Wind Energy: Issues to Consider

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Average residential electric prices in Texas have increased approximately 58 percent, or from 8.1 cents per kilowatt hour in 2002 to 12.7 cents per kilowatt hour in 2006. Steadily growing demand for electricity and rising input costs for electric generation are largely responsible for this increase. As producers look to increase capacity ahead of demand, increased regulations and environmental concerns over greenhouse gases have opened the door to renewable sources of electricity production, such as wind. According to the World Wind Energy Association (WWEA), 14,900 megawatts (MW) of wind generation capacity were added worldwide in 2006, with the U.S. leading the way adding 2,454 MW.[1] Overall, Germany leads the world in wind capacity while the U.S. has recently surpassed Spain to reach the second position.[2]

In the U.S., Texas claims the top spot in installed wind capacity with 4,356 MW, or 26 percent of total U.S. capacity, as of the end of the fourth quarter of 2007.[3] Texas accounts for another 1,238 MW of the 3,626 total capacity that is under construction in the U.S.[4] In addition, Texas ranks second in wind energy potential, meaning a large portion of the state has winds that are suitable for wind energy generation for small farm, ranch, or residential applications or large wind farm applications. Furthermore, federal and state incentives for renewable energy generation have created a favorable environment for investment in wind energy systems. For those landowners who find themselves in a suitable location for wind energy production, the following is a general overview of issues to consider for both small and large wind applications. More detailed information can be found via the links provided.

Small Wind Applications

Landowners looking to add a small wind turbine for farm or residential use are generally referred to as small wind applications, or up to 100 kilowatts (kW) of generation capacity. A typical farm or residential application consists of a 10 kW turbine mounted on

an 80 foot tower and costs around $3,000-$5,000 per kW of generation capacity.[5] If a battery storage system is used to store excess electric generation, this generally will double the cost of the system. Federal and state incentives may help to offset the capital cost so it is important to become familiar with those early in the process.

Before embarking on such a project, it is important for landowners to research and review all applicable local, state, and federal laws and regulations. Small wind systems can be installed as stand alone systems, or as grid connected systems. Grid connected systems generally require the approval of the utility provider. Utilities are required by federal law to purchase production from independent providers at the utility's avoided cost of generation, however, this does not apply to electric cooperatives.[6] Several factors must be examined when considering an investment in a small wind system: wind availability or class, zoning restrictions, generation capacity needed, site selection, and utility interconnection.

First and foremost, does the potential site have sufficient wind availability for a turbine to operate? Generally, small, grid-connected wind applications require a minimum annual average wind speed of 5 meters per second (mps) or close to 11 miles per hour (mph).[7] It should be pointed out that each year technological improvements in the turbines allow for economic efficiency at lower wind speeds. It is best to check your manufacturers' recommendations.

Annual average wind speed data for the U.S. can be found on the National Renewable Energy Laboratory's website. Texas data can be found at the Texas State Energy Conservation Office (SECO) website while more specific weather station locations can be found on the National Climatic Data Center site (websites are listed at the end). For small wind applications, this data is a reliable source to use when determining if your location has sufficient wind to power a turbine. A class 2 wind is generally recommended as the minimum for small wind applications.[8] For a more accurate record of wind data at a specific location,

a tower mounted anemometer is the best method to do so. An anemometer is an instrument that is used to collect wind speed and directional data over time, typically a year or more. These systems are generally not cost effective for small wind applications as they generally cost from $14,000 for a 50 foot tower to $25,000 for an 80 foot tower.[9] To help offset this cost, SECO has implemented an anemometer loan program, administered by the Alternative Energy Institute at West Texas A&M. This program provides the data logger, sensor(s), and wiring for the landowner provided tower.[10]

Once it is determined that there is sufficient wind for a turbine, the next step is to review local zoning restrictions, if applicable. Suburban or rural zoning restrictions must be carefully studied with regard to the use of wind turbines, the tower height, and the noise produced. First, one must check zoning restrictions to make certain turbines are allowed or take the necessary steps to get permits. Tower height may be restricted due to nearby airports or to ensure the tower would fall completely on your property in the event of a structural failure. The noise level emitted from the turbine must be in compliance with stated noise restrictions.

Next, an estimate of annual electric needs must be computed to determine optimal generation capacity. This can be accomplished by looking at historical electric bills to determine monthly and/or annual usage. According to Bergey, residential homes typically consume 1,000 to 2,000 kilowatt-hours of electricity per month which translates to a turbine rated between 5-15 kW.[11] They list their 10 kW unit (BWC Excel-S) as the best selling residential unit in the U.S.[12] For those looking at adding a turbine for a specific farm use such as an irrigation pump, turbine capacity would be estimated based on the equipment manufacturer's electric requirements and turbine manufacturer recommendations. Once annual consumption is estimated, investors can research different turbine manufacturers and work with them on selecting a turbine.

When selecting a site, it is also a good time to contact your utility provider to begin determining and preparing for their requirements to connect to the grid. A favorable site relies on a combination of features, including zoning restrictions, topography, and proximity to transmission lines. It is important that the turbine be mounted at least 30 feet higher than existing structures, such as trees and buildings, within 300 feet to ensure consistent wind flow without turbulence. If the potential wind turbine site is near an airport or landing strip, the Federal Aviation Administration has regulations that must be taken into consideration when selecting the tower height. If a connection to the grid is desired, proximity to existing transmission lines is an important consideration that will affect the total investment. Generally, utility companies will extend transmission lines a certain distance at no charge, then a fixed amount per foot thereafter. Selecting a site that is both geographically favorable and is in close proximity to transmission lines is ideal. If this is not possible, both factors must be weighed in determining which is most economical or practical for your situation.

Once the site is selected and the turbine is in place, its time to get it online. If the unit is a stand alone system, or will only be connected to a house or specific farm or ranch equipment, the turbine manufacturer should aid in this transition with knowledge and expertise as to appropriate equipment that will be needed, such as an inverter. Those connecting to the grid will need to contact their utility company to aid in the connection. For this type of system, the Public Utility Commission of Texas has a publication, the Distributed Generation Interconnection Manual, which covers safety and technical requirements for installing a distributed generation system.[13] In general, utilities will require some type of interconnection agreement. These agreements generally outline the terms, whereas excess production that goes into the grid will be purchased by the utility provider at a standard price. For those systems with net metering, an agreement will be required as well with the utility provider. Net

metering is a simplified method of metering electricity produced and consumed by a home or farm with its own electric generation capacity. Specifically, the meter on this type of system spins backward when the turbine is producing more electricity than the home or farm is using. The consumer is only billed for the net energy consumed during the billing period, essentially receiving the retail value for electricity produced.

Large Wind Applications

Landowners who are in an area with class 3 or higher winds may be seeing an increasing number of large wind developments in their area. Just as for the small wind applications, the wind speeds required for efficient operation are declining. These projects are typically measured in megawatts for the combined capacity of all turbines, where each turbine may have a rated capacity of up to 3 MW. Developers negotiate with landowners for the right to place one or typically multiple turbines on their land. For landowners considering leasing their land for a wind project, there are a number of factors that need to be considered. Although it is not a requirement, it is a good idea for landowners to consult with a lawyer when negotiating or reviewing lease terms and conditions. Some similarities may exist between traditional mineral leases and wind leases, however, there are a number of fundamental differences the landowner must be aware of when entering into a wind lease agreement, including, but not limited to, lease terms, royalties, surface rights and other agreements such as easements and meteorological towers.

When preparing to negotiate or examining a contract to lease your property for wind energy, it is important to keep in mind both parties are working toward a mutually beneficial agreement. Consult with neighbors, lawyers, or provided references to get a concept of the general lease terms and conditions in your area. In addition, review any mineral or other leases on the property under consideration for conflicts. It is important that surface rights are upheld with

regard to current revenue sources such as ranching or farming. Some types of hunting may be limited or prohibited in the terms of the agreement, such as hunting with a centerfire rifle, as some agreements may limit the amount of deer hunting while others may prohibit it. Those relying on hunting as a primary revenue source may negotiate compensation for lost revenue if the developer does not allow rifle hunting. In general, most wind energy leases have a 20 year term. Royalties from electricity produced typically begin at 2-4 percent and may escalate up to 6 percent over the 20 year term, which translates to around $2,000 and up per turbine per year.[14] Recent (2008) experience in Texas indicates that as the turbines generation capacity increases, the minimum level per turbine increases to around $4,500 per year.[15]

Other agreements considered in addition to the land agreement are surface rights, easements for primary outgoing transmission lines, and/or substations, and a lease for meteorological tower(s). With wind leases, surface rights are typically specified in the agreement, as the lessee has no automatic right to use the surface.[16] If the land allows, transmission lines from each turbine will typically be located underground, along with wiring for turbine controls, to the primary outflow lines. The primary outgoing transmission lines are located above ground to the substation and subsequent main transmission line on the grid. In addition, developers may seek permission to lease land for a meteorological tower to collect wind speed and directional data for the wind development. Either or both of these may be included in the primary lease agreement or treated as a separate agreement.

Remember, this is not intended to be a comprehensive list of wind lease terms and conditions. Proper research and consultation with professionals experienced in wind lease agreements is a good complement to the negotiation process. An excellent resource for wind lease considerations can be found through the link on the following page. A number of additional resources for landowners researching wind energy are also listed.

Wind Lease Considerations
- http://recenter.tamu.edu/pdf/1856.pdf

Wind Energy Glossary
- http://www.undeerc.org/wind/literature/Wind_Glossary.PDF

Federal & State Incentives
- http://www.dsireusa.org/
- http://www.dsireusa.org/library/includes/genericfederal.cfm?CurrentPageID=1&state=us&ee=1&re=1
- http://www.seco.cpa.state.tx.us/re_wind-incentives.htm

Small Wind
- http://www.seco.cpa.state.tx.us/re_wind_smallwind.htm
- http://www.eere.energy.gov/windandhydro/windpoweringamerica/pdfs/small_wind/small_wind_guide.pdf
- http://www.eere.energy.gov/windandhydro/windpoweringamerica/pdfs/small_wind/small_wind_corn.pdf
- http://www.eere.energy.gov/consumer/your_home/electricity/index.cfm/mytopic=10880
- http://www.awea.org/smallwind/

Wind Availability
- http://www.seco.cpa.state.tx.us/re_wind_maps.htm
- http://www.nrel.gov/wind/resource_assessment.html
- http://rredc.nrel.gov/wind/pubs/atlas/maps.html
- http://www.nrel.gov/gis/wind.html
- http://www.ncdc.noaa.gov/oa/ncdc.html

Site Selection
- http://www1.eere.energy.gov/windandhydro/federalwindsiting/
- http://www.awea.org/smallwind/toolbox2/INSTALL/evaluate.html
- http://www.eere.energy.gov/windandhydro/windpoweringamerica/siting.asp

Equipment Providers
- http://www.awea.org/smallwind/smsyslst.html

Utility Interconnection
- http://www.awea.org/smallwind/toolbox2/grid_connecting.html
- http://www.dsireusa.org/library/includes/incentive2.cfm?Incentive_Code=TX10R&state=TX&CurrentPageID=1&RE=1&EE=1
- http://www.puc.state.tx.us/electric/business/dg/dg.cfm

Net Metering
- http://www.awea.org/pubs/factsheets/netmetfin_fs.PDF
- http://www.dsireusa.org/library/includes/incentive2.cfm?Incentive_Code=TX02R&state=TX&CurrentPageID=1&RE=1&EE=1

Economic Model
- http://www.eere.energy.gov/windandhydro/windpoweringamerica/docs/small_wind_economic_model.xls

References

[1] World Wind Energy Association (WWEA), available online: http://www.wwindea.org.
[2] West Texas Wind Energy Consortium, "West Texas Wind Wire". Volume 3, Issue 6, November 2007.
[3] American Wind Energy Association (AWEA), available online: http://www.awea.org.
[4] Ibid.
[5] Ibid.
[6] Ibid.
[7] American Wind Energy Association (AWEA), available online: http://www.awea.org.
[8] Bergey Windpower Company, available online: http://www.bergey.com/.
[9] AAT Inc., available online: http://www.aat-solutions.com/?id=19
[10] Texas State Energy Conservation Office, available online: http://www.seco.cpa.state.tx.us/re_wind_smallwind.htm#loan
[11] Bergey Windpower Company, available online: http://www.bergey.com/.
[12] Ibid.
[13] Public Utility Commission of Texas, available online: http://www.puc.state.tx.us/electric/business/dg/dg.cfm
[14] Energy and Environmental Resource Center, "Harvesting the Wind". University of North Dakota, April 2003.
[15] Fuqua, James. Personal Communication. May 12, 2008.
[16] Fambrough, Judon. "Wind Rights and Wrongs."Tierra Grande. Journal of the Real Estate Center at Texas A&M University, April 2008.

Photography by Brian J. Frosch in Nolan County, TX, and James W. Richardson in Garza County, TX.

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