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The Fox Islands Wind Project (A)

On an unseasonably warm November afternoon in his Houston, Texas home, energy investment banker and peak oil author Matthew R. Simmons (HBS '67), founder of Simmons & Company International, related to a second-year MBA student at Harvard Business School the news of the opening of a new wind energy project in coastal Maine, the development of which he had followed closely as a trustee of the Island Institute.[1] The Fox Islands Wind project, Simmons said, represented a major achievement, both because of the challenges that the team, led by George Baker (HBS '84), had overcome and because the development potentially offered a template for the development of future community-based sustainable wind projects.

The Fox Islands of North Haven and Vinalhaven are two of 15 remaining year-round island communities on the coast of Maine that are not connected by a bridge to the mainland. By virtue of their separation from the mainland, the market for electricity on the islands is unique and costly for residents. In 2008, residents paid approximately $0.29/kWh, but after the wind project prices declined to $0.24/kWh, a decrease of 17%. Historically, electricity prices on the islands had been three times the national average because of the high cost of importing electricity via an underwater cable and maintaining the distribution network on the islands. Baker, who maintained a home on Frenchboro, a similar community 15 miles away, became interested in energy issues during a sabbatical from his teaching position at Harvard Business School. Upon delving into the issues faced by island residents further, he decided to work to make alternative sources of energy available in order to lower costs for island residents.

Among the challenges that the Fox Islands team had to overcome were identifying a location where such a project made sense from a technological standpoint, building support for and understanding about the impacts and changes to the host community, and raising sufficient financing for the project. In 2009, after approximately eight years of research and planning by various stakeholders and approximately 18 months of active project work, the Fox Islands Wind project came

[1] The Island Institute is a nonprofit organization that serves as a voice for the balanced future of the islands and waters of the Gulf of Maine. The primary goals of the Island Institute are supporting Maine's year-round island communities, conserving Maine's island and marine biodiversity and developing model solutions that balance the needs of the coast's cultural and natural communities.

Professor Joseph B. Lassiter III and James Corcoran, Max Gazor, Dylan Hogarty and Alexander H. Somers, Jr. (all MBA 2010) prepared this case. HBS cases are developed solely as the basis for class discussion. Cases are not intended to serve as endorsements, sources of primary data, or illustrations of effective or ineffective management.

online with three 1.5MW GE turbines capable of generating approximately 11,600 MWh per year.[2] With the Fox Islands Wind project complete, Baker began to consider whether to pursue similar projects elsewhere in Maine and the United States more broadly.

The Fox Islands

In 1603, Captain Martin Pring of Bristol, England named two islands off the coast of what is now Maine the Fox Islands for the silver-grey foxes he observed there. The one mile-wide straight that separates the islands is still known as the Fox Islands Thoroughfare; however, the northern island is known today as North Haven and the southern island as Vinalhaven. The islands are approximately 12 miles east of Rockland, Maine in Penobscot Bay (see **Exhibit 1** for a map of the Fox Islands).[3]

Today, North Haven is still best known for its sizable summer colony of prominent business and political leaders from Boston, New York, and other major cities. The economy of Vinalhaven today is most dependent on the lobster industry while North Haven is dominated by maintaining its summer resort community.[4] According to the 2000 U.S. Census, North Haven and Vinalhaven had 381 and 1,235 inhabitants, respectively, with a total combined land area of 37 square miles (23,648 acres).[5] With no bridge connection to the mainland, residents rely on the approximately one hour and fifteen minute ferry rides from Rockland as the primary method to transport goods and people to the island.

The Energy Challenge on Fox Islands

In 2008, the residents of the Fox Islands faced some of the highest electricity prices in the U.S. with recent prices three times the national average. In addition to other economic and social factors, the high cost of electricity threatened the sustainability of the year-round community on the island. In Maine, year-round island communities had declined from over 200 to just 15 in 2008. Solving the Fox Islands' electricity problems was a crucial step in bolstering the sustainability of the community.

The total electrical costs on the Fox Islands were approximately $0.29/kWh in 2008. This price was determined by two components, an energy charge and a delivery charge. The energy charge represented the cost of electricity generation and was variable. Energy charges over the past five years on the Fox Islands were approximately $0.11/kWh. Energy charges varied across the U.S. depending on the fuel source used to generate electricity; for example, Kentucky and West Virginia had low energy charges because electricity was generated using inexpensive coal (see **Exhibit 2** for a comparison of energy charges across the U.S.). In regions that relied on gas or nuclear power, energy charges were higher. The second electricity price component, delivery charge, is a cost to consumers that covers the cost of electricity transmission and distribution (T&D). Recent delivery charges on the Fox Islands were approximately $0.18/kWh. The high delivery charges were the result of the few (approximately 2,000) customers on the islands relative to the high fixed cost of the necessary T&D equipment, which included a 10-mile umbilical cable from the mainland, power lines on the island and maintenance and repair costs. With only 2,000 customers to cover these fixed expenses T&D costs represented a significant component of electricity prices.

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[2] 11,600 MWh per year calculated assuming three 1.5MW turbines and average yearly utilization of 29% (3 x 1.5MW x 8760 hours per year x 29%) = 11,600 MWh per year. George Baker's utilization estimate was based on seasonal wind conditions and equipment scheduled maintenance requirements as well as the ability to sell excess power to the grid.

[3] Town of North Haven, Maine, "A Brief History of North Haven," http://www.northhavenmaine.org/content/4099/Brief_History/, accessed April 2010.

[4] Ibid. and Vinalhaven Chamber of Commerce. "History," http://vinalhaven.org/history, accessed April 2010.

[5] U.S. Census Bureau website, "Census 2000 Data for the State of Maine," http://factfinder.census.gov/servlet/GCTTable?_bm=y&-geo_id=04000US23&-_box_head_nbr=GCT-PH1&-ds_name=DEC_2000_SF1_U&-format=ST-7, accessed March 2010.

Consumers on the islands purchased electricity from Fox Islands Electric Cooperative (FIEC, the Coop), a community owned T&D co-op established in 1974 with the purchase of Vinalhaven Light and Power. In 1976, with the help of a loan from the Rural Electrification Administration (REA), the new co-op laid a 10-mile submarine electric cable between North Haven and Central Maine Power Company's lines at Rockport, on the mainland. The cable was energized in 1977. As a T&D company, FIEC did not generate electricity, but only engaged in transmission as a regulated monopoly. Historically, T&D and generation had been separated and regulated by government mandate in Maine with fixed prices set by the government. In 2000, to increase competition and keep electricity prices low for consumers, the industry was deregulated to allow competition set prices for generation. In 2005, the old submarine cable was replaced with a new one. The co-op purchased all of its electricity directly from the New England Grid.

Another unique feature of electricity on the Fox Islands was the seasonality of demand, with consumption spiking in the summer months of July and August (see **Exhibit 3** for energy usage patterns on the island). Electricity in the summer was not driven by air conditioning usage, as few people on the Fox Islands used air conditioning, but rather by summer residents who arrived and began using electricity. Seasonal residents and year-round residents typically had different viewpoints on the electricity challenge on Fox Islands. For seasonal residents, the high cost of electricity was not a major concern as they were typically wealthy and only used electricity for a couple months a year. Year-round residents on the other hand had to bear the costs of high electricity all year and were typically more sensitive to prices than their wealthier seasonal neighbors.

The Genesis of the Fox Islands Wind Project

The wind project on the Fox Islands was the result of nearly eight years of research and planning (see **Exhibit 4** for a timeline of events). Dave Folce, the General Manager of the Fox Islands Electric Cooperative began exploring the idea of wind power on the island in 2001 as a potential method of mitigating high energy prices for island residents. Later that year, he also persuaded the University of Massachusetts Renewable Energy Research Laboratory to begin a three-year study measuring wind speeds near an abandoned quarry on Vinalhaven. Over the course of the three-year study, comprehensive data was gathered on the average wind speed, direction, and frequency of wind from a 40 meter high tower 40 located at the quarry site.

The UMass study confirmed that the quarry site on Vinalhaven would serve as a "good, but not great" site for windmill placement and three years of data was very helpful for moving the project forward. However, in 2005, the submarine electric cable connecting the Fox Islands with the mainland failed and made the future of wind energy on the islands uncertain. FIEC was forced to borrow $4.0 million to replace the cable to make the necessary improvements to establish a good connection with the mainland grid. While this event put the wind project on hold, ultimately it would serve as a critical catalyst for the project. A secure and reliable connection with the mainland grid was essential for a wind project on the island as the project would require power to be imported from and exported to the grid.

By 2007, the overall increase in global energy prices coupled with a pro-wind political climate in Maine paved the way for the development of the Fox Islands Wind project. In early 2008, the Fox Islands Electric Cooperative formally requested assistance with the project from the Island Institute and George Baker was introduced to the project.

George Baker

George Baker became involved in the Fox Islands Wind project through the Island Institute, where he served as the Vice President for Community Wind. Baker had taken sabbatical from teaching at Harvard Business School during which he studied the potential for wind projects. In 2008, Baker

went on leave from HBS to become CEO of Fox Islands Wind LLC and pursue the project full-time. In addition to his duties at Fox Islands Wind, he serves on the Maine Governor's Task Force on Ocean Energy, and is a member of the Advisory Board of Neptune Wind, an offshore wind development company (see **Exhibit 5** for biographies of Baker and other key stakeholders).

Building Community Support for the Project

In addition to evaluating the economic viability of wind energy, Baker needed to determine whether the community would support the construction of three large wind turbines on the island and build enthusiasm for doing so. As Baker evaluated the situation, he believed that strong community support would be critical to the success of the project. Without support from the community, opponents of the project would have a series of levers at their disposal to delay or potentially halt the project. For instance, critics of the project could pressure public officials to block the project or deter potential investors by causing them to think it would not succeed.

Risk of Concern from the Community

Unfortunately, problems launching several other notable wind energy development projects suggested to Baker that community support might be difficult to obtain. Most famously, the Cape Wind project, an offshore wind development off of Cape Cod, had drawn strong criticism from people and groups in the Cape Cod area. These groups had banded together and, with the help of powerful political connections, sought to stymie the project. Residents claimed, for example, that the wind turbines would obstruct their views of Nantucket Sound, that bird species would be harmed by the rotors of the wind turbines, that the turbines would interfere with airport activity and that fishing would be harmed. Opponents of Cape Wind had delayed the construction of the wind turbines for nearly a decade, despite the project's being supported by most of the key decision makers in the state government. The delays had imposed huge costs on the developers of Cape Wind.[6]

News reports also suggested that community concerns about wind turbines were becoming more significant. Robert Bryce, an energy journalist wrote: "Lawsuits that focus on noise pollution are now pending in Maine, Pennsylvania, and New Zealand. In New Zealand, more than 750 complaints have been lodged against a large wind project near Makara since it began operating last April. The European Platform Against Windfarms lists 388 groups in 20 European countries. Canada has more than two-dozen anti-wind groups. In the U.S. there are about 100 such groups, and state legislators in Vermont recently introduced a bill that will require wind turbines be located no closer than 1.25 miles from any residence."[7]

Baker hoped to avoid a situation similar to Cape Wind on the Fox Islands. On the contrary, he wanted to move forward with widespread community support. As he assessed the situation, Baker believed there were two distinct groups to whom he needed to appeal. The first group was full-time residents of the islands. For many in this group, their electric bill was a significant expenditure, and they were involved in the life of the islands throughout the year. Many would likely be focused on finding ways to reduce their electric bill and would perceive this as largely an economic issue. The second group was summer residents of the islands. This group was likely to be less concerned with their electric bill as it was a relatively smaller expenditure for them. On the other hand, Baker believed, many in this group would find the sustainability element of the project appealing.

[6] Richard Vietor, "Cape Wind: Offshore Wind Energy in the USA," HBS No. 9-708-022 (Boston: Harvard Business School Publishing, 2008).

[7] Robert Bryce, "The Brewing Tempest Over Wind Power," *Wall Street Journal,* March 1, 2010.

Initial Steps to Build Support

From the time that the project was in the initial planning stages (spring 2008), Baker focused on developing community support from both groups. The primary means by which he planned to do this was through frequent and open communication with the island residents. In Baker's view, it was vitally important that he, as the team leader, and others be accessible to island residents, especially those who had concerns about the project. In other developments that had run into problems with local communities, a key issue had often been that the island residents viewed the developers of the project as outsiders coming in to exploit the resources (in this case wind) that the area offered. Baker resolved not to allow this to happen in the Fox Islands development.

From the outset, the project had the support of several key "opinion leaders" in the community. One was State Representative Hannah Pingree of North Haven. In 2007, she had voiced strong support for the project in meetings with other community leaders and advocated for it in the statehouse to the extent that state support was needed. In particular, Pingree convened a meeting of island electric cooperatives and addressed an element of the state's electricity deregulation law that prohibited a T&D company such as FIEC from engaging in generation activity as contemplated in the Fox Islands plan. Eventually, a special law was passed to permit the FIEC to operate wind turbines.

Baker's principal means of building support in the community more broadly was through hosting town hall meetings on the subject with both year-round and summer residents to communicate directly with them and to ensure that the nature and details of the project were effectively presented. Baker held more than a dozen town hall meetings beginning in the spring of 2008. By the time the summer residents arrived that year, the backing of the year-round residents had been secured.

During the course of these meetings, residents expressed several concerns. One was that the project was financially risky. With the cooperative already heavily indebted, some residents thought that the debt needed to develop the wind project would be more than the cooperative could support and lead to higher electricity prices. A second concern involved the blinking red lights required on top of the turbines for aviation safety. Third, some residents were concerned that construction would be disruptive. Very few people expressed concerns about the aesthetics of the turbines or about noise.

For his part, Baker tried to address each of these concerns by explaining how the project would work and what steps were being taken to mitigate potential problems. Baker also focused attention on the benefits of the project, chiefly lower electricity rates and making the community a model for using renewable sources of energy, something that many island residents took pride in. The important thing for residents was that they would be the primary consumers of the energy produced by the turbines and that they would realize an economic benefit from them. By emphasizing the local nature of his efforts, Baker blunted the objection to developers swooping into communities that had been raised in other communities.

Baker said that the town hall meetings helped him to develop a rapport with many of the Fox Islands residents and made it easier to deal with objections that arose. The Fox Islands project was not free of negative rumors in the community regarding such issues as financing andconstruction problems. However, Baker had established credibility in the community and people were either willing to come directly to him with concerns, or people who heard rumors were willing to talk to Baker directly, which enabled him to proactively allay concerns before the rumors spread.

A Vote of Cooperative Members

By the summer of 2008, Baker and his team were ready to proceed with the project and start making significant development expenditures. Before continuing, the wind project needed the approval of FIEC to confirm the alliance between the two. Although the board of FIEC had the authority to approve the project on its own, they were mindful of the importance of the community's

support and decided that their approval alone would not be sufficient. Instead, the Coop arranged for the proposed wind development to be submitted to a vote of all cooperative members, essentially all residents of the island. This would afford the community a formal opportunity to express its view on the project. The vote was held in August 2008 and cooperative members approved the project by a vote of 384 to 5.

According to Baker, the vote was "hugely important." The margin of the vote helped to cement public enthusiasm and enabled Baker and others to show vendors and regulators that the project had the people's support. Before the vote, Baker had avoided making announcements about the project off the islands. "There are a bunch of anti-wind people in Maine, and we didn't want to fire them up," Baker said. Once the cooperative members' support had been secured, however, they put out a press release announcing the results and that they needed turbines to proceed.

Anxious to proceed quickly lest public support wane, Baker focused on four key tasks. First was working with the Vinalhaven Planning Committee to revise an ordinance governing wind power on the islands. The ordinance had been written to make it difficult to build wind turbines on the islands as a means of giving the community leverage against any possible for-profit wind developer. However, given the structure of the wind project and the strong support within the community, the Planning Committee began working on changes to the ordinance. Second, Baker and his team needed to work to finalize the financing for the much larger construction and completion phase of the project. Third, Baker had to work to satisfy both the new town ordinance and the Maine Department of Environmental Protection's (DEP) permitting process. The Fox Islands Wind project was the first to be reviewed under the Department's Small Wind Certification process, which focused on safety, the amount of shadow flicker produced by the rotor blades and the sound emitted by the turbines. After review, the DEP approved the project.

Fourth, Baker worked to locate the wind turbines themselves. At the time, there was a three-year waiting list for turbines. In the aftermath of the vote, EOS Ventures, a firm that provides design and construction services for renewable energy projects, began working with Baker and helped him to persuade GE to deliver turbines by the summer of 2009, far sooner than the waiting list suggested was possible. Getting the turbines quickly was essential to maintaining momentum for the project in the community. The show of community support for the project was helpful in engaging EOS and GE in the effort to procure turbines.

Managing Community Relations Through the Construction Phase

By the spring and summer of 2009, construction on the wind turbines was progressing quickly. According to Baker, the community "could have [had] lots of issues" with the disruptions caused by the construction process. For instance, as a result of material deliveries to the site, the main North/South artery on Vinalhaven was frequently obstructed for "weeks on end." However, the construction and logistics team made a concerted effort to educate residents about the project beforehand so that they were prepared for the process. "We put in a lot of work so there would be no surprises," Baker said.

Several examples demonstrate the degree of support the project received from the community. Approximately 200 people gathered when the barge carrying the rotor blades arrived and cheered the truck as it pulled onto the island. One resident who lived on a sharp corner around which construction vehicles were having a hard time turning agreed to have the road temporarily expanded into his yard. Perhaps most memorably, according to Baker, when a truck became stuck on the main road one day and it took several hours to arrange to have it moved, traffic began to build up on either side of the road. Eventually, islanders on one side of the truck began trading vehicles with islanders on the other side of the truck. In general, employees of Cianbro, the construction company, made a

concerted effort to be part of the community while on the island, which contributed to goodwill in the community.

By November 2009, the project was complete and ready to be dedicated and placed into service. As they had throughout the process, a large portion of the community rallied behind the wind project and hundreds of people attended a celebration (see **Exhibit 6** for photos).

Post-construction Community Relations Challenges Emerge

However, after the turbines began to operate, Baker said "within days, a small number of neighbors started expressing concerns about the sound [being produced by the turbines]." These neighbors claimed that they had been told that they would not be able to hear any noise from the turbines. Although the Maine Department of Environmental Protection had considered and approved the noise level being emitted by the turbines, sound had not been a significant concern expressed by residents during the planning phase. The turbines were operating within the parameters of the DEP's noise requirements (see E**xhibit 7** for the requirements and **Exhibit 8** for the change in noise level by distance from the turbine tower). According to news reports, "approximately a half-dozen neighbors say the noise has been so disruptive that it makes it impossible to live normal lives – that they can't sleep at night and that the noise is harming their health."[8] The concerns created a challenge for Baker. Although the project was not obligated to take any steps to address these concerns, the community ownership model demanded that he work to understand, communicate and come to agreement about the best course of action.

Baker began to work immediately. In order to assess the situation, Baker asked the concerned neighbors to complete logs of the sounds levels and when it bothered them in order to understand the nature of the problem better. Perhaps there were certain triggers of noise that could be easily addressed. In addition, he worried about what the reaction to noise would be in the summer, when people spent more time outside. Gentler summer breezes would likely reduce the noise somewhat but further comments were not inconceivable.

Beginning on February 1, 2010, the cooperative launched a month-long experiment in which the turbines will be slowed down randomly at night in order to test whether that would address residents' concerns. The changes in turbine speed would be varied in order to test reactions to a range of speeds. Residents were again asked to keep detailed notes about what kind of noise they heard and the degree to which it bothered them.[9] In addition to slowing the turbines down, another option available to Baker was to modify the gearboxes and generators themselves. Such changes would be expensive and highly specialized because they involved equipment that had already been designed, built and installed, however. They could also compromise the overall effectiveness of the turbines.

A local journalist reporting on the situation spoke to other island residents in addition to those who had commented on the noise. He reported that the town manager, Marjorie Stratton, "said that what she hears on the street is that islanders still feel good about the project and…the project is doing exactly what it was predicted to do." Stratton said that it is important to balance the interests of the vast majority of customers with those who live close to the turbines: "We can't do everything to serve these 25 customers that are close by. We have to serve all of the customers." Furthermore, based on "conversations with about 20 islanders," the reporter found that the vast majority of the people he spoke with continued to support the project, though they had some sympathy for those reacting to the noise.[10] One of the people who lived near the turbines, Cheryl Lindgren, described the noise as a

[8] David A. Tyler, "As electric co-op conducts sound experiment, Vinalhaven residents debate solution to turbine noise issue," *The Working Waterfront*, February-March 2010.

[9] Ibid.

[10] Ibid.

"repetitive 'whump, whump.'" Upon hearing the turbines for the first time, she said, "I can feel this sound. It's going right through me. I thought, 'Is this what it's going to be like for the rest of my life.'"[11]

With regard to visual pollution, rather than being upset about the new addition to Vinalhaven's topography, island residents were "just ecstatic" about the turbines, Baker said. They became a source of pride for many residents. Vinalhaven resident Gery Torborg told a reporter "This is fantastic. I think they are beautiful," as the turbines began to operate.[12]

As he reflected on the steps he took to build community support and the community's reaction to the wind project, Baker wondered how to address the concerns that had been raised and how to apply what he learned in this project if he were to try to develop other projects elsewhere. In further developments, he might be more susceptible to being labeled an "outsider" than he had been on the Fox Islands, where he had become well known to much of the community.

Financing the Project

Capital Costs

In addition to building community support, obtaining the financing for the Fox Islands Wind project or for any other wind project was no trivial matter. A typical onshore wind installation was estimated to cost approximately $2,000/kW. According to industry research, the turbines accounted for 60-65% of the total cost, with transportation costs making up 5-10% and transmission lines, interconnect and sub-station construction being responsible for 10-15%. Construction costs generally accounted for the remaining 15-20%.[13]

The Fox Islands Wind project's capital requirements were expected to be far greater than typical wind projects (on a per kilowatt basis). A typical project could be expected to be much larger, with total generation capacity usually in excess of 100MW. Fox Islands Wind would be building three 1.5MW turbines for total generation capacity of 4.5MW. The project would therefore be negatively impacted by its lack of scale. Additionally, the cost of installation would be substantially higher due to its location on a small island unconnected to the mainland. Baker's team initially estimated that total installation costs would be twice the mainland cost. The economic downturn of 2008-2009 did bring some relief to price pressure on the turbines, however. At their peak in 2008, turbine prices had increased to $1,800/kW with wait times of around 24 months. By 2009, industry experts estimated that prices had fallen 30-35% due to the collapse in commodity prices, limited financing and market oversupply.[14] Baker's team initially estimated that its turbines would cost approximately $1,500/kW.

Figure A Initial Fox Islands Wind Capital Cost Estimates

	Total Cost	Per kW
Turbines	$6,750,000	$1,500
Installation	5,850,000	1,300
Total	**$12,600,000**	**$2,800**

Source: Fox Islands Wind Investor Presentation.

[11] "Wind power overpowers its neighbors," Letvineyardersdecide.org, http://letvineyardersdecide.org/wind/index.php/2010/01/wind-power-overpowers-its-neighbors/, from *Kennebec Journal and Morning Sentinel,* January 24, 2010.

[12] David A. Tyler, "Islanders awed by wind turbines," *The Working Waterfront,* December 2009-January 2010, http://www.workingwaterfront.com/articles/Islanders-awed-by-wind-turbines/13533/.

[13] Simmons & Company International, "2009 Alternative Energy Review," p. 43.

[14] Simmons & Company International, "2009 Alternative Energy Review," p. 35.

Wind Power Economics

The economics of generating wind power is characterized by high upfront capital costs and very low marginal operating costs. While *average* costs (which include capital costs) had come down substantially over time, it was still believed that wind power was uneconomic when compared to more conventional hydrocarbon energy sources such as coal or natural gas (see **Exhibit 9** for a comparison of levelized costs of electricity). To achieve parity with conventional sources, capital costs would need to decrease substantially or hydrocarbon pricing would need to increase, either directly or through some form of carbon pricing.

As it was unclear when or if wind power could become economic on a standalone basis, both the states and the federal government had developed incentives to promote wind power generation, primarily in the form of production tax credits (subsidies for generation) and renewable portfolio standards (RPS), in which the state mandates a minimum supply of renewable energy be purchased by electricity providers. The renewable energy could either be generated in-state or be purchased from out-of-state generators through renewable energy credits (RECs). Renewable energy credits are tradable commodities that represent proof that one MWh of electricity was generated from an eligible renewable energy source.[15] This market allows for separation of the "greenness" from the "energy."

Baker expected to take advantage of the current renewable energy production tax credit of $0.021/kWh. However, production tax credits exhibited some volatility due to their dependence upon periodic renewals by Congress. Production tax credits had been allowed to lapse three times in recent history: in 1999, 2001, and 2003 (see **Exhibit 10** for impact of PTC lapses on wind installations). Baker also intended to sell the RECs generated by the project to further increase the economic viability of the project, although prices for RECs exhibited high amounts of price volatility.[16]

The economic feasibility of the Fox Islands Wind project was bolstered by the fact that households on the island paid substantially higher electricity bills than households on the mainland. A wind project on the mainland was likely to remain uneconomic in the near term compared to conventional power sources there, but island residents had few other alternatives for reducing their electricity bill. Traditionally, island communities separated from the grid had been supplied by standalone diesel generators, but island residents had found these lacking in the past. Fuel costs were highly variable, and the generators were disruptively noisy as well as incredibly inconvenient.[17] Diesel power was also considerably more expensive. According to a University of Massachusetts study, diesel generators on another island produced energy at approximately $0.39/kWh, a substantial premium to residents' already high rates.[18] New England's latitude and weather likely precluded the widespread use of solar power. Tidal power held some promise, but Baker believed the technology was several years from being viable.

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[15] Lori Bird, "Overview of Renewable Energy Certificate (REC) Markets," National Renewable Energy Laboratory, January 8, 2008, http://www.ftc.gov/bcp/workshops/carbonoffsets/presentations/lbird.pdf, accessed April 17, 2010.

[16] According to NREL, REC prices in 2006 ranged from $5 to $55 per MWh. Lori Bird, "Overview of Renewable Energy Certificate (REC) Markets," National Renewable Energy Laboratory, January 8, 2008, http://www.ftc.gov/bcp/workshops/carbonoffsets/presentations/lbird.pdf, accessed April 17, 2010.

[17] According to an article in *Rural Electrification Magazine*, low voltage generated by the diesel generators was terribly destructive to many appliances. Additionally, businesses that needed large amounts of electricity needed to notify the powerhouse in advance to ensure enough generators were running. Frank K. Gallant, "A Good Job for Vinalhaven," *Rural Electricification Magazine*, October 1983, http://www.foxislands.net/aboutfie.htm, accessed March 2010.

[18] Gabriel Blanco, James F. Manwell, and Jon G. McGowan, "A Feasibility Study for Wind/Hybrid Power System Applications for New England Islands," Renewable Energy Research Laboratory, University of Massachusetts, p. 16.

Additional Challenges

Baker faced substantial challenges beyond those of financing a more conventional wind farm. First, the size of the project was larger than the current size of the cooperative. With assets of around $11 million, the Fox Islands Electric Cooperative would be more than doubling its size with a single transaction. Securing debt financing for such a large transaction would likely be difficult, particularly given how difficult financing was to obtain following the 2008 financial crisis. Second, the cooperative had very limited resources and obtaining funds to support the pre-development work necessary for approval and financing to be obtained presented a challenge. Finally, the Fox Islands Electric Cooperative was a non-taxable institution; thus, production tax credits (PTCs) were worthless to the project directly, substantially reducing the viability of the project.

Baker needed to find a tax equity investor willing to fund a substantial portion of the project. Tax equity investors were investors, often from unrelated industries, who would contribute equity to the project in exchange for the tax benefits associated with the project. However, the financial crisis had decimated the tax credit market as corporations often had substantially less taxable income to be offset by tax credits. According to industry sources, the production tax credit market grew from approximately $600 million in 2005 to more than $5.2 billion in 2007. In 2008, however, the market declined sharply to $2.5 billion. Never a market with an abundance of players, the tax credit market was believed to have only four active participants in 2008, down from eighteen previously.[19]

Solving the Pre-development Challenge

Early projections suggested that the project would require approximately $300,000 of pre-development work (lawyers, bankers, engineers, consultants, etc.). In a traditional for-profit project, the sponsor would fund these costs up front as part of its equity commitment. However, as a cooperative, FIEC lacked the resources to begin the pre-development work. Baker had several options available to him: because of the cooperative's community-based non-profit status and the "green" nature of the project, he could petition for grant funding from a foundation or other similarly-minded institution. Receiving grant funding would likely require substantial time, and Baker could not be certain of grant approval. Moreover, a grant conflicted with one of his motivations; Baker wanted to establish the viability of supplying wind power to Vinalhaven without grants. As such, he devised a creative financial instrument, a "contingent promissory note," which promised to pay 10% interest per annum when the project received permanent financing but nothing if the project did not proceed. Baker noted that although the return was probably below-market for the risk investors were taking, "These weren't disinterested private investors; these were island individuals who were really interested in doing this. These were foundations that made investments out of their endowments because they were interested in us." There were additional benefits as well; obtaining financing in this manner gave Baker speed and flexibility in moving the project forward. The contingent promissory notes allowed for smaller amounts to be raised as needed.

Tax Equity Financing

Tax equity investors received a return on their investments primarily through two sources. The first source was through the production tax credits. The PTCs currently in place allow for a $0.021 production tax credit per kilowatt-hour of generation for the first ten years of a project's life. Since the Fox Islands Wind project was expected to generate approximately 11,600 MWh annually, this could be expected to produce a tax credit of around $243,600 per annum for the equity sponsor.[20] The

[19] Chadbourne & Park LLP, "Project Finance Newswire," January 2009, p. 27. Many tax equity investors were financial institutions such as Lehman Brothers, AIG, Citibank, JPMorganChase, Bank of America, MetLife and New York Life, as well as institutions such as GE.

[20] $0.021 x 1000 (MW/kW) x 11,600 = $243,600.

second source was accelerated depreciation. Under IRS guidelines, the equity investors were allowed to depreciate most project costs using a five-year, double-declining-balance depreciation method.[21] According to tax experts, this generally allowed 90-95% of the cost of a wind project being depreciated within six years.[22] Accelerated depreciation provided value to the tax equity investor by postponing tax payments for several years.

Because the cooperative did not pay taxes, Baker needed to find a willing tax equity investor with taxable income to offset. In exchange for a ten-year stream of tax deductions, the investor would provide an upfront equity investment. To accomplish this, Baker needed to create a taxable entity, Fox Islands Wind LLC (FIW), to own the project assets. FIW would be primarily (99%) owned by the tax equity investor, with the *de minimis* residual owned by FIEC (see **Exhibit 11** for full corporate diagram). The tax equity investor would also receive a dividend of $25,000 per annum. After ten years, ownership of FIW would "flip," and the cooperative would buy out the tax equity investor's interest. The tax equity investor would receive no further economic benefits.

Baker reached out to three well-known institutional tax equity investors but quickly found them to be uninterested in financing such a small project. Continuing his pattern of creating a community project, Baker met with a local Maine company, Diversified Communications, a privately-held, family-owned business that operates in the broadcasting, exhibition, publishing and emerging-media industries. The company had strong community ties within Maine, having been founded by former Governor Horace A. Hildreth, Sr. in 1949. The company was enthusiastic about the project and committed $4.3 million subject to an agreed-upon target rate of return.

Debt Financing

Baker had several debt financing options. He considered bank financing, but found interest rates to be high, in the 8-10% range. There were also government-sponsored financing programs that could be investigated. One option was the Clean Renewal Energy Bond (CREB). The Energy Policy Act of 2005 provided electric cooperatives with the ability to issue CREBs to finance renewable energy projects. Under this program, the federal government provides the purchaser of the bond with a tax credit in lieu of an interest payment. While a CREB program was an option, it had two main drawbacks. First, the program was allocated through a competitive process; Baker could not be certain of success, and there was a considerable waiting period. Second, the CREB could not be issued by a taxable entity, meaning FIEC would be unable to use tax credits to induce a tax equity partner.

The second government-sponsored financing option Baker considered was a loan from the Rural Utilities Service (RUS), an agency of the United States Department of Agriculture (USDA).[23] The RUS's mandate is to bring public utilities to rural areas through public-private partnerships. The RUS was already the cooperative's lender. The RUS was hesitant to lend to a newly-formed for-profit subsidiary but was eager to provide financing to a renewable energy project. By educating the RUS about the complicated structure and the rationale behind it, Baker was successful in securing a $9.5

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[21] Under the five-year, double-declining balance method, 40% (2 times 100% divided by 5 years) of the book value is depreciated annually.

[22] Patricia G. Hammes, Mitchell E. Menaker and Robert N. Freedman, "Putting the Wind (Back) to Work," *New York Law Journal*, July 6, 2009, http://www.law.com/jsp/nylj/PubArticleNY.jsp?id=1202431933621&slreturn=1&hbxlogin=1.

[23] The RUS was originally created as the Rural Electrification Administration (REA) in 1935. In 1994, the REA was reorganized into the RUS. The United States Department of Agriculture, Rural Development, "The Story of Rural Electrification: 1935 - Present," http://www.rurdev.usda.gov/tx/Legislative%20Seminar/USDA%20Rural%20Development%20-%20Rural%20Electrification.pdf, accessed September 3, 2010.

million 20-year loan at an expected rate of 4.25% per annum. The loan was sized at the maximum allowable under RUS regulations to allow flexibility for cost overruns.[24]

Construction Financing

Baker had achieved the permanent financing necessary for the Fox Islands Wind project, but he still needed to find bridge financing to cover the cost of construction as the RUS only lent against completed projects. Although in theory a bank could look at the financing commitments lined up, the large size of the project relative to the cooperative's existing assets made banks hesitant to provide bridge financing. Again, Baker needed to be creative; an existing privately-owned non-profit called the National Rural Utilities Cooperative Finance Corporation (CFC) was dedicated to supplementing RUS lending, but the CFC only lent to cooperatives. Given the unfamiliarity of the CFC with this type of project, Baker again needed to work closely to describe the details of the project to obtain the $9.0 million construction loan. First, a structure by which the CFC lent to the cooperative and the cooperative in turn lent to FIW had to be devised. Second, an education of the construction process and required uses of funds prior to construction was required to convince the CFC to fund the $1.5 million down payment to GE to hold the August 2009 turbine delivery date.

Subsequent Developments

An unexpected but favorable boon to the project occurred in February 2009, when President Obama signed the American Recovery and Reinvestment Act of 2009 (ARRA), which provided the option of a 30% investment tax credit for developers of clean energy. The stimulus plan greatly improved the economics of wind power financing and quickly increased the availability of wind financing nationwide.[25] The tax credit also greatly improved the economics for Diversified Communications, which agreed to increase its equity investment to $4.8 million initially and $5.0 million by the end of the project.[26] **Figure B** shows the final all-in costs of the project.

[24] The RUS requires a minimum times-interest-earned ratio of 1.05x. Times-interest-earned is defined as (operating income plus interest) divided by interest.

[25] Russell Gold, "Wind Farms Set Wall Street Aflutter," *Wall Street Journal*, August 31, 2009, http://online.wsj.com/article/SB125167463443070949.html.

[26] Because the 30% investment tax credit is based on the project's total costs, the return to the tax equity investor increases with debt-funded cost overruns. Diversified Communications agreed to increase its investment by $200,000 to a total of $5.0 million in order to bring its total return closer to original projections.

Figure B Final Fox Islands Wind Project Sources & Uses

Sources (Permanent Financing)

	Total Cost	Per kW
RUS 4.25% 20 year loan	$9,500,000	$2,111
Tax equity contribution	5,000,000	1,111
Total	**$14,500,000**	**$3,222**

Uses

	Total Cost	Per kW
Pre-development costs	$600,000	$133
GE turbines	7,600,000	1,689
Construction	5,000,000	1,111
Property & escrow	1,300,000	289
Total	**$14,500,000**	**$3,222**

Source: Fox Islands Wind Presentation to the Gulf of Maine Research Institute.

Final project costs were higher than expected for several reasons. First, pricing for turbines turned out to be higher than budgeted. Although prices fell dramatically during 2008, Baker had limited leverage to renegotiate price with GE because it was crucial to obtain delivery and installation on-time due to the looming onset of bad weather. Second, the project incurred approximately $500,000 of cost overruns due to an error in forecasting the electrical grounding of the base.

Operating the Project

The completed wind project generated slightly more than half of the island's electricity use during the year. During the winter, when winds blow substantially stronger and electricity use was lower (fewer residents), the project produced excess electricity. During the summer, the island would need to import energy. To facilitate the efficient management of this variability, the cooperative entered into a 20-year power purchase agreement (PPA) with FIW. Under this agreement, the cooperative buys power from the FIW in exchange for paying FIW's operating and financing costs (see **Figure C** below). The cooperative, in turn, entered into a sale and purchase agreement with the Vermont Public Power Supply Authority (VPPSA), its historic partner for electricity purchases, to sell VPPSA its excess electricity and buy from VPPSA any deficit at wholesale prices (see **Exhibit 11** for a diagram).

Figure C Fox Islands Estimated Annual Operating and Financing Costs

	Total Cost	Per kWh
Financing costs	$770,000	$0.066
Insurance	50,000	0.004
Operations & maintenance	95,000	0.008
Lease and other payments	30,000	0.003
Total before RECs	**$945,000**	**$0.081**
REC sales	(354,960)	(0.031)
Total	**$590,040**	**$0.051**

Source: Fox Islands Wind estimates. Cost per kWh is equal to cost divided by expected annual generation of 11,600 MWh. Totals may not add due to rounding.

An additional source of savings for the island's residents was the sale of Renewable Energy Credits (RECs). Baker negotiated the sale of the project's RECs at a five-year fixed rate of $30.60 per MWh to Cape Light Compact, an energy services organization serving Cape Cod and Martha's Vineyard. As part of the REC sale, FIEC cannot claim that the energy it produces is "green" as the

"greenness" is sold along with the REC, but the community benefits by a savings of approximately three cents per kWh for its power generated by the project.

Extensibility Issues

Baker hoped that the Fox Islands Wind model would make wind energy generation projects more actionable on other island communities across Maine. Many community members, investors, philanthropists, and municipalities expressed interest in exploring wind generation on neighboring islands. As Baker wondered how to extend this model, he made note of some key considerations.

Equipment

In order for Baker to consider bringing his wind solution to other islands he would have to first secure additional wind turbine units. High demand for wind turbines resulted in long waiting lists for equipment. For instance, lead times for GE's popular 400-foot, 1.5MW turbines were three to four years. Wind power could be harnessed using smaller turbines, though more turbines required more land, construction and transportation costs, and also increased noise levels. The larger turbines were in demand for a good reason: a two times increase in turbine blade length generates a four times increase in power. Given timing constraints, however, was it appropriate to wait until larger turbines could be acquired, or should the Vinalhaven model be replicated using more, smaller turbines?

Site Selection

Wind turbine power output is a cubic function of wind speed, thus a doubling of wind speed increases power by eight times. Since wind speed is such a critical factor of turbine power output, careful measurement must be done to select the appropriate wind site. The Vinalhaven site, with average wind speed of 5.3 meters/second (m/s) at 40 meters and 6.5 m/s at 80 meters, would only be classified as "marginal" to "fair" under the U.S. Department of Energy standards.[27] In comparison, a 9 m/s "superb" site would generate 2.7 times more energy than the Vinalhaven site. With much of the Maine coast averaging wind speeds between 6.5-8.5 m/s, the region is a strong candidate for wind energy (see **Exhibit 12** for Maine wind speeds and **Exhibit 13** for Maine wind projects).

Land leasing or acquisition was another important consideration. Each turbine was required to be distanced from surrounding structures by at least 1.5 times its height. For each of the 400-foot-tall 1.5MW Vinalhaven turbines, this translates to a circle with a radius of 600 feet, which would contain the equivalent of 26 acres or (see **Exhibit 14** for turbine site selection). With concerns around noise pollution, the site radius would likely need to be increased substantially in future projects. Property devaluation was another real concern. Although a recent study funded by the U.S. Department of Energy revealed that wind power projects had a negligible impact on property values,[28] many Maine residents remained skeptical. Could these site selection requirements lead to difficulties in land acquisition?

Community Support

Baker acknowledged that overwhelming community support was a key ingredient for the success of Fox Islands Wind. The enthusiasm and resolve of Fox Islands residents helped to make financing, permitting and turbine acquisition much easier. Many residents had been intrigued about wind energy even prior to Baker's committed efforts to advance the idea. This pull-based model solidified community support. Could such a project succeed in a push-based situation, where an island

[27] US Department of Energy, "Maine 50m Wind Power", http://www.windpoweringamerica.gov/pdfs/wind_maps/me_50m.pdf, accessed March 2010.

[28] Ernest Orlando Lawrence Berkeley National Laboratory, "The Impact of Wind Power Projects on Residential Property Values in the United States," http://eetd.lbl.gov/ea/EMS/reports/lbnl-2829e.pdf, accessed March 2010.

community has to be persuaded of the merits of wind energy? George Baker knew that other island communities, plagued by high electricity costs, were closely monitoring the Vinalhaven project.

Developing strong relationships was also a crucial piece of the community story. Trust and existing relationships made it possible for Fox Islands Wind to borrow $1.5 million from the CFC to cover a 20% down payment for the wind turbines. Based on little more than a handshake with Baker, EOS and Cianbro worked for months on the project with no formal contract. A pair of supportive individuals also offered the land lease for the site to the project at a bargain rate. Baker wondered how replicable these key relationships were.

Noise Complaints

Although most of the residents of Vinalhaven considered the wind project to be a resounding success, a small but vocal majority was bothered by the turbine noise (see **Exhibit 15** for turbine noise sources). Baker was concerned that the complaints could escalate to shroud the economic and environmental success of the wind project. More importantly, this controversy had the potential to delay or derail further wind developments on neighboring islands by sapping community support.

With local media and wind energy critics watching closely, Baker knew he had to act quickly to mitigate the concerns. Despite commissioning noise studies and reducing output on one turbine to comply with DEP noise standards, Baker considered taking additional action. Fox Islands Wind could offer to buy the properties of those affected residents, insulate their homes or further scale back turbine power output. Baker wondered whether island ratepayers would support such actions.

Financing

Financing was a key ingredient to the success of Fox Islands Wind. Tax equity credits, favorable financing terms and "green" philanthropists who were committed to the project helped to make it financially viable. But could this type of financing be replicated? Even though the expected returns on tax equity were favorable enough to attract investors, and funding sources were now better informed about this project, the 10% contingent promissory note was subsidized by "green" investors and interested summer residents. Although Baker expected the next project financing to be easier, would Fox Islands Wind be viable without tax subsidies and low-interest government loans? What external conditions were necessary in terms of energy costs, wind and public policy?

Looking Ahead

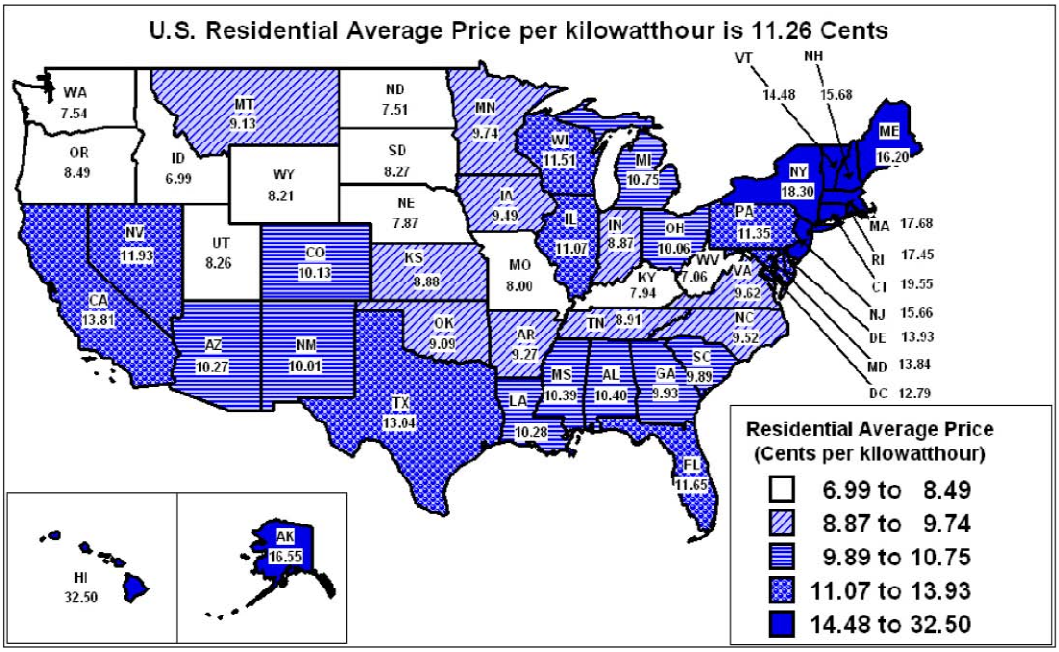
Beyond his expectations, George Baker had become deeply involved in the Vinalhaven community. As Baker leaned back and put his cowboy boots on his desk, he reflected on the history of Fox Islands Wind. He was amazed at what had been accomplished in a short time, especially since he had no prior industry experience. Baker educated himself through extensive reading and close cooperation with strong partners. His past experience as a teacher helped him to communicate the details of the project to residents clearly and to build support. Baker had found leading a project enjoyable. Walking through Vinalhaven and being thanked for his efforts was especially rewarding.

Baker also envisioned what the future held in store. Was this a one-hit wonder, or could this model be extended to benefit other island communities? Then, his phone rang. It was the mayor of a neighboring island who had expressed interest in a wind project. "George Baker," he answered.

Exhibit 1 The Fox Islands of Vinalhaven and North Haven

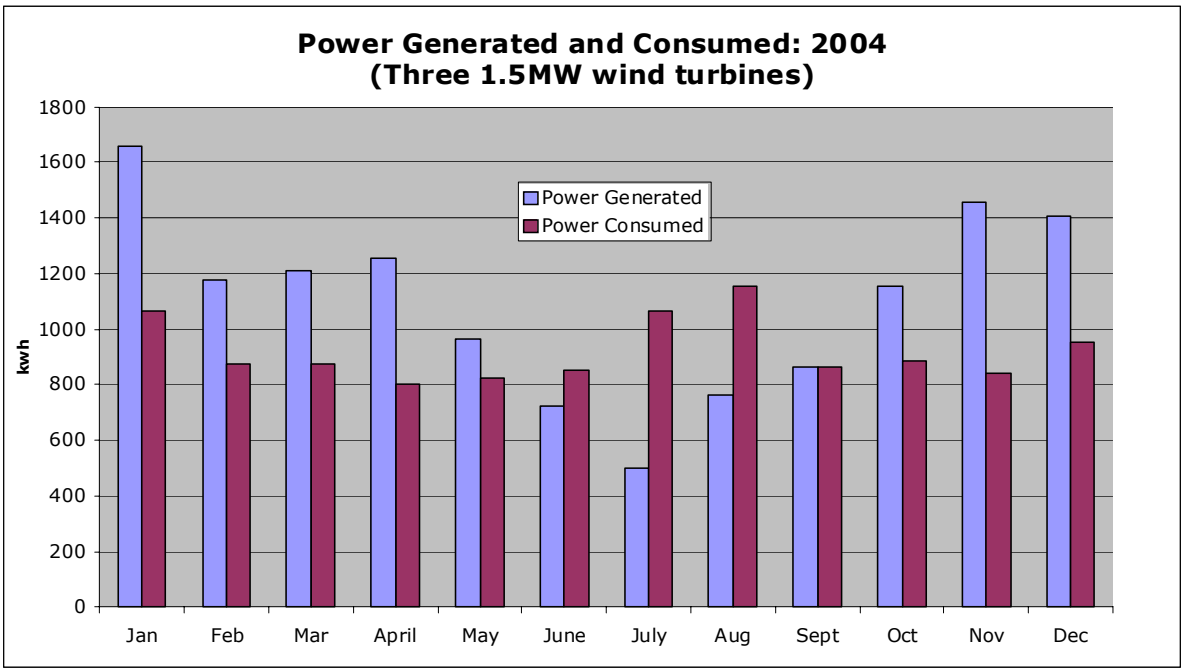
Source: United States Environmental Protection Agency, environment map of Vinalhaven and North Haven, http://www.epa.gov/myenv/MYENVIEW.results2?pQuery=&minx=-69.16065&miny=44.10374&maxx=-69.05766&maxy=44.15918&mw=750&mh=290&ve=13,44.13142,-69.14310&pText=04841,%20ME&pFilter=undefined, accessed April 2010.

Exhibit 2 Average Residential Price of Electricity by State, 2008



Source: U.S. Energy Information Administration, "Annual Electric Power Industry Report," Figure 7.5, http://www.eia.doe.gov/cneaf/electricity/epa/epa_sum.html, April 2010.

Exhibit 3 Energy Usage on Fox Islands



Source: Fox Islands Wind LLC.

Exhibit 4 Timeline of Key Events in the Fox Islands Wind Project

2001	University of Massachusetts begins a three year wind study on Vinalhaven
2003	Bill Alcorn and Del Webster buy the 73 acre Swenson's Quarry site to be used as a wind farm
2005	Fox Islands Electric Cooperative installs a new electrical umbilical connecting the islands to the mainland
2007 (spring)	Island Institute convenes a meeting of the island electric cooperatives to discuss wind power on the islands
2007 (fall)	Fox Islands Electric Cooperative funds a feasibility study of a wind project at Swenson's Quarry
2008	George Baker takes a leave of absence from Harvard Business School and begins to focus on the Fox Islands Wind project in Maine
2008 (spring)	Community meetings to discuss wind project begin on North Haven and Vinalhaven, feasibility, engineering and environmental studies begin
2008 (July)	Ratepayers on both Vinalhaven and North Haven voted overwhelmingly 382-5 to authorize the Fox Islands Electric Cooperative Board to proceed with developing detailed plans to erect up to three turbines on a site in the middle of the island
2009 (June 8)	Site construction commenced
2009 (November 17)	Several hundred islanders gathered at the project site to celebrate the successful, on-time completion of the project

Source: Fox Islands Wind LLC.

Exhibit 5 Biographies

George Baker

George P. Baker is the Herman C. Krannert Professor of Business Administration (on leave) at the Harvard Business School. For the past two years, Baker has been on leave from HBS, serving as the Vice President of Community Wind at the Island Institute, a Rockland Maine based non-profit. He has been the driving force behind the Fox Islands Wind Power project in Vinalhaven Maine, and serves as the CEO of Fox Islands Wind LLC. He has also worked with numerous other communities to explore and develop community wind on the Maine coast. He serves on the Maine Governor's Task Force on Ocean Energy, and is a member of the Advisory Board of Neptune Wind, an offshore wind development company.

At HBS, Baker teaches in the MBA program, as well as in the doctoral program. Prior to joining the faculty at Harvard, he worked both as a consultant with Temple, Barker and Sloane, and as a marketing manager with Teradyne Inc. Baker holds a Ph.D. in Business Economics from Harvard University and an MBA from the Harvard Business School. He lives in Rockland Maine and Newton Massachusetts with his wife, Lauren Jennings, an attorney.

Matthew R. Simmons

Matthew R. Simmons graduated cum laude from the University of Utah and received a Masters degree with distinction in Business Administration from Harvard Business School. He then served on the faculty as a research associate for two years. In 1974, he founded Simmons & Company International. Simmons serves on the Board of Deans Advisors of Harvard Business School and is past President of the Harvard Business School Alumni Association. He is a board member of the Island Institute, which focuses on the Gulf of Maine and its 15 year-round island communities. He also serves on the Board of Directors of Houston Technology Center and the Center for Houston's Future.

Simmons serves on The University of Texas' M.D. Anderson Cancer Center Foundation Board of Visitors (Houston) and is a Trustee of the Bermuda Institute for Ocean Sciences. He is a member of the National Petroleum Council, Council on Foreign Relations and The Atlantic Council of the United States. In addition, he is past Chairman of the National Ocean Industry Association. Mr. Simmons is a Trustee of the National Trust for Historic Preservation and the Farnsworth Art Museum in Maine.

Hannah Pingree

Representative Hannah Pingree was sworn in as the 99th Speaker of the Maine House of Representatives on December 3, 2008. Pingree has sponsored bills that help island communities to develop wind energy projects.

Prior to serving in the Maine Legislature, she was a fundraiser for the U.S. Senate campaign of Chellie Pingree, her mother. She also worked for two years in New York City as the political director and "Election 2000" producer for iVillage.com, the largest political internet site for women. In addition to serving in the Legislature, professionally, Hannah runs a capital campaign to build a new public school facility on North Haven. Hannah is an honors graduate of North Haven Community School, Brown University and was a 1998-99 Fellow for Leadership in Public Affairs for the Coro Foundation in New York City. In the Legislature she represents 11 islands and coastal towns. She grew up on the island of North Haven.

Source: Fox Islands Wind LLC.

Exhibit 6 Photographs of Construction and Opening

Photo by Suzanne Pude/Island Institute (2009)

Photo by Peter Ralston/Island Institute (2009)

Photo by Peter Ralston/Island Institute (2009)

Photo by Peter Ralston/Island Institute (2009)

Source: © Peter Ralston/Island Institute, 2010, http://www.pralston.com/, and Suzanne Pude/Island Institute, http://www.islandinstitute.org.

Exhibit 7 Excerpt from Maine Department of Environmental Protection Noise Requirements

(1) Sound From Routine Operation of Developments.

(a) Except as noted in subsections (b) and (c) below, the hourly sound levels resulting from routine operation of the development and measured in accordance with the measurement procedures described in subsection H shall not exceed the following limits:

(i) At any property line of the development or contiguous property owned by the developer, whichever is farther from the proposed development's regulated sound sources:

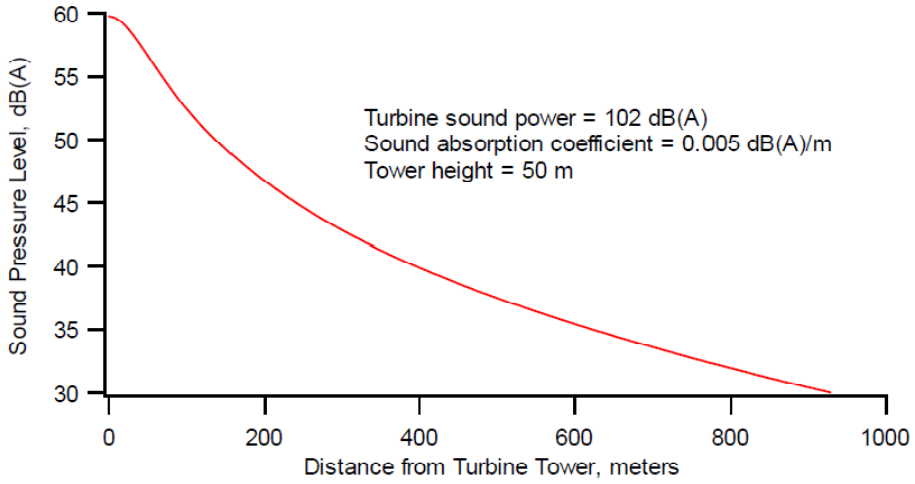
75 dBA at any time of day.

(ii) At any protected location in an area for which the zoning, or, if unzoned, the existing use or use contemplated under a comprehensive plan, is not predominantly commercial, transportation, or industrial;

60 dBA between 7:00 a.m. and 7:00 p.m.
(the "daytime hourly limit"), and
50 dBA between 7:00 p.m. and 7:00 a.m.
(the "nighttime hourly limit").

Source: Maine Department of Environmental Protection, "Rule 06-096, Ch 375, Section 10:C, Sound Level Limits," http://www.maine.gov/sos/cec/rules/06/096/096c375.doc, accessed April 2010.

Exhibit 8 Variation in Wind Turbine Noise by Distance from Turbine



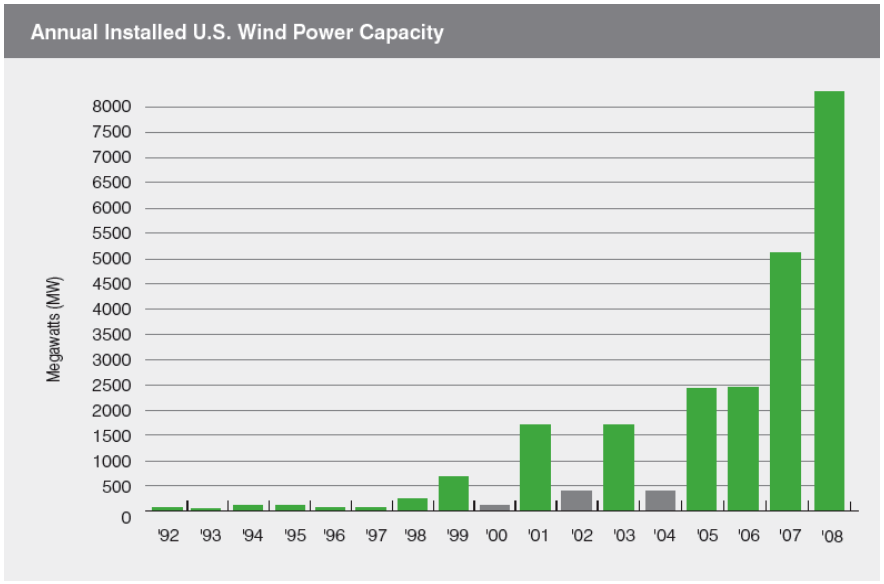
Source: Anthony Rogers and James Manwell, "Wind Turbine Noise Issues," Center for Energy Efficiency and Renewable Energy, University of Massachusetts at Amherst, http://www.npp.ca/images/WindTurbineNoiseIssues.pdf, Figure 7, p 12, March 2004.

Exhibit 9 Estimated Levelized Cost of Electricity Comparison

	Wind	Natural Gas
Capacity (kW)	1	1
Hours in a year	8,760	8,760
Capacity factor	32%	88%
Availability	95%	95%
Interest rate	6.0%	5.0%
Depreciation years	25	30
Depreciation cost	$72	$32
Operating cost (% of capex)	2.00%	2.00%
Capital cost	$1,800	$950
Fuel cost ($/Mcf)		$4.00
Heat rate		7,500
Interest	$108	$48
(+) Depreciation	$72	$32
(+) Operating cost	$36	$19
Annual cost of system	$216	$98
Energy produced (in kWh)	2,663	7,323
Fuel cost ($/kWh)	$0.000	$0.030
Capital recovery + O&M ($/kWh)	$0.081	$0.013
Total dispatch cost	$0.081	$0.043
PTC subsidy	($0.021)	($0.000)
Total $/kWh	$0.060	$0.043

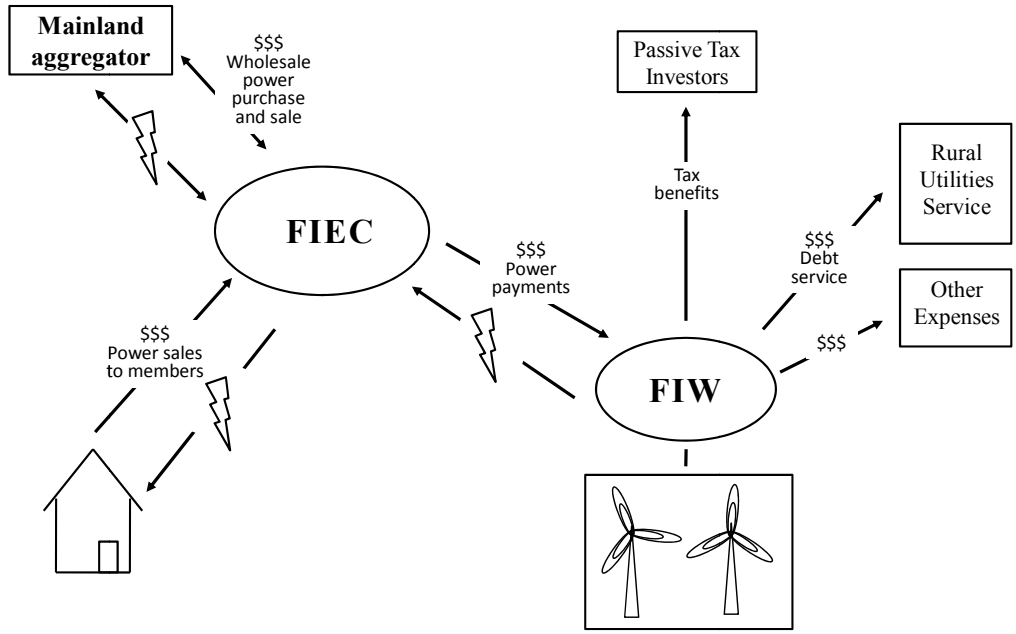
Source: Hammond, Pearce W., Burt Y. Chao, Brian D. Gamble, "Onshore Wind Farm Capital Cost Breakdown," Perspectives and Outlook on Clean Energy," Simmons & Company International, June 11, 2010, p 41.

Exhibit 10 Impact of PTC Lapses on Wind Installations



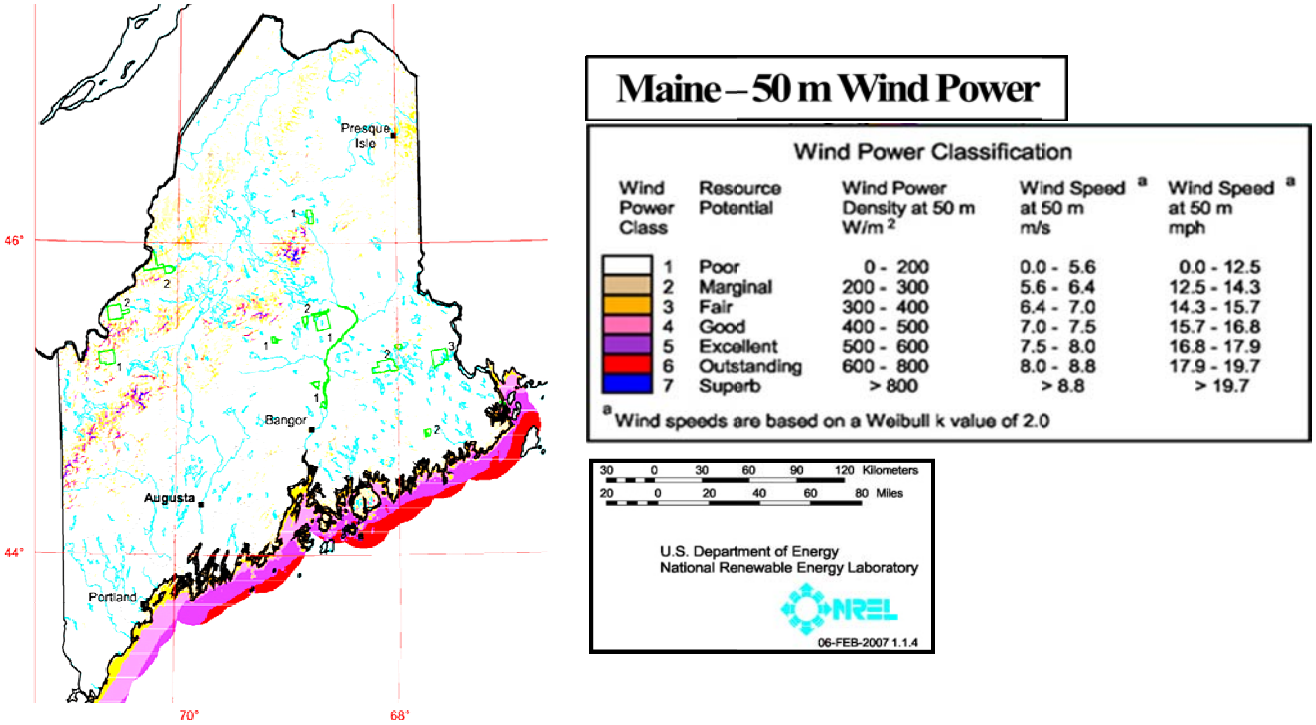
Source: American Wind Energy Association, "Windpower Outlook 2009: Wind: A leading source of new electricity generation," January 17, 2008, p 4, http://www.awea.org/newsroom/releases/awea_market_release_q4_011708.html, accessed April 2010.

Exhibit 11 Corporate Diagram



Source: Fox Islands Wind LLC.

Exhibit 12 Maine Wind Power Classification



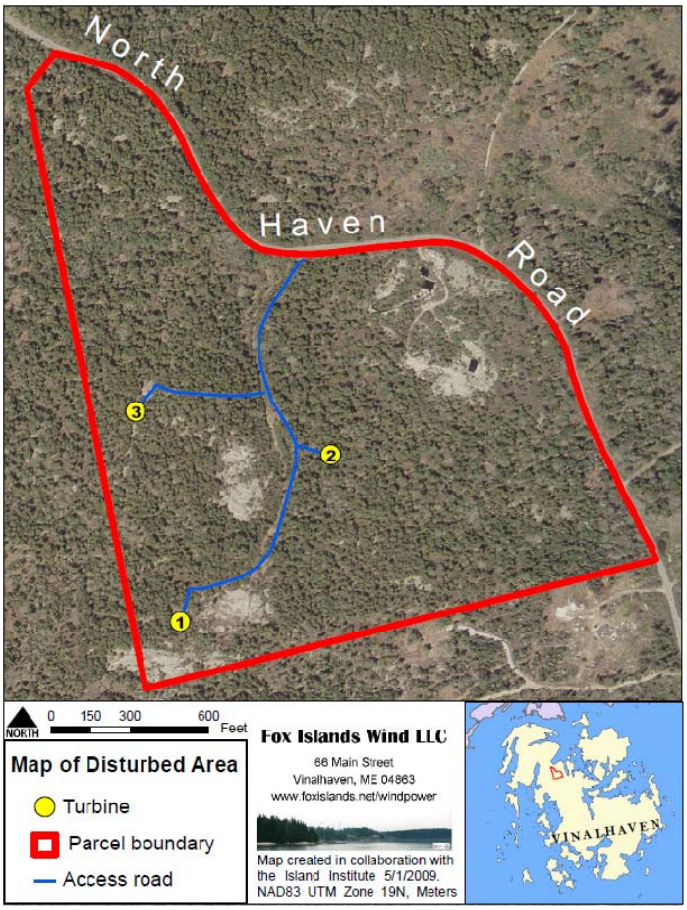
Source: US Department of Energy, National Renewable Energy Laboratory, "Maine 50-meter wind resource map," http://www.windpoweringamerica.gov/maps_template.asp?stateab=me, accessed April 2010.

Exhibit 13 Wind Power in Maine, March 2010

Name	Capacity (MW)	County	Status
Kibby Mtn.	132	Franklin	Partial operation
Rollins Mtn.	60	Penobscot	Proposed
Stetson Mtn.	57	Washington	Operating
Record Hill	55	Oxford	Proposed
Oakfield	51	Aroostook	Proposed
Mars Hill	42	Aroostook	Operating
Longfellow	40	Oxford	Proposed
Stetson II	25.5	Washington	Under construction
Fox Islands	4.5	Knox	Operating
Beaver Ridge	4.5	Waldo	Operating

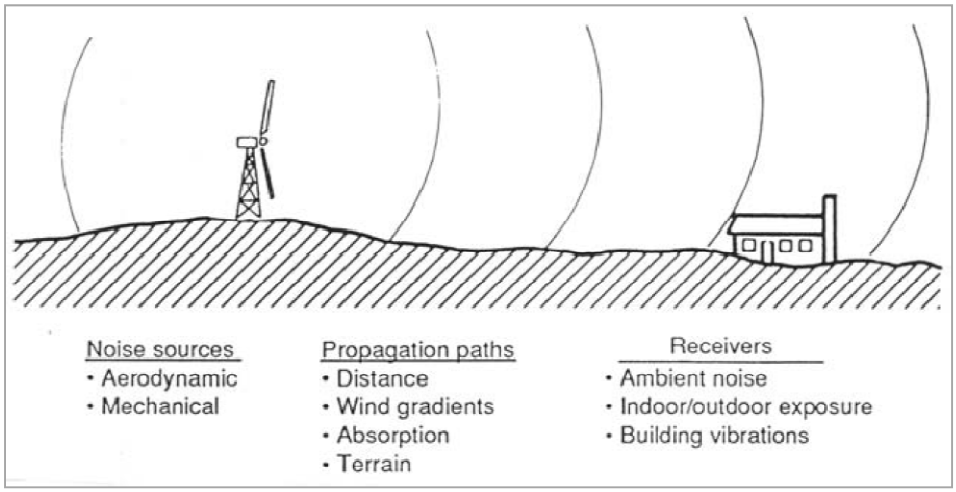
Source: Casewriter.

Exhibit 14 Turbine Site Selection on Vinalhaven Island



Source: National Resources Council of Maine, http://www.nrcm.org/documents/VinalhavenMap.pdf, accessed March 2009.

Exhibit 15 Examples of Noise Sources, Receivers and Propagation Paths



Source: A. Rogers, J. Manwell, S. Wright, "Wind Turbine Acoustic Noise", University of Massachusetts at Amherst Renewable Energy Research Laboratory, January 2006.