsky. “If we weren’t going to make money on it, it was going to be a no-starter.”

Dan Force, a Portsmouth resident, lives next to the wind turbine. Force voted in support of the wind turbine, but he did not expect the turbine to be spinning in his front yard.

“I voted thinking it [wind turbine] was going in the site near the middle school, the primary location,” said Force. “At the last minute it was determined that they couldn’t put the turbine there because the FAA said that the wind turbine, that size, was too close to the Newport County Airport. That was when they decided to go with the secondary location by the high school.”

Donna Olszewski, a Portsmouth resident, has been living in her home by Portsmouth High School for 16 years. Donna was in full support of the wind turbine when the idea was being shared, but when the turbine finally made its way up her street she knew she was in trouble.

“We knew we would hear the sound,” said Donna. “In summer you can’t keep your windows open because you really hear it [wind turbine]. We have to use a fan or an air conditioner to drown out the sound. For some reason the noise of the air conditioner and the fan is more constant, like a white noise, where the turbine gets louder and softer as the blades pass.”

Not only is the noise an issue, but shadow flicker is a concern for many people who live close to wind turbines. Shadow flicker occurs when the sun is behind the turbine and the blades pass in front of the sun. The passing of the blades cause a strobe light effect on the surrounding area. According to Dan Force, he gets about 90 hours of shadow flicker in a calendar year. Living with shadow flicker is similar to driving down a road surrounded by trees. As the sun shines through the trees and you drive down the road, a flicker effect happens. Unlike Dan Force, who has gotten used to the sensation of shadow flicker, Donna Olszewski finds it difficult to live her life with the flicker.

“There is no question that the flicker effect is quite dramatic,” said Gary Crosby. “Certain periods of the day, certain months of the year it has a very dramatic effect. Are people getting used to it? Probably not. I think that people around the area, for the most part, have learned to live with it.”

Donna Olszewski is not against wind power and wind energy, she just does not support turbines being built close to residential homes. She does not have any control over any sound or light in her own home. The ability for Donna to shut off the light or to close a

window to drown out a noise is gone because of a wind turbine that sits a mere 740 feet from her house. The turbine controls the home she has lived in for 16 years.

The Portsmouth wind turbine generated about $400,000 over three years. In February of 2012 the turbine began to have some technical issues and started to shut down. In June of 2012 the turbine stopped spinning and has not been operational since. It is now estimated that the Town of Portsmouth will have to pay $460,000 to fix the turbine's gearbox.

"They went with the lowest bidder," said Paul Jestings. "Sometimes the lowest price is not always the best way to go. Critics of wind turbines are going to focus on the broken turbine now. I keep telling them that they have to make a decision because every day the turbine sits there it is losing money!"

National Grid

National Grid serves all of Rhode Island for their electrical needs except for one municipal company. National Grid is able to help people with projects relating to energy efficiency. Solar rays, wind turbines, and any other method of sustainable energy can be used for residential or commercial purposes. National Grid works with their customers to make sure that the process of installing these renewable energy sources goes smoothly and they are installed in a safe manner. Along with the energy sources being installed safely, National Grid also has to ensure that the energy source will not affect the larger energy distribution system.

Tim Roughan, the National Grid Director of Energy and Environmental Policy, is also aware of the noise wind turbines can make.

"When the blade comes by the tower itself, there's actually this subsonic noise that occurs," said Roughan. "It's like a shadow, but you can't actually hear it -- it's like your subwoofer -- those really low frequencies that you can't hear, but you can feel. That's standard issue for customers and other people who live nearby."

National Grid studies the utility and the proposed generation of wind turbines before they are installed. They look at how the turbine will react in certain conditions such as hurricanes, blizzards, and wind storms. National Grid is there to make sure that the turbine will not cause any problems for the people that surround the wind turbine.

"What happens when a line that is connected to a wind generator goes down?" said Roughan. "Say a car hits a pole, a squirrel gets fried, or something like that. When that happens we've got to make sure that the wind turbine disconnects and stops generating electricity."

If the turbine were to continue spinning and generating electricity, it would feed the power out to the line that was down. The wire may look like a dead wire, but in reality the turbine is keeping that wire live.

When wind turbines produce more energy than they need, the excess power is put on to the larger electric distribution system. Whoever owns that turbine is then paid by National Grid for that excess power at the same rate that customers would pay on their electric bills.

Government, Farmers, and Wind Turbines

According to the DOE and Lawrence Berkeley National Laboratory as of 2011, wind energy provides three percent of the energy in the United States. Turbines represent one-third of new, sustainable energy built in the United States. Wind energy comes in second to natural gas because the energy source is currently cheaper to extract due to a high amount of natural gas found in shale rock. Although natural gas is cheaper to extract, turbine prices have been reduced 20 to 30 percent since 2008, according to the DOE.

According to Vestas, the turbine company that is the world leader in wind energy, the United States is making strides when it comes to producing turbines and wind energy, but it is still behind the rest of the world. As of 2011, Denmark had 29 percent of its energy coming from wind power -- the United States barely had three percent. According to the DOE, the United States has the capacity to have 20 percent of its electricity come from wind power by 2030.

Although Vestas falls short to General Electric in providing the United States with wind turbines, Vestas is the only company in the world whose sole purpose is manufacturing wind turbines and wind power. Vestas has more than 12,000 turbines installed in the U.S.

“The United States has so much potential for wind energy,” said Andrew Longeteig, Communications Specialist at Vestas. “In Europe people are in such tight knit spaces and there is not that much space. The U.S. has the capacity to build large-scale wind projects. Wind is clean and free. There is no pollution, no carbon dioxide.”

Wind turbines have also helped farmers in the Midwest. Farmers can lease their land to someone who wishes to install a turbine, or they can install their own turbine to create power on their farm. Turbines are benefiting farmers because when the harvest is poor, the farmer does not necessarily lose as much.

“Turbines are very good for rural farmers,” said Longeteig. “With the drought this year many of them were able to keep their land because of the money coming in with the wind turbine.”

There are many government programs that help these rural farmers install wind turbines. The Rural Energy for America Program assists agricultural producers and small rural businesses. According to the United States Department of Agriculture, both agricultural producers and small rural businesses are guaranteed both loans and grants that help eligible participants install renewable energy systems. Along with installing these renewable energy systems, the loans and grants go into the maintenance of the systems.

The program is comprised of the Renewable Energy System and Energy Efficiency Improvement Guaranteed Loan and Grant Program, The Energy Audit and Renewable Energy Development Assistance Grant Program, and The Feasibility Studies Grant Program. Each of these programs assists participants with construction, audits, and feasibility studies.

The programs to assist agricultural producers and small rural businesses are not the only government incentive to building a turbine. Every state has their own programs to encourage or discourage people from installing wind turbines. Some states attempt to squeeze past regulations so they can make money, while other states put up so many regulations that it’s impossible to install a turbine.

Wind energy and other methods of sustainable energy play an important role in this declining economy. Many of the incentives for wind power, such as investment tax credits, production tax credits, and the $1,603 cash grant will expire at the end of the year.

President Obama spoke during the Presidential Town Hall Debate in 2012 and announced that he supported wind power as well as other sustainable energy sources. President Obama said that he is making sure traditional methods of energy are being implemented as well as doubling the production of clean energy. He has also come out and said that he will renew some of the incentives for wind energy.

Congressman David Cicilline of Rhode Island spoke at Roger Williams University during October of 2012 and spoke about how it is important to invest now in sustainable energy.

“For many businesses, for many families, the problem of energy is real,” said Cicilline. “It is both a challenge and a huge opportunity for us. As the President has said, we have all options on the table. We should end the subsidies we give to Big Oil, reinvest that

money as part of our national energy responsibilities, and understand that we have to be serious about looking at solar, wind, and geothermal sources of energy."

The investment the government makes in wind energy has an effect on everyone in the country because it not only affects energy prices, but it affects the unemployment rate. Wind turbines need to be installed, maintained, and monitored.

IBEW

Sean Callaghan, a Business Agent at the International Brotherhood Of Electrical Workers Local 103 in Boston, understands the importance of wind turbines and other means of renewable energy. The IBEW Local 103 has a small 100 kilowatt wind turbine on their facility in Dorchester, Mass. Along with the turbine Local 103 has solar panels across the street and an electric car charger on site.

The turbine produces energy for the training building and for the administration building across the parking lot. The turbine was installed in 2005 and it is small compared to the giant turbines seen on television and in pictures. Because the turbine is older, it is more mechanical inside. There are levers and other mechanical devices compared to the newer turbines, which are more hydraulic, and pressure based.

The turbine sits on the edge of Interstate 93 just south of Boston. Almost every day the road is jammed with rush hour traffic during commuting hours. As people sit in their cars waiting impatiently to get to work they can almost always look to the side of the road and see the IBEW turbine spinning furiously.

The turbine spins much faster and than newer wind turbines because of the way it was made. The blades are much heavier on the ends, which means it takes a more force to stop the turbine from spinning. The foundation goes 80 feet into the ground, going into the bedrock. The Local 103 turbine has to be smaller because of its location in the city, but it does everything the IBEW needs it to do.

"The turbine is beside our training center, right next to the highway," said Callaghan. "It's almost like a marketing tool for us. It shows that we can install these [wind turbines]. We can do it for you."

IBEW Local 103 is promoting the fact that they can do the electrical work for wind turbines. Along with the turbine on site, which they shut off once a month to maintain, they also have installed the turbines in other Massachusetts towns. The town of Scituate, Mass. called Local 103 directly and asked if the electricians could help them with their wind turbine.

“We have an apprenticeship program here. It’s five years and every kid gets the same training. Everyone is trained to understand the turbine.”

The more wind turbine production is supported by the government and by the common person, then the more jobs the workers from Local 103 have. Supporting wind energy and the production of wind turbines creates new occupations and therefore an opportunity to lower the unemployment rate.

Turbine Cowboys

There is a popular show on the Weather Channel called “Turbine Cowboys.” The show depicts the workers who make sure wind turbines are working properly. These maintenance workers travel the country and climb turbines much higher than the 164 foot turbine at Portsmouth Abbey. Some of the turbines in the Midwest are over 300 feet high and someone has to make sure they are running properly.

These workers climb the dangerously high turbines every day to inspect and fix the turbines. The job is prone to three major types of fatal injuries: falling hazards, electrical hazards, and rotator hazards. Some of the workers may not return home to their families at the end of the day.

Even though these injuries can and do happen, there are workers lined up across the country to take safety classes and learn how to maintain a wind turbine. The show follows these “turbine cowboys” as they climb up the tall towers and hang off the side of the tower inspecting blades and other parts of the turbine.

The Climb

Wind turbines are not machines that are simply plugged in and -- *voilà!* -- power is created. Instead, turbines need maintenance and that often requires someone to climb towers and fix things that may be out of place in the nacelle, the box-like object that sits on top of the tower and holds almost 8,000 different components that make up the turbine.

The wind turbine at Portsmouth Abbey has a 164-foot tapered tubular steel tower. Inside of that tower sits a large gray box that has the manufacturer’s name, Vestas, on it. If there was ever an emergency, the box has a red button on the outside that will shut down the turbine. That box is the control system and it displays an overview on what is happening with the wind turbine. The control system displays the power the turbine is generating, how fast the turbine is spinning, the speed and direction of the wind, and

the pitch of the blades. All of these data are needed to ensure that the power being generated is produced safely and efficiently.

The control system sits at the base of the wind turbine, but a steel ladder runs straight up through the center of the turbine tower, allowing maintenance workers to reach the nacelle and the rotor.

Paul Jestings, the Director of Operations at Portsmouth Abbey, turned on his shiny white Ford F-150, drove past the hockey rink, turned up a small dirt road, and parked directly in front of the door for the wind turbine.

“Open the glove compartment and grab me my keys,” said Paul.

I grabbed a set of keys that easily weighed five or six pounds; wrong set. I reached into the crowded glove compartment again and grabbed another ring full of 20 or so keys; wrong set. I pulled out a key with a red tag; wrong set.

With a puzzled look on his face, Paul opened the middle console in his truck grabbed a pack of white Tic Tacs and found the set of keys he was looking for. He jumped out of the truck and walked over to the door of the turbine.

The shiny white turbine had a oval door that strongly resembled a hatch on a ship. Paul unlocked the large silver padlock and stepped into the turbine. Paul immediately handed me a blue harness and I could barely hear the words come out of my mouth as I thanked him. The soft whooshing of the blades on the outside turned into a violent whir once inside of the turbine.

I attached the blue straps around my legs and then the strap across my chest. Paul handed me a neon yellow cord with two large silver carabiners on each end. I attached one end of the carabiner to my harness and let the other end drag on the dirty cement floor. I tightened my harness and as I looked up, Paul was handing me a pair of black ironCLAD, Cold Condition gloves that had the words “Bro Joe” scribbled on them.

“These are Brother Joseph’s,” said Paul. “Your hands get rough once you get to the top.”

I had no idea who Brother Joseph was, but I was thankful for the gloves.

The wind turbine may have been shiny and white on the outside but the inside was a dull cream color. It was dark, dirty, and cold. Two lights hung off of the steel ladder that ran through the center of the turbine. The ladder was attached to the side of the tower with large metal brackets. Four black cords ran parallel to the ladder and as I looked up to the platform that marked the halfway point, I lost sight of the cords as they continued

upwards. The small metal platform at the halfway point did not look far away and I was ready for a quick climb to the top.

I took the other carabiner off of the floor and attached it to the safety line on the ladder. Firmly gripping the ladder with both hands, I gingerly placed my foot on the first rung and began to climb. Paul attached his carabiner to the safety line and we slowly started to move.

The metal rungs were cold against my fingers as I climbed. As I looked down the cement floor was getting smaller. My heart rate began to accelerate as I moved to the landing. Paul continued behind me, calm, collected, and patiently waiting for me.

“Just push the door open with your head,” said Paul.

We had reached the halfway point and all that was standing between me and a break was an extremely heavy steel door. I slowly stepped up onto the next rung and felt pressure on my head as the door lifted slightly. With my right hand I used all of my strength to swing the door to the side and out of my way. Four more steps and I was standing on a metal platform about the size of a large elevator.

Paul continued up the ladder and joined me on the platform. He reached over to the metal door and closed it with his foot. There were even more wires parallel to the ladder now; about four or five black wires and one yellow and green wire that ran to the top.

After about five minutes, Paul took my carabiner and clipped it back on to the safety line. I began to climb again. He clipped his carabiner and began to follow my slow pace.

The closer I moved to the top of the turbine the more the structure moved. The tower was slowly tapering in and with every gust of wind the turbine jerked all around. I tightened my grip on the ladder and looked down at Paul. The movement of the tower did not seem to faze him; he was still climbing at a steady pace.

As I reached the top, there was another metal door that I had to use my entire strength to open. I pushed open the door and I was standing on another metal platform identical to the platform at the halfway point. Running straight through the center of the platform were all of the cords and there was a metal railing with four rungs surround the cords. As Paul climbed through the small door, I noticed another metal ladder hanging from the ceiling. Paul reached up and pulled the ladder down, but it was still extremely far from the platform. Paul grabbed on to one of the thick black cords and pulled himself onto the railing. He climbed the four rungs and then reached for the ladder. Easily, pulling himself on to the other ladder, Paul continued climbing the last five steps until he was inside of the nacelle.

I imitated his movements and 162 steps later, I was at the top of a wind turbine. As I stepped into the nacelle I saw the large blue and silver pieces of mechanical equipment.

At the back of the nacelle there was a fan to vent the area. In front of the fan there was a drive shaft, which connected to a gear box, and then that connected to the rotor, which made the blades spin. There were electrical boxes covering the nacelle from floor to ceiling.

I pulled my gloves off and looked down at my hands. The thick black gloves did not stop the chafing from the ladder. My palms were raw and stung when I touched anything.

Paul walked to the back of the nacelle and opened a small hatch that allowed you to see outside. I felt like I was inside of a speedboat in the middle of the sky, ducking my head and climbing over various mechanical boxes as I was jolted around by the wind.

As I reached the hatch I could see for miles. It was a crisp, clear day in Rhode Island and the water was sparkling as the sun reflected off of Narragansett Bay and the Providence River.

Paul moved past me and walked to a small hatch in the ceiling. He twisted the metal handle and pushed open the door. I followed him and climbed out to the top of the turbine.

“The wind’s probably blowing about 20 knots today,” said Paul. “It’s really gusting.”

Within minutes my hair was everywhere, my fingers were numb, my face was numb, and I was nearly knocked over every time there was a large gust of wind.

The giant 77-foot carbon fiber blade looked like an airplane wing as it rested idle to my left. Directly behind the blade, I could see the Mount Hope Bridge and Roger Williams University.

At the other end of the turbine there were three different devices that measured the wind and an FAA light on each end. As Paul stood next to me he noticed that the light on the left corner was shaking in the wind.

“Good thing we came up here!” said Paul “That’s a $4,000 FAA light and it was about to go any minute.”

Paul went back down the hatch and searched for a bit of rope, but quickly discovered he was out of luck. Grabbing his radio, he signaled for someone to come help him.

“Hey can you come over to the turbine?” asked Paul. Paul looked at me and said, “I’m just talking to one of my guys.”

The radio finally answered him, “Why, you gonna jump?”

Paul chuckled to himself. “Nah, it’s too close to Friday.”

A few moments later the pulley on the outside of the turbine was moving and a red rope was being lifted to the top of the wind turbine. Paul grabbed the rope, clipped his carabiner on to the top of the wind turbine, and handed me his radio.

“You can be my assistant,” said Paul. “I need you to feed me the rope.”

Paul slowly got down on his stomach and did an army crawl out to the edge of the turbine where the broken light was located. The red rope dragged along behind him as he reached his destination. Paul pulled out his iPhone and stretched it over the light to take a picture. He took a look at it and placed it back in his pocket.

“The FAA bracket broke,” said Paul. “It must have been from Hurricane Sandy. Those were custom brackets too.”

Paul pulled out a piece of rope with two carabiners out of his pocket. He attached one carabiner to the safety line and the other to the red rope. Without hesitation, Paul began to tie the rope around the light, the safety line, and other brackets on the turbine to secure the light. He swiftly pulled the rope around the broken light and weaved the red rope all across the top of the turbine.

About 20 minutes had passed and Paul felt that the light was secure. He crawled back to the hatch and took out his phone again. He opened up the camera and began to snap pictures of the East Bay area.

“It’s gorgeous today!” said Paul. “You can see all the way up to Providence!”

After a few pictures were taken, Paul made his way back inside of the turbine and prepared for the journey down the 162 steps. He pulled on his blue and yellow gloves attached his carabiner to the safety and began the climb once again.

I zipped down the turbine in about 10 minutes and waited for Paul, who reached the ground shortly after myself. We took off our harnesses and drove back to the Administration Building at Portsmouth Abbey.

Although Paul does not have to climb the turbine regularly, he understands what it takes to climb the turbine.

“How are you arms doing?” asks Paul. “I bet you thought it would be all legs, but it’s your arms and shoulders that will be hurting tomorrow.”

He was right.

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Interview with Paul Jestings, Director of Operations, Portsmouth Abbey & School
Interview with Sean Callaghan, Business Agent, IBEW Local #103
Interview with Dan Force, Resident of Town of Portsmouth, R.I.
Interview with Donna Olszewski, Resident of Town of Portsmouth, R.I.
Interview with Gary Crosby, Town Planner of Portsmouth, R.I.
Interview with Rich Talipsky, Chairman of the Portsmouth Economic Development Committee
Interview with Tim Roughan, National Grid, Director of Energy and Environmental Policy
Phone interview with Andrew Longetieg, Head of External Communications, North America, Vestas
Phone interview with Lisa Lawless, Principal Civil Engineer, Department of Environmental Management