RENEWABLE ENERGY PROJECT:

Fig. 1. Ketan Bakar

Proposal for a Wind Farm in Lincoln County, WY

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Every year the United States emits an increasing amount of air pollution, causing a serious health risk and climate change in addition to being environmentally unsound. In 2006 alone, the United Sates emitted 6,000 million metric tons of carbon dioxide (CO_2), the most important greenhouse gas, and by the year 2030 the figure is estimated to rise to approximately 7,900 million metric tons (US DOE 14). Electric power plants are one of the largest polluters, emitting 70 percent of sulfur dioxide (SO_2) emissions, 34 percent of CO_2 emissions, 33 percent of nitrogen oxides (NO_x) emissions, 28 percent of particulate matter, and 23 percent of all heavy metal air toxins (Anderson 1).

The purpose of this proposal is to request approval from Lincoln County Commission to construct a 50 megawatt (MW) wind energy facility consisting of 20, 2.5 MW wind turbines. Development of wind energy is not only an important way to reverse the nation's pollution trend; it also creates jobs, increases state tax revenue, and conserves both water (US DOE 16) and energy. Furthermore, construction of wind energy projects, also known as wind farms, is in keeping with an initiative presented by the US Department of Energy (DOE) in 2006 calling for wind energy to make up 20 percent of electricity supply by the year 2030.

This proposal begins by outlining the need for a wind farm. Second, it explains the proposed plan for addressing the need by developing a wind farm. Third, it shows why Lincoln County is an ideal place for such a facility. Finally, the proposal addresses common concerns regarding wind farms and reviews the benefits of the project.

NEED FOR A WIND FARM

Before explaining the proposed facility in detail, it is helpful to take a look at some of the factors contributing to a need for such a project. Four major problems exist that will be lessened by constructing wind energy facilities:

- Pollution is a growing problem in the United States. The medical community has found that air pollutants lead to respiratory diseases such as asthma and cancer. These diseases are on the rise as pollution increases annually. Further, it is widely held in the scientific community that pollutants destroy natural resources, such as the ozone; contaminate water; and add to global warming.

- The current energy mix used is unsustainable. The large amounts of coal and natural gas currently used in producing electricity are non-replenishable. Also, coal and natural gas plants require a significant amount of water for the cooling process; these plants account for almost half of all water usage in the United Sates (US DOE 16). Broadening the energy mix to include larger amounts of replenishable energy is

necessary to use the non-replenishable resources more responsibly and conserve water.

- The current economy crisis demands solutions that will create new jobs, stimulate the economy, and increase state tax revenue. During construction, a wind farm creates many jobs in construction, management and support, and building the turbine components. Once the facility is operating, jobs are created in maintenance, management, utility services, and the manufacturing of parts and materials. The landowner also receives royalties. Not only are new jobs created, the facility also stimulates local economy with indirect and induced jobs such as banking, accounting, steel mill services, child care services, retail, grocery, public transit, automotive services, dining, and medical services. Furthermore, wind energy facilities are profitable businesses, bringing in much tax revenue. For example, the 144 MW wind farm located in Uinta County, Wyoming brought in $1 million in property taxes in the fiscal year of 2006/2007 (Flowers 24-33).

- The current energy mix requires the use of much imported fuel. Purchasing fuel from the foreign market increases dependence on politically unstable regions of the world and builds their economies at the expense of the United States economy. Conversely, if the wind and other natural energy industries were developed, using the energy produced in the United States would boost the national economy.

The problems listed above will not resolve themselves. Delaying action will only give them time to worsen and burden future generations. It is far better to take the necessary steps to address the problems now rather than to leave them for someone else to resolve.

PROJECT PLAN

The proposed plan is to construct a 50 MW wind farm on private property located in Lincoln County (41° 59.83’ latitude, 110° 45.646’ longitude) consisting of 20, 2.5 MW wind turbines manufactured by General Electric. The 2.5 MW turbines are tubular towers 75 to 100 meters tall (dependent on determined wind conditions) with three rotor blades and will cover approximately 3,000 acres. These turbines are the latest in design and efficiency and require less maintenance downtime than previous turbine models, making them the optimal choice for Lincoln County.

The plan is conducted in four phases. First, an outline of the work currently being done in the planning and permitting phase is outlined. Second is a plan for construction of the wind farm. Third, the operations layout is presented. Finally, a plan for decommission is discussed in preparation for any unseen future technology that may potentially outdate wind farms.

Phase One: Planning and Permitting

The wind farm is currently in the planning and permitting phase. A quick look at this phase is helpful in seeing that everything is, or will be, in order before the project moves forward to the next phase.

- First, an environment assessment was performed. Out of concern about a lack of evidence on the effect developments have on the Greater Sage Grouse (sage grouse), the Wyoming governor's office has mapped some zones of environmental constraints, which were consulted. The proposed land for the project does not fall into any of the constraint zones.

- Second, a Storm Water Pollution Prevention Plan was prepared. In conjunction with the Clean Water Act, this plan is mandated from any construction project that disturbs more than five acres. The needed National Pollutant Discharge Elimination System compliance permit is pending.

- Third, an anemometer tower was constructed on the property to measure the wind power density, speed, and variability. The tower is 60 meters tall and with the information gathered from it the wind power class can be determined. Wind power class is the category by which a geographic location is defined numerically, from class one (poor wind resource) to class seven (excellent wind resource).

- Fourth, this proposal was prepared to request approval from Lincoln County Commission to construct the wind farm.

This phase can reasonably be completed within one year, by which time the plan will have progressed to phase two.

Phase Two: Construction

This phase requires use of heavy equipment such as bulldozers, graders, trenching machines, concrete trucks, flat-bed trucks, and large cranes.

- First, roads will be laid to give access to where the wind turbines will be placed.

- Second, the sites for the turbine towers and ancillary structures will be excavated and concrete foundations will be poured.

- Third, the cables will be laid and the collection system and substation will be built. A trench will be dug and the electrical and communication cables will be laid underground.

- Fourth, the wind turbine towers will be erected. The nacelles, which sit atop the towers and house the turbines' electrical generators, will be mounted and the rotors will be attached. After all the wind turbine towers are standing, a system-wide test will be performed to test the electrical connections between the turbines and the power collection system.

The construction process for wind farms can generally be completed within one year. Once it ends, few on-site personnel are needed and little maintenance is required. The traffic and heavy equipment required during the construction phase will lessen significantly.

Phase Three: Operation

Wind farms are almost completely automated; the turbines each monitor wind conditions and automatically turn on when enough wind is present (approximately eight miles per hour) and shut down when the wind is too strong (approximately 56 miles per hour). Each wind turbine controls critical functions and records information in the Supervisory Control and Data Acquisition (SCADA) system. The SCADA system monitors the wind turbines and is capable of diagnosing the cause of any failures that may occur.

The typical lifespan on General Electric's 2.5 MW wind turbines is approximately 20 years, after which they will have to be replaced. Construction to replace aging equipment will take place in the operation phase in addition to regular maintenance.

Phase Four: Decommission

As indicated above, no intentions currently exist to decommission the wind farm, but a decommission plan is in place to prepare for future technological changes that could potentially make decommissioning necessary.

- First, the wind farm structures will be dismantled. This includes the wind turbines, overhead collection system, underground cables, and ancillary structures. The concrete foundations will also be removed.

- Second, all equipment, scraps, and garbage of any kind will be removed from the property. Where possible, materials will be recycled; otherwise, they will be properly disposed of.

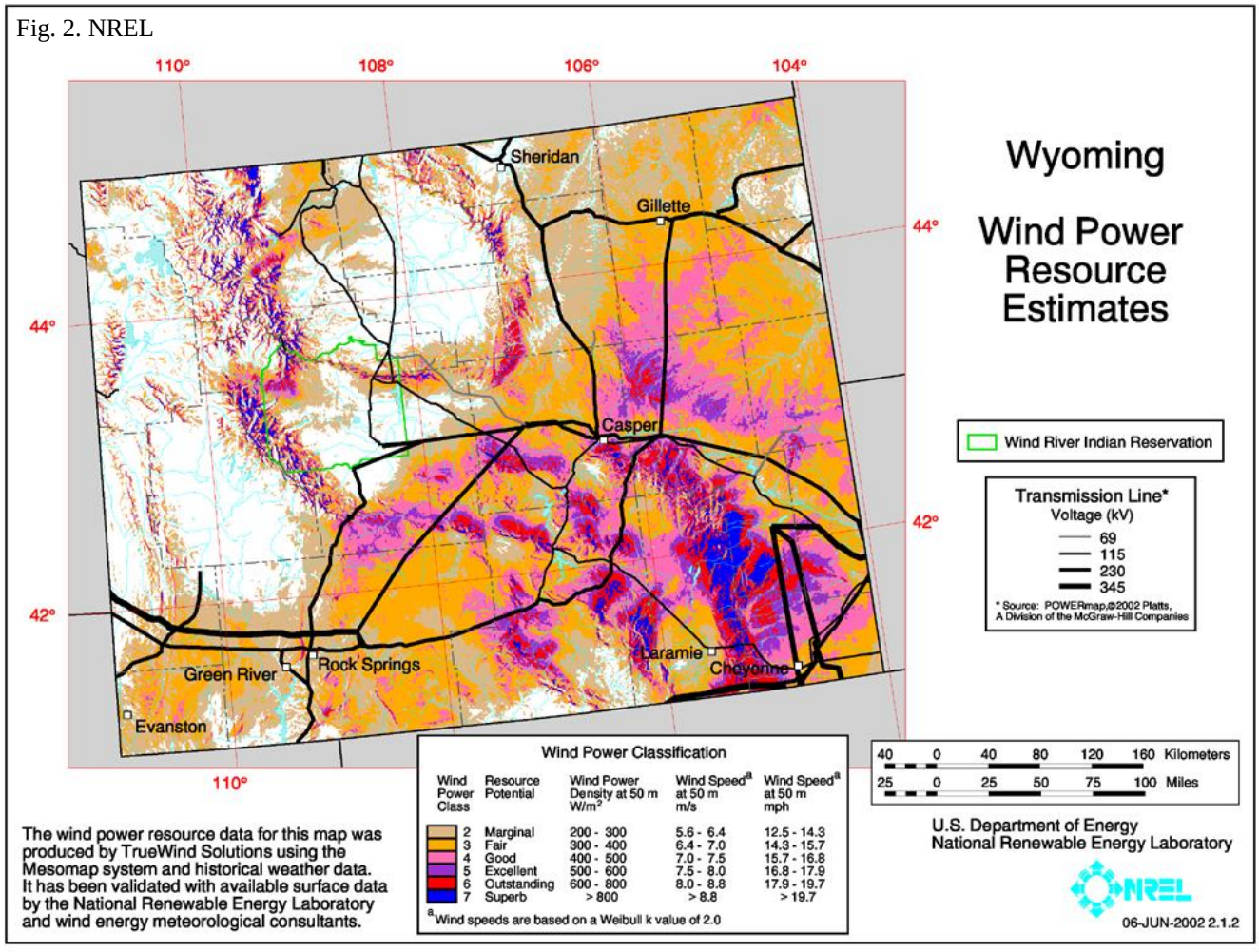
- Third, the roads will be filled in and vegetation will be restored; the property will be left in its natural state, prior to use as a wind farm.

WHY LINCOLN COUNTY?

Now that a look has been given into the importance of wind farms and the project plan, it is beneficial to review the reasons Lincoln County is the ideal place for a wind farm. In the proposed location, the wind quality is favorable and the Pacific Corp. transmission line runs directly through the property, making wind energy commercially feasible. The property is located in an area without wind farm restrictions imposed by the Wyoming governor's office. Finally, no one lives near enough the property to be disturbed by the construction or operations.

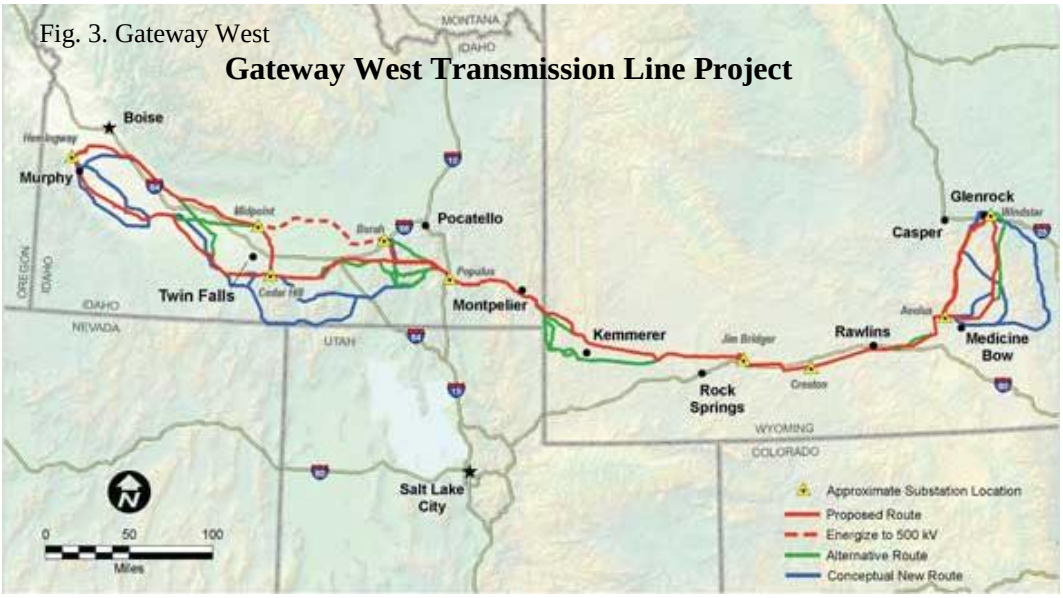
The first attribute to evaluate in a potential wind farm is the quality of the wind. The National Renewable Energy Laboratory (NREL) (2002) estimates the wind power class to be class four (NREL 1). An anemometer tower has been constructed to measure a precise wind power class, but it is too new to report annual averages. This wind power class is high enough that a wind farm would be nationally competitive.

Fig. 2. NREL



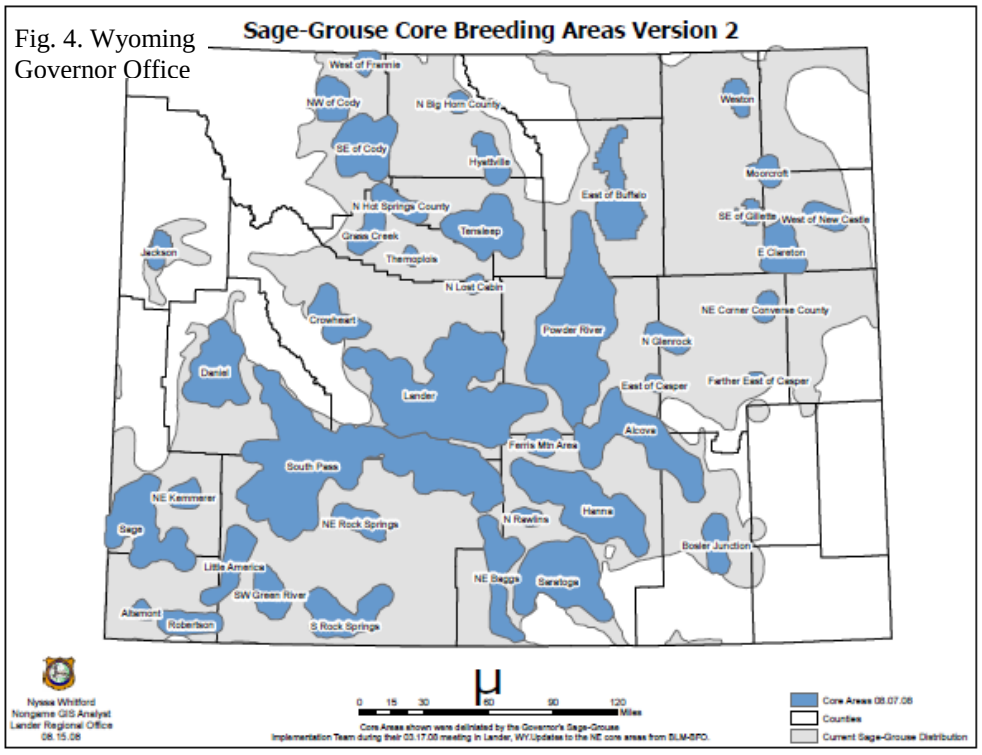
In addition to the Pacific Corp. transmission line running directly through the property, Gateway West has also announced a plan to build a new transmission line. Gateway West is considering two different routes for their new line, both of which run through the property. Having ready access to two transmission lines is beneficial for competition.

Fig. 3. Gateway West



Placement of the wind farm is also ideal from an environmental perspective. There are no wind farm restrictions imposed by the Wyoming governor's office because it is outside sage grouse breading grounds, as seen in the map below.

Fig. 4. Wyoming Governor Office



Wind farm construction and operations will not disturb residents because the property is remote. The nearest neighbors are approximately five miles away; the noise created by the wind farm will not carry such a distance.

ANSWERS TO COMMON CONCERNS AND BENEFITS

This final section will begin by answering commonly expressed concerns regarding wind farms and then will continue with a review of the benefits of creating wind farms.

Answers to Common Concerns

Several concerns exist that either downplay the importance of wind farms or oppose them altogether. These concerns deserve real consideration and answers; supporting wind farms is difficult as long as concerns due to misinformation exist. The five concerns discussed here are: emissions, the cost of throttle-backs, the cost of wind energy, the noise of wind farms, and bird deaths.

Myth: Wind energy does not reduce emissions. The argument made in support of this myth is that because wind does not blow constantly, backup energy must be produced alongside wind energy and there is no change in emissions. The truth is that power usage is extremely variable; so both spinning reserves, which are power plants that are held back from producing at their full potential, and non-spinning reserves, which are plants that do not operate unless more energy is needed, are used with the current system to allow energy production to fluctuate with demand. Wind variability is small enough that it is lost in the variability of power demand.

In the worst case scenario, adding 3 MW of wind energy to an electric grid requires an additional 0.01 MW produced from spinning reserves and 0.07 MW produced from non-spinning reserves. The increased emissions resulting from inefficient production in spinning and non-spinning reserves could add up to just under one pound per hour for 3 MW of wind energy. However, using 3 MW of wind energy reduces emissions by approximately 1,200 pounds per hour (Goggin 2).

Myth: Wind energy creates throttle-backs, which cost money. The argument behind this myth is that energy created by spinning and non-spinning reserves is more expensive than energy produced from plants operating at full power since the reserve plants are functioning inefficiently. In answer to this concern, these throttle-backs happen every day in meeting fluctuating needs with or without the use of wind energy. As seen in the previous paragraph, adding wind energy can add to the need of reserves, but not significantly. Wind energy is far lower cost than energy created in alternative power plants, so when wind energy is available it takes the place of higher-cost, less-efficient energy. This saves money rather than adding to expenses (Gray 3).

Myth: Wind energy is too costly. Opponents of wind energy claim that wind energy has to be heavily subsidized by the federal government because it is too costly to be marketable without. It is true that the federal government gives subsidies for wind energy, but these subsidies are dwarfed by subsidies given to other power plants. Over the last 50 years the federal government subsidies to wind, solar, and nuclear energy production have totaled $150 billion. Of this money, $142.5 billion was given for nuclear energy, leaving only $7.5 billion shared between wind and solar energy.

Despite receiving smaller subsidies, wind energy is highly competitive in the energy market, as has been seen in Texas. Utilities in Texas were required by state law to install 400 MW of wind energy by the beginning of 2003. As they began installing wind farms, though, they found them to be less expensive than their other alternatives and instead of installing 400 MW, they installed 900 MW of new wind energy one year earlier than required by law (Gray 2).

Myth: Wind farms are too noisy. Modern wind turbines generate very little noise because of changes such as sound-proofed nacelles, the part of the wind turbine that houses the generator; rotors that are placed further away from the tower; and design changes to the rotors that makes them more efficient. The turbines generate a broadband, meaning constant, noise that is only approximately 40 to 50 decibels at a distance of 750 to 1000 feet (Anderson 22-23).

Myth: Wind farms kill a large number of birds. For years wind farms have been criticized for the number of birds killed by collision with turbines. The wind farms in operation have performed many studies to obtain a count of birds killed. It has been found that wind farms located in migratory paths have higher bird fatality rates, but that even these rates are significantly lower than bird mortality due to collision with other structures. The following are estimates of annual bird collision mortality in the United States (Erickson 1):

- Vehicles: 60 million to 80 million
- Buildings and windows: 98 million to 980 million
- Power lines: tens of thousands to 174 million
- Communication towers: 4 million to 50 million
- Wind farms: 10,000 to 40,000

One reason for the difference in mortality rates between wind farms and the other structures on the list is the difference in the number of structures in each category. Yet, studies show even if wind farms were numerous, they would still only contribute to a small percentage of all collision deaths. Another problem with the above data is none of the other structures have been as thoroughly studied for bird collision mortality rates as have wind farms, which is why some of the estimates give a very large range. This concern is one that warrants additional studies performed on both wind farms and other structures for more accurate data, but studies performed thus far give reason to be optimistic about bird safety in wind farms (Erickson 19).

Benefits

The benefits to constructing a wind farm are: reduced pollution, usage of renewable energy, stimulated economy, and stabilized costs and prices.

Wind farms reduce pollution. Though wind energy currently makes up only approximately one percent (US DOE 2) of the current energy mix for electricity supply, it reduced CO_2 emissions by over 28 million tons in 2007 (Goggin 1). If the DOE's initiative calling for wind energy to make up 20 percent of electricity supply by the year 2030 were accomplished, it would mean a reduction of 825 million metric tons of CO_2 emissions in 2030 alone. Not only would projected annual emissions decrease, but cumulate emissions from the electronic sector would also decrease by more than 7,600 million metric tons through the same year (US DOE 14).

Wind farms make use of renewable energy. Using renewable energy conserves earth's limited coal and natural gas stores, making them last much longer. It also conserves water because wind energy does not require water for cooling as do other types of energy generation. Having a diversified energy mix increases stability by decreasing reliance on any one type of energy in the mix. Currently, too much reliance is placed on coal and natural gas.

Wind farms stimulate the economy. A wind farm will stimulate economic growth and increase tax revenue, even during recession years such as are presently seen. Though the 144 MW wind farm located in Uinta County, Wyoming is a larger wind farm than is being discussed in this proposal, it provides a good example since it is nearby and was constructed only six years ago. During the peak of construction, the Uinta project employed 175 workers, 25 percent of whom were local citizens. During that time, 50 Wyoming companies were subcontracted for the construction. Currently, eight fulltime employees run the wind farm. The property taxes on the wind farm in the fiscal year 2006/2007 totaled $1 million. In addition to direct jobs, wind farms also stimulate the economy with indirect and induced jobs (Flowers 33).

Wind farms have stable costs and prices. Not only is wind energy cost-competitive with energy generated in other ways, costs are much more stable than energy generated by coal or natural gas. The costs of operating a wind farm are minimal, making energy from this source less likely to increase rapidly in expense due to changing economy and political movements.

CONCLUSION

Thank you for considering the proposed wind farm in Lincoln County (41° 59.83' latitude, 110° 45.646' longitude). The partners in the venture, Boyd Jacobson and Dan Schwab, will be available to discuss the planned wind farm further. You can reach Boyd Jacobson at 801-829-5528 or Dan Schwab at 307-690-4191.

APPENDIX: REFERENCES

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