2020

Lincoln Land Wind Project

Siting Application Review

Morgan County, Illinois

Project No. 22053.040

Rev Number	Description	Responsible	Date
1.0	Final	Matt Minder	August 2020

Prepared By:

Patrick Engineering Inc.

LINCOLN LAND WIND PROJECT – MORGAN COUNTY, ILLINOIS
SITING APPLICATION REVIEW

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INTRODUCTION

This report has been prepared by Patrick Engineering Inc. (Patrick) on behalf of Morgan County, Illinois. Patrick performed a review of the Lincoln Land Wind Project (Project) proposed by Lincoln Land Wind LLC (Applicant), a subsidiary of Apex Clean Energy. The Project consists of installing up to 107 wind turbines (wind energy conversion system, WECS) to provide up to 302 MW of electric generation, and installing underground 34.5kV cabling from each turbine to a central collection substation, where the generated electricity will be "stepped up" in voltage and transferred to an Ameren 345kV substation and transmission line. An operation & maintenance (O&M) building will be installed adjacent to the collection substation to service the Project during its proposed operating life of at least 20 years.

In accordance with State law, the County must hold a public hearing for the County Board and general public, and the County Board must decide on the Project's siting within 30 days of the public hearing.

METHODOLOGY

Patrick received a digital copy of the 2,411-page application (Siting Application) submitted to Morgan County (County) by the Applicant dated February 18, 2020. Patrick reviewed the application to evaluate the following:

- Whether appropriate local, State, and Federal agencies have been contacted with respect to Site impacts (e.g., environmental impacts),
- Whether sound compliance is met using the wind turbines proposed by the Applicant, based on an independent review of Applicant's data and sound compliance study,
- Whether the decommissioning plan and associated financial assurance proposed by the Applicant is adequate for the County's use in decommissioning the WECS and restoring Project property to approximate pre-Project conditions, in the event of Applicant default.

This report includes the findings from Patrick's application review, and our opinions and recommendations for the County to consider in responding to the Applicant's Project siting request.

FINDINGS

Findings of Patrick's review are discussed herein.

1. Agency Contacts

Check that the appropriate agencies have been contacted regarding impacts to threatened and endangered species, wetlands and historic preservation, etc. This review is expected to include requirements by local road authorities, the County, IDNR, IEPA, Illinois Historical Preservation Agency, Illinois Farm Bureau, US Army Corps, the FCC, and Federal Aviation Agency.

The Applicant understands that there are or may be approvals required from the following agencies as noted in various parts of the application:

- Federal Aviation Administration (FAA)
- US Army Corps of Engineers (USACE)
- US Fish and Wildlife Service (USFWS)
- Illinois Department of Natural Resources (IDNR)
- Illinois Environmental Protection Agency (IEPA)
- Illinois Historic Preservation Agency (IHPA)
- Illinois Department of Agriculture (IDOA)
- Morgan County Engineer and local Road Commissioners

The Applicant has prepared documentation and studies to address specific requirements of many of the above authorizing agencies, such as:

- Determinations of No Hazard for the FAA,
- Wetland delineations for USACE,
- Habitat studies of Federal-listed species for USFWS,
- Wetland/floodplain evaluations and ecological consultation of State-listed species and habitats for IDNR,
- Sound compliance studies for IEPA,
- Archaeology and historic site investigations for IHPA, and
- Agricultural Impact Mitigation Agreement (AIMA) with IDOA.

The Applicant has also evaluated local road conditions to address concerns of the County Engineer and local road district commissioners. Various additional studies regarding shadow flicker, economic impacts, property value impacts, emergency response, and communication networks have also been performed to address County and local concerns.

2. Sound Compliance

Patrick completed a review of the sound compliance report provided by the Applicant as Appendix 4 to the Siting Application. Our report is provided as Attachment B.

3. Decommissioning Plan and Financial Assurance

Patrick completed a review of the decommissioning plan provided by the Applicant as Appendix 7 to the Siting Application. Our review is provided as Attachment C.

OPINIONS AND RECOMMENDATIONS

The below opinions and recommendations are written for the County's consideration. Where we recommend that Applicant provide additional information, such information should be provided by the Applicant in a reasonable timeframe that allows the County to incorporate such information in its decision-making process (by date of public hearing) or that may be incorporated as a condition to siting approval, should the County decide to approve the wind farm siting prior to the information becoming available.

1. Agency Contacts

   Patrick's review of the provided reports did not indicate any significant environmental concerns. It is likely that the Applicant will be able to gather and provide sufficient information to the approving agencies in order to obtain the required regulatory approvals to construct and operate the Project.

2. Sound Compliance

   Patrick performed a study to define the regulations applying to the noise assessment for the Lincoln Land Wind Project, review the noise modeling predictions supplied by the applicant, develop independent calculations, and compare the results. The comparative analysis shows the noise levels are within the regulatory limits for each receptor location. Patrick compared and validated the results for four locations. Patrick used the standard to model the site with the site's key factors, on a worst-case scenario.

3. Decommissioning Plan and Financial Assurance

   In Patrick's review of the Decommissioning Plan, our draft recommendations include:

   - Provide details on the lengths of access roads and crane paths to be restored.

- Provide details on the lengths and types of public roads to be restored.
- Provide details on the area used at each turbine location for laydown, processing, and removal of wind turbine components.
- Confirm or include soil reclamation / restoration costs for the substation and (if required) Project laydown areas.
- Confirm or include indirect costs for the Project in accordance with the County Ordinance requirements.
- Specifically address any differences between the County Ordinance requirements and AIMA requirements within the Agreement, so that both parties clearly understand which requirements govern the Developer's decommissioning responsibilities.

ATTACHMENT A

MORGAN COUNTY WIND FARM ORDINANCE
WIND ENERGY SYSTEM FACILITY CHECKLIST

Lincoln Land Wind Farm - Morgan County, Illinois
Siting Application
Decommissioning Plan - Ordinance Compliance Checklist

	Compliance with Section X of Morgan County Wind Farm Ordinance (2019-10A)	Comments
Part A.	A Decommissioning and Site Reclamation Plan shall be prepared by an independent Illinois Certified Professional Engineer and shall include:	Plan provided as Appendix 7
A1.	Provisions describing the triggering events for decommissioning the WECS Project;	Section 1.0, Introduction
A2.	A description of the methodology and cost to remove all above ground and below ground WECS facilities of the approved Siting Approval Permit;	Sections 3.0-3.2, costs in Section 6.0
A3.	Provisions for the removal of all above ground and below ground WECS facilities of the approved Siting Approval Permit;	Sections 3.0-3.2
A4.	Methodology and cost to restore all areas used for construction, operation and access to a condition equivalent to the land prior to the WECS construction;	Section 3.2, Restoration
A5.	A work schedule and a permit list necessary to accomplish the required work;	Section 4.4, Permitting, Section 5.1, Decommissioning Schedule
A6.	Methodology to identify and manage any hazardous or special materials.	Section 3.0, Engineering Techniques
A7.	Submission of a draft form of Financial Security to the County in the form of a surety bond (performance and payment bond), irrevocable letter of credit or a cash escrow account that names Morgan County as the beneficiary, or other type of Financial Security that is approved by the County. If an irrevocable letter of credit or surety bond (performance and payment bond) is selected, the original of the irrevocable letter of credit or surety bond shall be held by the County. If a cash escrow is selected, the cash escrow shall be held and managed by an independent third party (e.g., escrow agent or title company) on behalf of the County, subject to escrow instructions that incorporate the applicable decommissioning and repair / replacement / restoration obligations of this Agreement as executed by the County and the Applicant. The amount of Financial Security shall be equal to the positive difference between the total cost of all decommissioning and restoration work and the net salvage value of all removed WECS equipment or materials, plus a ten percent (10%) contingency, as adjusted by the County after input from the County's engineer (the "Decommission Security"). To determine that amount, the Applicant and the Morgan County Board shall: (a) obtain bid specifications provided by a professional structural engineer; (b) request estimates from construction / demolition companies capable of completing the decommissioning of the WECS Project; and (c) certification of the selected estimate by a professional structural engineer. The Morgan County engineer, an independent engineer of the County's choosing, and the Regional Planner will review all estimates and make a recommendation to the Morgan County Board for an acceptable estimate. Morgan County reserves the right to pursue other estimates. All costs to secure the estimates will be funded by the Applicant.	Sample Decommissioning Bond provided in Appendix 18
A8.	A provision that the terms of the Decommissioning and Site Reclamation Plan shall be binding upon the Applicant (which, for the avoidance of doubt, including any of its successors-in-interest and assigns);	Section 1.0, Introduction
A9.	Confirmation by affidavit that the obligation to decommission the WECS facilities is included in the lease agreement for every parcel included in the Siting Approval Permit application. A list of all landowners should be kept current and affidavits shall be secured from Applicant and landowners stating their financial understanding;	Not addressed
A10.	A provision that allows for the County to have the legal right to transfer applicable WECS material to salvage firms;	Section 6.0, Decommisioning Costs, p. 12
A11.	Identification of and procedures for Morgan County to access the Financial Assurances; and	Not addressed
A12.	A provision that Morgan County shall have access to the site, pursuant to reasonable notice to affect or complete decommissioning. A portion of the Decommission Security will be required to be held for one (1) year past the decommissioning to settle any potential disputes.	Section 6.0, Decommisioning Costs, p. 12

Lincoln Land Wind Farm - Morgan County, Illinois
Siting Application
Decommissioning Plan - Ordinance Compliance Checklist

	Compliance with Section X of Morgan County Wind Farm Ordinance (2019-10A)	Comments
Part B.	Provisions triggering the decommissioning of any portion of the WECS Project due to abandonment:	Section 1.0, Introduction
B1.	Inactive construction for twelve (12) consecutive months.	Section 1.0, Introduction
B2.	If no electricity is generated by the WECS Project for twelve (12) consecutive months after electricity is initially generated, unless the inactivity is due to required or ongoing, active maintenance, repairs, replacement or rehabilitation work and written proof is provided that new parts have been ordered and will be received within six (6) months.	Section 1.0, Introduction
B3.	The Applicant dissolves or abandons the WECS Project without first transferring the WECS Project to a successor-in-interest or assign.	Section 1.0, Introduction
B4.	If any part of an individual turbine or the WECS Project falls into disrepair, is in threat of collapsing or any other health and safety issue.	Section 1.0, Introduction
Part C.	Provisions for the removal of structures, debris and cabling; both above and below the soil surface:	Section 3.0, Engineering Techniques
C1.	Items required to be removed include but are not limited to: turbines, transformers, foundation pads, electrical collection systems and transporters, underground cables, fencing, access roads and culverts. A landowner must sign an agreement if they wish for the access roads or culverts to remain.	Section 3.0, Engineering Techniques
Part D.	Provisions for the restoration of soil and vegetation:	
D1.	All affected areas shall be inspected, thoroughly cleaned and all construction related debris shall be removed.	Section 3.1, Decommissioning
D2.	Items required to be restored include but are not limited to: windbreaks, waterways, site grading, drainage tile systems and topsoil to former productive levels.	
	a. In work areas involving decommission from expansion of turbine crane pads, widening access roads or any other work areas, the topsoil must be first removed, identified and stored separate from other excavated material for later replacement as applicable.	Section 3.1, Decommissioning, p. 4
	b. The 48-inch below-surface excavation area shall be filled with clean sub-grade material of similar quality to that in the immediate surrounding area.	Section 3.1, Decommissioning, p. 4
	c. All sub-grade material will be compacted to a density similar to surrounding grade material.	Section 3.1, Decommissioning, p. 4
	d. All unexcavated areas compacted by equipment used in decommissioning shall be de-compacted in a manner that adequately restores the topsoil and sub-grade material to the proper density consistent and compatible with the surrounding area.	Section 3.2, Reclamation, p. 6
	e. Where possible, the topsoil shall be replaced to its original depth and surface contours.	Section 3.1, Decommissioning, p. 5
	f. Any topsoil deficiency and trench settling shall be mitigated with imported topsoil that is consistent with the quality of the effected site.	
D3.	Disturbed areas shall be reseeded to promote re-vegetation of the area to a condition reasonably similar to the original condition. A reasonable amount of wear and tear is acceptable.	Section 3.2, Reclamation, p. 6
D4.	Restoration measurements shall include: leveling, terracing, mulching and other necessary steps to prevent soil erosion; to ensure establishment of suitable grasses and forbs; and to control noxious weeds and pests.	Section 3.2, Reclamation, p. 6
D5.	Items required to be repaired after decommissioning include but are not limited to: roads, bridges and culverts.	Bridges and culvert repairs not addressed
D6.	An independent drainage engineer shall be present to ensure drainage tiles, waterways, culverts, etc. are repaired as work progresses.	Not addressed
D7.	A soil erosion control plan shall be approved by the Morgan County Soil and Water Conservation District.	Section 4.0, BMPs (SWPPP)
D8.	All applicable stormwater management, floodplain and other surface water rules, regulations and ordinances shall be followed.	Section 4.0, BMPs (SWPPP), Section 4.4, Permitting

Lincoln Land Wind Farm - Morgan County, Illinois
Siting Application
Decommissioning Plan - Ordinance Compliance Checklist

	Compliance with Section X of Morgan County Wind Farm Ordinance (2019-10A)	Comments
Part E.	Estimating the costs of decommissioning:	
E1.	Costs shall include but not be limited to engineering fees, legal fees, accounting fees, insurance costs, decommissioning and site restoration.	Not provided. Legal & accounting fees not typically included in decommissioning estimates.
E2.	When factoring the WECS salvage value into decommissioning costs, the authorized salvage value may be deducted from decommissioning costs if the following standards are met:	
	a. The net salvage value shall be based on the average salvage price of the past five (5) consecutive years, this includes any deconstruction costs.	Not provided. Scrap metal pricing from 2019.
	b. The maximum allowable credit for the salvage value of any WECS shall be no more than the estimated decommissioning costs of removal of the above ground portions of that individual WECS or up to seventy-five percent (75%) of the total estimated decommissioning costs, whichever is greater.	Section 6.0, Decommisioning Costs, p. 13-16
E3.	Adjustments to the financial assurance amount that reflect changes in the decommissioning costs and salvage values shall be submitted every five (5) years after the initial ten (10) years of operation, subject to the provisions of Subsection VI.J.4 (Design and Installation; use of Public Roads; Financial Security) above, and shall be adjusted for inflation and other factors. The amount of the Decommission Security shall be adjusted accordingly within six (6) months of receiving the updated information as determined by an Illinois professional engineer. Failure to provide financial assurance as outlined herein shall be considered a cessation of operation.	Section 1.0, Introduction
E4.	When determining salvage values, demolition costs, transportation costs and road permits shall be a consideration.	Insufficient information to determine if addressed in pricing.
E5.	If salvage value items are removed prior to decommissioning, then the Decommission Security may be adjusted to provide a credit.	Not addressed.
Part F.	Financial assurance:	
F1.	The Applicant shall post the Financial Security for the WEC Project, including the Decommission Security, to be eligible to receive a WECS Building Permit.	Not yet completed.
F2.	The County shall have immediate access, upon written notice to the Applicant, to use the Decommission Security if:	
	a. After abandonment of the Project, the Applicant, upon a reasonable determination by the County Board, fails to address a health and safety issue in a timely manner; or	Not addressed
	b. The Applicant fails to decommission the abandoned turbine(s) or the entire WECS Project in accordance with the Decommissioning and Site Reclamation Plan	Not addressed
	If possible for the type of Decommission Security provided, the Applicant shall grant perfected security in the Decommission Security by use of a control agreement establishing the County as an owner of record pursuant to the Secured Transit Article of the Uniform Commercial Code, 810 ILCS 9/ et seq.	Not addressed
F3.	The County Board or its escrow agent shall release the Decommission Security when the Applicant has demonstrated and Morgan County concurs that decommissioning has been satisfactorily completed, or upon written approval of the County to implement the decommissioning plan. Ten percent (10%) of the Decommission Security shall be retained one (1) year past the date to settle any outstanding concerns	Not addressed
F4.	Any interest accrued on the Decommission Security that is over and above the total value as determined by the Illinois professional structural engineer shall go to the Applicant	Not addressed
F5.	The Applicant shall identify procedures for Morgan County to assess the financial assurances, particularly if it is determined that there is a health and/or safety issue with the WECS and the principal company fails to adequately respond as reasonably determined by the County Board	Not addressed
F6.	The County shall be listed as a debtor in connection with any proceeding in insolvency or bankruptcy, but shall not be responsible for any claims against the Applicant	Not addressed

Lincoln Land Wind Farm - Morgan County, Illinois
Siting Application
Decommissioning Plan - Ordinance Compliance Checklist

	Compliance with Section X of Morgan County Wind Farm Ordinance (2019-10A)	Comments
F7.	The Applicant shall agree that the obligations and liabilities under a Siting Approval Permit shall be binding upon the Applicant (which, for the avoidance of doubt, includes its successors-in-interest and assignees, such as the WECS Permittee) and the Operator. The Applicant further shall agree that the sale, assignment in fact or at law, or other transfer of the Applicant's financial interest in the WECS shall in no way effect or change the Applicant's obligation to continue to comply with the terms, covenants and obligations of a Siting Approval Permit unless such successor-in-interest or assignee agrees to assume all obligations of the Siting Approval Permit, including but not limited to the decommissioning obligations associated with the WECS	Not addressed
F8.	Morgan County and its authorized representatives have the right of entry onto the WECS premises for the purpose of inspecting the methods of reclamation or for performing actual reclamation if necessary	Section 6.0, Decommisioning Costs, p. 12

LINCOLN LAND WIND PROJECT – MORGAN COUNTY, ILLINOIS
SITING APPLICATION REVIEW

ATTACHMENT B

LINCOLN LAND WIND POWER PROJECT – MORGAN COUNTY, IL
NOISE ASSESSMENT STUDY AND REVIEW

2020

Lincoln Land Wind Project

Noise Assessment Study and Review

Morgan County, Illinois

Project No. 22053.040

Rev Number	Description	Responsible	Date
1.0	Final	Al Hymans	August 2020

Prepared By:

Patrick Engineering Inc.

LINCOLN LAND WIND POWER PROJECT – MORGAN COUNTY, IL
NOISE ASSESSMENT STUDY AND REVIEW

Executive Summary

The purpose of this study is to define the regulations applying to the noise assessment for the Lincoln Land Wind Project, review the noise modeling predictions supplied by the applicant and develop independent calculations, and compare the results. The evaluations performed indicate that the turbines, as situated, and given the parameters used under normal conditions, will generate noise levels that are in compliance with state regulations at the receptor locations identified in the Application for Morgan County.

The issue of noise when siting wind farms falls into two main categories: 1) compliance with noise regulations governing the area within which the wind farm is being located and 2) the health and welfare of the people who are or will be living in the areas where the wind farm is being located. Patrick was commissioned by Morgan County to review the APEX Lincoln Land Wind project for compliance with the county Wind Farm ordinance. The study summary contained herein therefore addresses the issue of compliance with existing noise regulations. Patrick is neither trained in, nor has the medical expertise to address the health and welfare issue.

Regulation

The governing regulations come from the Morgan County Wind Energy Conversion Systems Siting Regulations Ordinance (Ordinance No. 2019-10A). Part of this ordinance requires compliance with the Illinois Pollution Control Board (IPCB) noise regulations. These regulations define maximum allowable noise levels that are permitted at property lines of one class of land to another class of land caused by equipment or facilities generated noise. Land types are classified as Class A, B, or C. For wind farms with electric generating equipment, the land upon which the turbine stands is classified as Class C, while agricultural land is also classified as Class C. Residential land is classified as Class A. Agricultural land usually has a farm residence that is located upon the Class C farm property. The land occupied by the farm residence is considered to be Class A land for the purpose of the sound analyses performed by most sound analysts. Since the residence is located within the property boundaries of the property owner, there are no specific property lines that can be readily identified surrounding the residence.

The Morgan County ordinance defines setback requirements for the turbines to be from the center of the turbine foundation to the point of the primary structure foundation nearest the center of the turbine tower foundation. This minimum distance is defined as 1,320 feet for participating property owners and 1,650 feet for non-participating property owners. Primary structure is defined by the ordinance as follows “for each property, the structure that one or more persons occupy the majority of time on that property for either business or personal reasons. The term ‘primary structure’ includes structures such as residences, commercial buildings, hospitals, and day care facilities. The term ’primary

structure' excludes such ancillary structures as hunting sheds, storage sheds, pool houses, unattached garages and barns".

The primary applicable regulation for this location is as defined by the Illinois Pollution Control Board (Title 35: Environmental Protection, Subtitle H: Noise, Chapter 1: Pollution Control Board, Section 901.102 Sound Emitted to Class A Land). This regulation defines the sound levels allowed to be emitted from an agricultural/industrial site and received on a residential site during daylight and nighttime hours. These levels are divided into frequency bands much like a stereo equalizer. This is to account for noise annoyance that is dependent on the frequency. Generally, higher audible frequencies cause greater annoyance than lower frequencies.

This is reflected in the regulations that restrict the sound levels at higher frequencies, and is shown graphically on Figure 1.

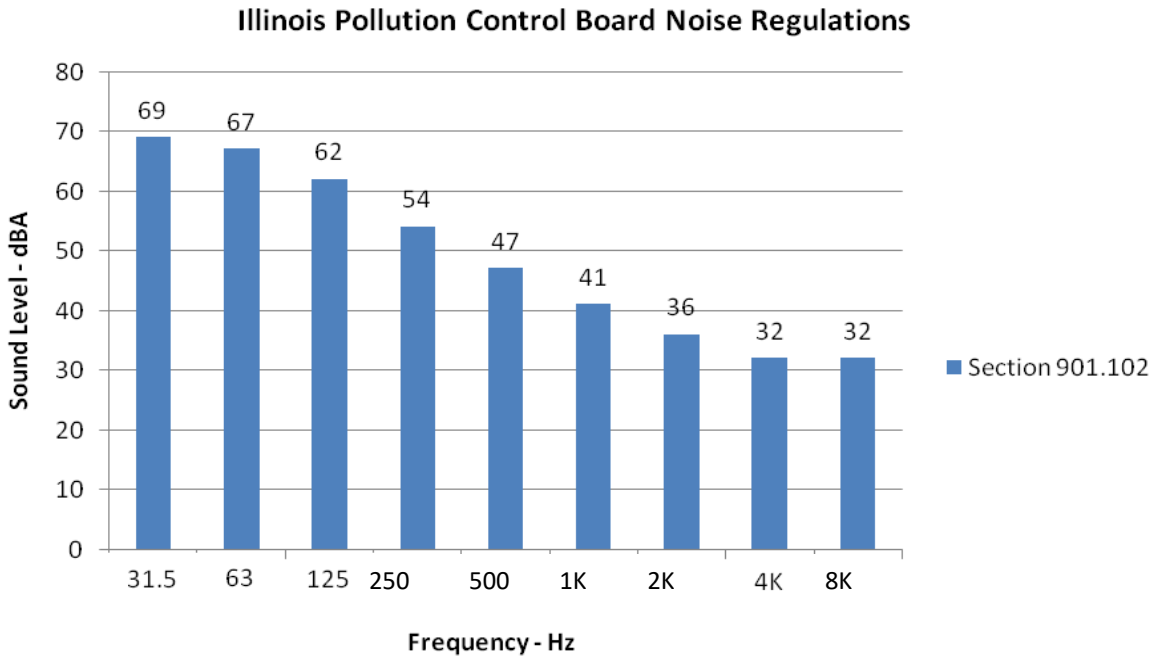


Figure 1. Allowable Night time sound emitted from Class C land to Class A land.

A secondary regulation (Section 901.106, Prominent Discrete Tones) was determined to apply to the transformers used to step up the voltage at each turbine foundation from the generated voltage to the distribution voltage. A source with higher individual or discrete tones can cause more annoyance than a source with equal levels across all frequencies. With our measurements broken into frequency bands, if one frequency band is much higher than the others at the source, we classify that as a discrete tone. Transformers typically create discrete tones in the lower octave bands. A tonal adjustment factor[3] is applied to the transformer sound level emissions depending on the frequency band. The adjustment factors for each frequency band is shown in Table 1. In this case the turbine sources did not exceed the defined limits and were not classified as having discrete tones or frequencies.

TABLE 1. Transformer Noise Emissions			
Frequency Band - Hz	Tonal Adj - dB	Transformer Sound Levels	Adjusted Transformer Sound Levels
31	-1	77	76
63	5	72.8	77.8
125	7	76	83
250	2	76.4	78.4
500	2	73.3	75.3
1000	-4	61.4	57.4
2000	-9	53.4	44.4
4000	-14	44.4	30.4
8000	-21	34.4	13.4

Manufacturers' data is used in the specified analysis to determine if discrete tones are present. This was accomplished for the GE 2.82-127 turbine.

The application source and receptor data was reviewed for all locations, and a summary of the highest sound levels versus frequency band was created. The data was scanned across every sound emitting point source and across every band to determine the maximum predicted levels. This summary is plotted in Figure 2 and shows that all the predicted levels are lower than the regulation.

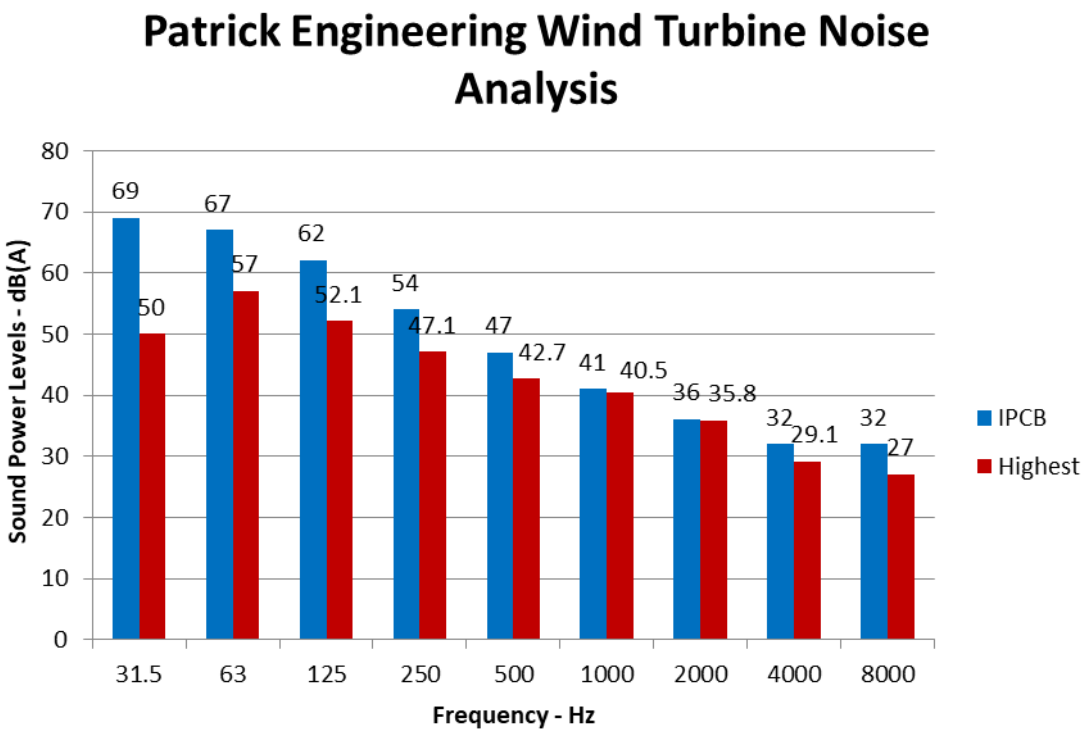


Figure 2. Illinois Pollution Control Board (IPCB) limits versus anticipated maximum sound power levels within each octave band.

Analysis Approach

Patrick first identified the applicable regulation, and then determined the sound level that cannot be exceeded. Sound Propagation Modeling is used to predict the sound levels based on the sources' characteristics and location.

- Sound Propagation Modeling is a well studied phenomenon and a standard has been developed by the International Standards Organization (ISO). The standard is ISO 9613 and it defines the equations and factors which must be used to predict sound power levels at receptors based on the sound power level of a single source or multiple sources.
- The standard allows accurate prediction of the sound level at receivers based on modeled sources over any given distance and assumes optimal sound propagation. To attain this the receiver is assumed to be downwind of the sound source and the wind speed is under 5 m/s (11mph).

All commercially available sound propagation modeling packages will use this basic approach. The equation shows that the sound at a receiver produced by a source is based on the directivity of the source and several attenuation effects. These attenuation effects include the distance from source to receiver, absorption of sound by the atmosphere, absorption of sound by the ground effect, and several other minor effects.

Based on this, Patrick was able to predict the sound propagation sound power levels at various receivers using the standard equations. This allowed validation of the APEX noise studies, which were performed for those locations by RSG. Patrick did this by creating a noise prediction model for four representative points in this study. These points were selected since they displayed the highest predicted sound level bands. The results of the 4 models should all match if all the key factors are exactly the same.

The key factors in the equation for this model include:

- Location, height and sound power output of the sources. The locations of the sources were defined, the height specified as 114 meters (373.9 ft) and the sound power from the turbine documented for each of the 120 wind turbines. Additional sources were defined as the transformers with height of 3ft (1m) and the sound power as specified.
- Location of the receivers. Receiver locations were defined.
- Atmospheric information. These values were set to 15°C (59°F) and 70% relative humidity.
- Geometry of the sound sources – i.e. point sources or line sources. Wind turbines are point sources while traffic is assumed to be a line source.
- Ground Factor. The ground covering can be included in the calculations. A value of 0 is used for hard ground such as pavement, ice, water and concrete. A value of 1 is used for grassland, trees, vegetation, farm land and a value between -0 and 1 is used for a mix of hard and porous ground. Setting the Ground Factor to 0 is conservative and will result in the highest predicted values.
- Other factors can be included such as screening and miscellaneous but were not determined to be relevant.

Limitations

Patrick identified several key input variables which can affect the results of the sound propagation modeling. There are other limitations which must be addressed in a wind farm site survey:

- Elevation
    - Noise levels can be much higher when the receptor is in a valley or depression downwind of the wind turbine. Detailed modeling takes into account the relative elevation between the sources and the receivers.
- Sound Power
    - The sound power of the Wind Turbine is a key factor. This value must be specified for the exact model of wind turbine. The sound power must be determined for the normal wind speed range (12 mph) for accurate sound propagation modeling. Sound levels at higher wind speeds are required to assess where the increased wind can cause problems. A value of 15 mph (6.7 m/s) was used for the purpose of this review to account for the higher sound power.
- Wind Speed

    The ISO Standard for sound propagation assumes the favorable conditions of downwind location with wind speeds less than 12 mph. As the wind speed increases it becomes increasingly difficult to measure the sound level. This is due to the problem of the wind

noise over the microphone causing errors in the sound level. Also, as wind speed increases the sound output from the wind turbines increases. Data available from the Wind Turbine manufacturer must be examined for sound level output versus wind speed. In particular, the sound level output must be analyzed to determine if discrete tones are present. This is required since the secondary regulation for discrete tones was determined not to apply in this analysis.

  - Wind Turbines operate most effectively in the range of 12 mph to 27 mph (5 m/s to 12 m/s). At this range the wind noise starts to exceed the noise limits set by the Pollution Control Board. A key factor is to inspect the increase in the wind turbine noise in this range. For this review a wind speed of 15 mph (6.7 m/s) was used. Comparing the increase in the turbine noise with the increase in the noise due to the wind can indicate if higher wind speeds need to be evaluated. At higher speeds evaluating the turbine blade tip speed can help to determine if the turbine noise will increase.

- Reflections
  - Reflections from large surfaces can cause errors in the modeling results. This is solved when the setback results in distances greater that 1.1 times the tower height. Trees and vegetation normally attenuate the sound – but the site must be evaluated, as a tree line without leaves may act as a reflective surface if the spacing is close and diameter of the trees are large.

Results

Results from the RSG noise study performed for APEX can also be compared to an independent solution – a commercially available and proven ISO 9613 modeling package to validate their results. This package SPM 9613 v2 by Power Acoustics, Inc. was used to predict the sound levels at four of the locations where the sound level was found to be the highest. Dwelling locations receptors R14, R27, R192 and R211 were independently modeled by Patrick. The results of these studies along with the predicted values from the Patrick model are shown in Figures 3 and 4.

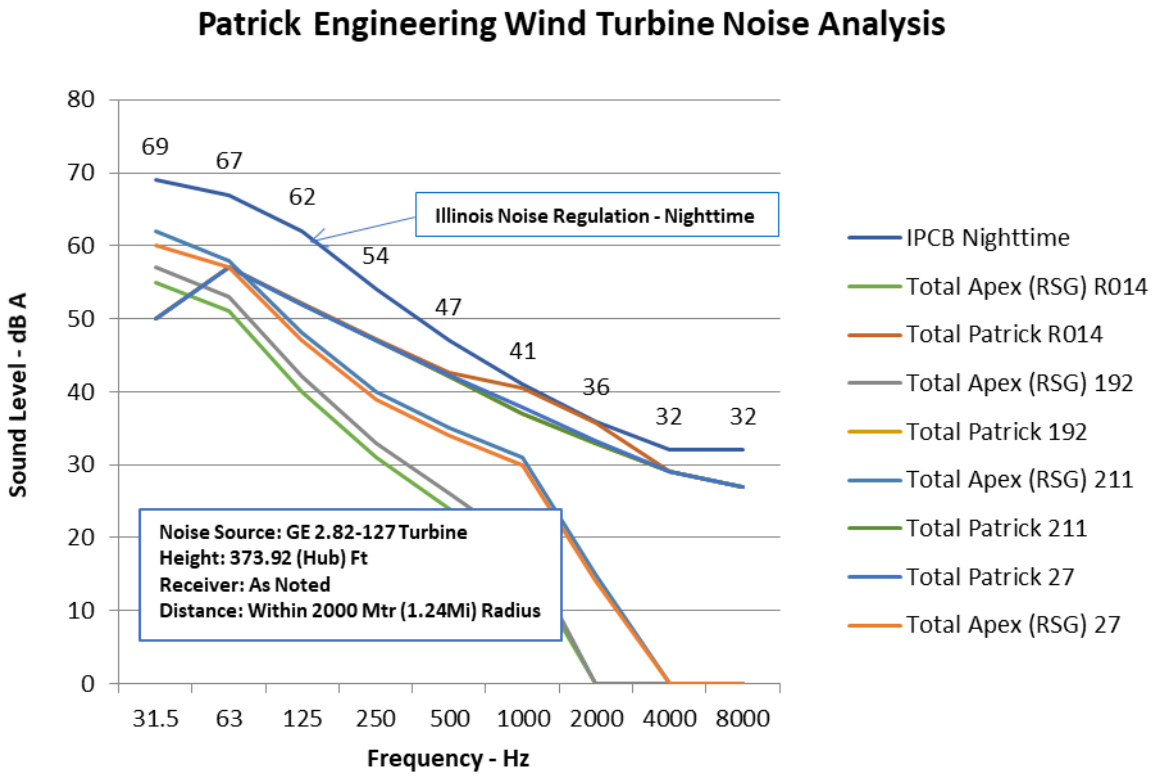


Figure 3. Validation of sound prediction models at Locations 14, 27, 192, 211

It can be seen immediately that all the levels predicted are below the IPCB regulation for these locations. The Patrick model did not include any NRO's (Noise Reduction Operations) other than the LNTE (Low Noise Trailing Edge) blades. The Patrick model includes the addition of the noise from the step up transformer at the base of the turbine tower as well as the standard noise levels attributed to nighttime ambient noise for rural (farmland) areas.

Patrick Engineering Noise Study Model Results Business and Commercial Ambient Levels									
Frequency Band	31.5	63.0	125.0	250.0	500.0	1000.0	2000.0	4000.0	8000.0
IPCB Nighttime	69.0	67.0	62.0	54.0	47.0	41.0	36.0	32.0	32.0
Ambient Levels	50.0	57.0	52.0	47.0	42.0	37.0	33.0	29.0	27.0
Total Apex (RSG) 211	62.0	58.0	48.0	40.0	35.0	31.0	15.0	0.0	0.0
Total Patrick 211	50.0	57.0	52.0	47.0	42.0	37.0	33.0	29.0	27.0
Total Apex (RSG) R014	55.0	51.0	40.0	31.0	24.0	17.0	0.0	0.0	0.0
Total Patrick R014	50.0	57.0	52.1	47.1	42.7	40.5	35.8	29.1	27.0
Total Apex (RSG) 192	57.0	53.0	42.0	33.0	26.0	19.0	0.0	0.0	0.0
Total Patrick 192	50.0	57.0	52.0	47.0	42.0	37.0	33.0	29.0	27.0
Total Apex (RSG) 27	60.0	57.0	47.0	39.0	34.0	30.0	14.0	0.0	0.0
Total Patrick 27	50.0	57.0	52.0	47.1	42.3	37.9	33.3	29.0	27.0

Figure 4. Comparative Sound Data

Although the correlation between the APEX (RSG) studies and the Patrick Engineering model show a consistent curve shape for noise at the given receptors, it can be stated that each approach followed the standard for calculation correctly. The differences may indicate a different ground hardness factor was used and that some NRO's were incorporated in the Apex (RSG) models. Also, the Patrick model used only wind turbines within a 2000 meter radius of the given receptor.

Conclusion

Patrick reviewed the Illinois Pollution Control Board sections which apply to this site. The specific sound level regulations are in Section 901.102 for night time, which is the strictest of requirements. We also determined which sections were not applicable; Section 901.106 was found not to apply to the sound sources by analysis of the published manufacturers' specifications.

Patrick reviewed the ISO standard 9613 which defines the formulas used to predict sound propagation and the attenuation factors, and identified the key input factors critical to obtain accurate results. Patrick used the standard to model the site with the site's key factors, on a worst case scenario.

Finally, Patrick reviewed the predicted results obtained by the studies presented by RSG and, using a well-established, published sound propagation software tool, Patrick compared and validated the results for four locations. The comparative analysis shows the noise levels are within the regulatory limits for each receptor location.

References

1. Acoustics – Attenuation of sound during propagation outdoors – Part 2: General method of calculation, International Standard ISO 9613-2: 1996 (International Organization for Standardization, Geneva, Switzerland, 1996)
2. SPM 9613 modeling package, Power Acoustics, Inc. http://poweracoustics.com/
3. Handbook of Acoustics by Malcolm J. Crocker, Chapter 79, Page 1032, Table 21

ATTACHMENT C

LINCOLN LAND WIND POWER PROJECT – MORGAN COUNTY, IL
REVIEW OF PROJECT DECOMMISSIONING PLAN

2020

Lincoln Land Wind Project

Decommissioning Plan Review

Morgan County, Illinois

Project No. 22053.040

Rev Number	Description	Responsible	Date
1.0	Final	Matt Minder	August 2020

Prepared By:

Patrick Engineering Inc.

LINCOLN LAND WIND POWER PROJECT – MORGAN COUNTY, IL
REVIEW OF PROJECT DECOMMISSIONING PLAN

TABLE OF CONTENTS

1.0 INTRODUCTION

The Lincoln Land Wind Power Project (Project) is a proposed wind energy project, to be constructed beginning in 2020, consisting of up to 107 wind turbine generator (WTG) sites within an approximately 36,000-acre area in eastern Morgan County, near South Jacksonville, Illinois. This report (Report) presents an independent review of the Apex Clean Energy (Developer) Decommissioning Plan (Plan) to decommission all WTGs and includes a discussion of plan components for Project decommissioning.

The scope of the decommissioning work is based on a review of the following:

- Morgan County (County) Ordinance, Resolution 2019-10A, Wind Energy Conversion Systems Siting Regulations Ordinance, Part X: Decommissioning and Site Reclamation Plan Required (herein referenced as the Ordinance)
- Permit Application documents submitted by Developer and available from the Morgan County website (http://morgancounty-il.com/documents/commissioners/lincoln-land-siting-permit-complete.pdf), including:
    - *Decommissioning Plan, Lincoln Land Wind Power,* dated January 2020, prepared for Developer by Westwood Professional Service (Appendix 7 of the Permit Application)
    - Illinois Department of Agriculture (IDOA) Agricultural Impact Mitigation Agreement (AIMA) (Appendix 11 of the Permit Application)

The above documents are referenced in this Report. The Plan review included in this Report provides an independent assessment of whether the Plan:

- meets County Ordinance requirements,
- provides reasonable assumptions for decommissioning, and
- provides a reasonable estimate of the decommissioning cost.

Patrick's review was conducted and this Report was prepared in accordance with Patrick Engineering Inc. (Patrick) Proposal No. 2C0WR0014 Revision 1, dated March 26, 2020.

2.0 PROJECT BACKGROUND

The design lifetime of the proposed wind energy conversion system (WECS) is 30 years. For the purposes of this Report, it is assumed that the WECS will be fully decommissioned at the end of Project life, including all wind turbine generators (WTGs) and associated infrastructure.

This Report provides a review of the Plan's decommissioning and restoration phases for the Project, including the list of the wind farm components to be dismantled and removed, and the final disposition of the components (either recycled or disposed). This Report also provides a qualitative review of the Plan's estimated costs and revenues (salvage value) associated with decommissioning activities.

3.0 PROJECT COMPLIANCE WITH COUNTY ORDINANCE

Patrick reviewed the Plan with respect to its conformance with the County Ordinance, which addresses the requirements for decommissioning plans. A copy of Section X of the Ordinance is included as Attachment A.

Patrick noted the following during the course of our review:

The Plan appears to generally satisfy the requirements of items A through E of the County Ordinance, with some exceptions:

- *Item A.9 - Confirmation by affidavit that the obligation to decommission the WECS facilities is included in the lease agreement for every parcel included in the Siting Approval Permit application. A list of all landowners should be kept current and affidavits shall be secured from Applicant and landowners stating their financial understanding.*
  No affidavit appeared to be included in the Plan documents.
- *Item A.12 - Identification of and procedures for Morgan County to access the Financial Assurances.*
  This item is not addressed in the Plan.
- *Item D.5 - Items required to be repaired after decommissioning include but are not limited to: roads, bridges and culverts.*
  It is unclear whether these items are addressed in the Plan cost estimate.
- *Item D.6 - An independent drainage engineer shall be present to ensure drainage tiles, waterways, culverts, etc. are repaired as work progresses.*
  This item is not addressed in the Plan.
- *Item E.1 - Costs shall include but not be limited to engineering fees, legal fees, accounting fees, insurance costs, decommissioning and site restoration.*
  It is unclear whether engineering, legal, accounting, and insurance costs were incorporated into the Plan.
- *Item E.2a - The net salvage value shall be based on the average salvage price of the past five (5) consecutive years, this includes any deconstruction costs.*

This value in the Plan isn't prepared as prescribed by the Ordinance. Salvage values were based on scrap metal prices from 2019.

- *Item E.4 - When determining salvage values, demolition costs, transportation costs and road permits shall be a consideration.*
  It is unclear whether these costs are addressed in the Plan cost estimate.
- *Item E.5 - If salvage value items are removed prior to decommissioning, then the Decommission Security may be adjusted to provide a credit.*
  This item is not addressed in the Plan.

Item F of the County Ordinance describes the financial assurance instrument to be provided to the County, which is understood to be addressed in a legal agreement (Agreement) between the County and the Developer which was not provided as part of the Plan or Application. It is anticipated that the Agreement will be drafted separately from the Plan, and that both documents should reference each other to be consistent with County Ordinance requirements.

It is anticipated that the Plan will be certified by an Illinois Registered Professional Engineer prior to final acceptance by the County, in accordance with the County Ordinance.

It is noted that the Plan and Agreement should meet the minimum decommissioning requirements found in the AIMA (Appendix 11 of the Permit Application), which is a required agreement for any wind farm development in the State of Illinois. The AIMA requires Developer to provide only a percentage of the decommissioning estimate in financial assurance within the first 10 years of Project operation (10% by end of year 1, 50% by end of year 6), with 100% of the financial assurance amount (less anticipated salvage value) required by the end of year 11 of Project operation.

4.0 PROJECT COMPONENTS

Project components, based on the Plan and Permit Application, are currently proposed to include:

1. One hundred seven (107) GE-127 with 114 meter hub height, 2.82-megawatt (MW) WTGs**
2. WTG reinforced concrete foundations, which includes a 5-foot pedestal
3. A single step-up transformer located near the base of each WTG
4. Aggregate access roads to provide vehicle and equipment access to the WTG sites
5. Temporary crane pads required to support crane loads during WTG disassembly
6. An underground electrical collection system that connects the step-up transformers to a 34.5/345kV collection substation
7. A 345kV transmission line from the collection substation to an interconnection switching station owned by the utility (Ameren)
8. An Operation & Maintenance (O&M) building adjacent to the collection substation
9. Two (2) meteorological (met) towers

The components of a WTG include the tower (made up of multiple sections), nacelle, hub, rotor, rotor blades, and associated ancillary elements such as anchor bolts and internal electrical wiring and components.

**Note: Within the Plan, the Developer notes that up to four different turbines are still under consideration for the Project: (1) 2.82-MW GE 127 turbine, (2) 3.03-MW GE 140 turbine, (3) 4.2-MW Vestas V150 turbine, and (4) 4.8-MW Nordex N149 turbine. As the Project's overall power production will be near 303 MW, the GE 127 turbine will require the largest number of turbines to maximize power production, and is therefore anticipated to require the largest decommissioning cost. The Developer has provided 4 separate cost estimates, with the highest estimate derived from using the GE 127 turbine. The remainder of this report will assume use of the GE 127 turbine for decommissioning costs.

5.0 DECOMMISSIONING PLAN STEPS AND COST ESTIMATE

Decommissioning activities must follow a logical construction sequence in order to permit a safe and efficient teardown, disassembly / demolition, material removal, and restoration of the WTG sites, substation, and related areas. Plan decommissioning steps are summarized below, along with a summary of the Plan decommissioning cost estimate.

Schedule

The entire decommissioning process is anticipated to require 8 months, based on the schedule provided in the Plan.

Public Road, Access Road, and Crane Path Preparation

The Plan states that public roads and access roads will be prepared by installing radius improvements at strategic locations to allow for ingress and egress of equipment and transportation vehicles. Some access roads will be widened from 16 feet to 36 feet to allow crane access by compacting in-place soil. Off-road crane paths will be prepared by compacting native soil, and water crossings will be added where required. Topsoil will be redistributed if stockpiled. Disturbed soils will be decompacted and restored to tillable or revegetated condition. Public roads will be restored to equal or better condition. Aggregate removed from access roads may be used for public road restoration.

Crane Pad Grading and Removal

The Plan states that crane pads will be installed by stripping and stockpiling topsoil, and placing granular materials. Turbines will be disassembled, and sections stored in the vicinity of the crane pad for further disassembly and loading onto transportation vehicles. Once turbines are removed, crane pad area will be re-graded as needed, topsoil re-applied, and decompacted to a depth of 18 inches.

Wind Turbine and Transformer Removal

Wind turbine modular components (tower sections, nacelle, rotor/hub assembly, and 3 blades) will be disassembled. Wind turbines will be refurbished and reused where feasible or sold for scrap material value. Components will be placed on tractor-trailers and removed from site to a prearranged receiving location. Components that are not designated for resale will be cut in pieces and loaded on tractor-trailers and transported to a licensed recycling or disposal facility.

Turbine Foundation and Access Road Removal

Turbine foundations removal consist of excavating the overburden, breaking up concrete, and cutting rebar to a depth of at least five (5) feet. Concrete will be broken into a transportable size and later crushed for re-use or disposed. Rebar will be recycled. The foundation area will be backfilled with native soils, and the area decompacted to a depth of 18 inches and the surface restored to pre-development conditions. Drain tiles, if damaged, will be repaired.

Access roads may remain if agreed in writing with the landowner. Road removal will consist of removing aggregate, underlying geotechnical fabric (if used), replacement and grading of topsoil, and

decompacting and restoration of disturbed areas. Aggregate will be removed and either reused or disposed. Geotechnical fabric will be disposed.

Underground and Overhead Electrical Collection Lines

Underground electrical cables and fiber optic conduits will be removed where within 5 feet of the ground surface. The affected areas will have topsoil replaced and graded (if needed), soil decompacted, and restored.

Overhead cables are assumed to be part of the collection substation, which is adjacent to the interconnect substation owned by the transmission company. Removal of overhead cables are assumed to be included.

Collection Substation

The collection substation, which will be owned by the Project, will be removed at the time of decommissioning. The interconnection substation will be owned by the transmission company and will not be removed as part of Project decommissioning. All substation components (steel, conductors, switches, transformers, etc.) will be disassembled and removed for reuse, recycling, or disposal. Foundations, aggregate, and fencing will be removed to a depth of 5 feet and removed for reuse, recycling, or disposal. The work area will be backfilled as required with native soils, and the area decompacted and restored.

Operation and Maintenance Building and Laydown Yard

The Project is anticipating constructing a building adjacent to the collection substation as an Operation and Maintenance (O&M) facility. The Plan states that the building's economic life will be longer than the wind farm life. No cost for resale or disposal of the building was included in the analysis.

During decommissioning, the Plan states that a Laydown Yard will be needed beyond the parking/storage areas that will be part of the O&M facility; however, the Plan also indicates that materials will be removed from the project directly from their existing locations, and no cost allowance is provided for laydown yard restoration.

Decommissioning Expenses

The estimated total decommissioning expenses are approximately $18.1 million. Patrick assumes the costs listed in the Plan are in 2020 U.S. dollars. Decommissioning expenses include a 10% contingency for added or unforeseen expenses that may arise from a more detailed examination into the decommissioning process at the actual time of activity.

Decommissioning expenses are broken down into the following categories shown in Table 1:

Table 1. Plan Decommissioning Cost Estimate

Activity	Estimated Cost Per Turbine	Estimated Cost Project (2020 $)
Project Mobilization		$753,000
Wind Turbine Equipment	$59,516	$6,368,182
Wind Turbine Foundations	$20,312	$2,173,399
Turbine Access Roads/Crane Paths	$57,624	$6,165,791
Laydown Yard		$0
Underground Collection System		$45,381
Project Substation		$168,627
SUBTOTAL		**$15,674,380**
Contingency (10%)		**$**1,567,438
County Administration Costs (2.5%)		$431,000
Crop Losses		$443,200
TOTAL ESTIMATED COST		**$18,116,018**

Notes:

1. Cost and quantities are preliminary because the design is preliminary.

Patrick developed the following comments after review of the Plan and associated documents:

- The Plan appears to provide a comprehensive description of the tasks required to complete decommissioning of a wind energy project.
- Project mobilization costs are approximately 5% of the total cost, which appears reasonable.
- The Plan estimate includes costs for the County to administer Project decommissioning, which are expenses that may be incurred as a matter of course by the Project owner, but would be outside of the County's normal operations, and may include:
    - Project management (includes bidding, selection, procurement, etc.)
    - Demolition & Construction observation & documentation
    - Permit applications and fees

  Such costs could reasonably be contracted to an outside consultant by the County, and may total between 2% and 3% of the total project cost. The Plan assumes these costs at 2.5% of overall Project cost.
- The Plan lacks details regarding quantities of decommissioning items. It is important for the County to have these details to understand that the Developer has fully considered the scope and extent of decommissioning requirements. Detailed information should be provided for these items:

- Approximate length of access roads and crane paths planned for the Project.
- Approximate length of public road restoration estimated for the Project, detailed by type of road surface impacted (e.g., oil & chip, asphalt pavement, etc.).
- Approximate area utilized for laydown, processing and removal of wind turbine components. Literature and prior experience suggests that 1 to 2 acres is typically needed to provide laydown area for turbine components.

- The cost to remove the meteorological towers is included in the Plan estimate.
- Plan costs for foundation removal are consistent with prior wind farm decommissioning estimates, and appear reasonable.
- The Plan incorporates potential crop loss costs. Such costs are likely, even if decommissioning activities take place in winter months (e.g., crops such as winter wheat may be planted). Crane travel paths, turbine laydown areas, and access road corridors will likely impact crop production either due to inability or delay in planting, or from direct damage to crops.
- Aggregate removal and hauling costs included in the Plan are consistent with prior estimates reviewed by Patrick and appear to be reasonable. It is Patrick's experience that used aggregate is unlikely to have significant salvage value, due to the cost to process the aggregate to an acceptable gradation/quality for re-use or re-sale; however, it is likely that nearby entities (e.g., farmers, other local landowners, and local townships) will accept the used aggregate "as is" at their property for low to no cost.
- Topsoil replacement costs appear to be consistent with prior estimates and appear to be reasonable.
- Costs for disconnection and removal of turbine transformers, pads, shallow wiring, and circuit junction boxes appear to be reasonable. It is noted that the Plan indicates buried electric conduits will be 4 feet or more in depth, but assumes minimal removal costs. The Plan, as well as AIMA, requires buried electric conduit removal to a depth of 5 feet below ground surface.
- The Permit Application indicates that an operation & maintenance (O&M) building will be built adjacent to the collection substation. The Plan assumes that the economic life of the building will be longer than the wind farm. Therefore no disposal or resale value is included. We believe some allowance should be made to handle potential building removal in the event that the County must administer decommissioning of the Project.
- Project substation removal costs appear to be low relative to prior estimates obtained for similarly-sized wind farms. Further clarification and definition should be provided.
- No allowance is provided for soil reclamation / restoration of substation or laydown areas.
- Contingency costs are a standard industry practice, based on other decommissioning plans and prior estimates. However, the 10% contingency is lower than industry standard, which is typically 15%.

- Plan costs should account for estimated inflation for each year the Plan will be in effect (e.g., for 5 or 10 years until the Plan is reviewed and revised).
- Plan should indicate whether indirect costs, such as engineering, legal, accounting, insurance, transportation, and permit fees, are included within the Plan cost estimate.

6.0 SALVAGE VALUE

Estimated revenues from salvage of decommissioned Project elements are estimated in the Plan to be approximately $6.1 million, again assuming 2020 U.S. dollars. Resale/re-use value of turbines/components are assumed to be $0. All turbines are assumed to be processed and sold for scrap metal. Salvage costs are detailed in Table 2.

Table 2. Plan Decommissioning Revenue Estimate

Item	Original Cost (107 Turbines)	Salvage Value (% of Cost)	Estimated Salvage Value (2020 $)
Turbine Components, Parts, Materials (Resale/Re-Use)	Unknown	0%	$0
Item	**Weight (tons)**	**Salvage Value ($/ton)**	**Estimated Salvage Value (2020 $)**
Miscellaneous Structural Steel (Scrap)	25,393	$240	$6,094,000
TOTAL ESTIMATED REVENUE			**$6,094,000**

Notes:

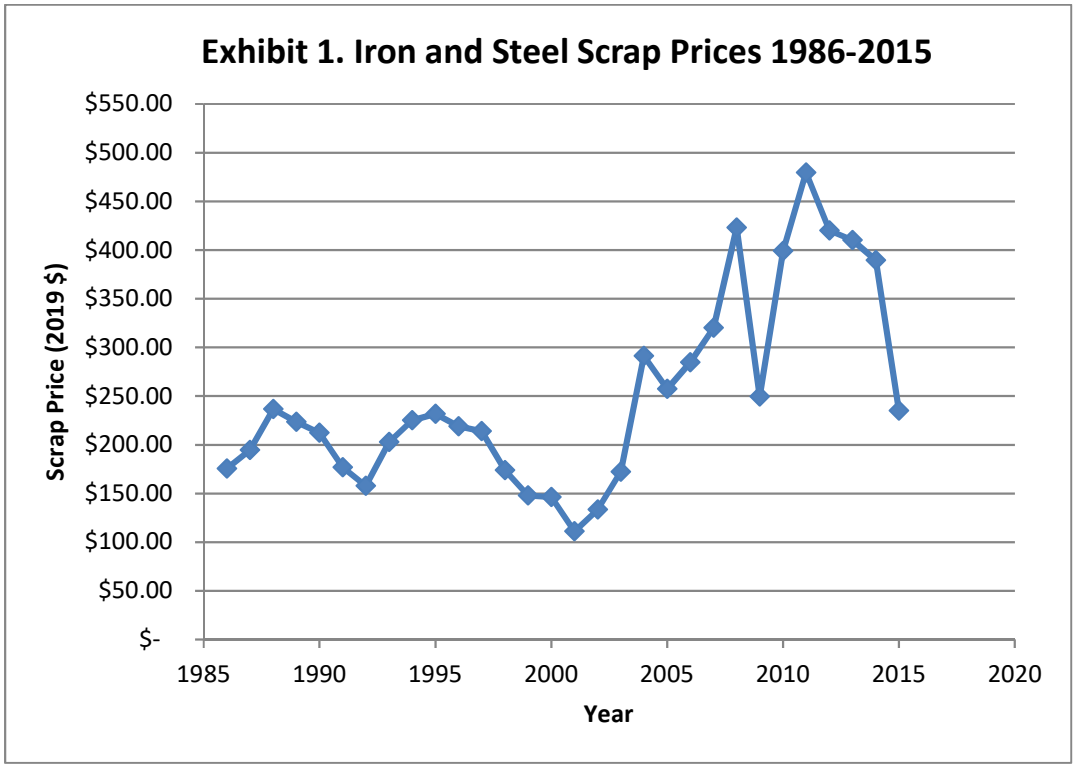
1. Salvage value for steel assumes all turbines are processed and sold for metal (steel) scrap. It is assumed that 237 tons of salvageable steel is available per turbine. Total scrap steel value is $240/ton scrap price. Scrap weights and salvage values for other metals (copper, aluminum wire, etc.) were not included in this estimate.

Patrick notes the following in relation to the revenue estimate:

- Current scrap prices may not represent market conditions at the time of decommissioning. The Plan does not include other valuable scrap metal, such as copper or aluminum, in its estimate. Including other metals will increase the salvage value of the scrap, and will correlate to a lower net cost for decommissioning.
- Scrap prices are volatile. A contingency should be placed on salvage value of both reusable wind turbine components and scrap metals, based on historical scrap prices and engineering judgment.

  Patrick reviewed historical statistics from the US Geological Survey for iron and steel scrap prices for the years 1986 through 2015 (30 years of data), in order to compare Plan scrap prices to the long-term average price for scrap steel in the U.S.

For this 30-year period, the average price for scrap was approximately $250/ton in 2019 dollars, which is similar to the value used in the Plan ($240/ton). However, scrap prices during that time vary widely (see Exhibit 1) – prices range from just over $100/ton to over $400/ton.



7.0 SUMMARY AND RECOMMENDATIONS

In Patrick's review of the Plan, our draft recommendations include:

- Provide details on the lengths of access roads and crane paths to be restored.
- Provide details on the lengths and types of public roads to be restored.
- Provide details on the area used at each turbine location for laydown, processing, and removal of wind turbine components.
- Confirm or include soil reclamation / restoration costs for the substation and (if required) Project laydown areas.
- Confirm or include indirect costs for the Project in accordance with the County Ordinance requirements.
- Specifically address any differences between the County Ordinance requirements and AIMA requirements within the Agreement, so that both parties clearly understand which requirements govern the Developer's decommissioning responsibilities.

8.0 LIMITATIONS

The evaluations contained in this Report are based on the information, assumptions, and analyses contained herein. In the event that Project elements differ from those assumed, the evaluations contained in this Report should not be considered valid until the differences are reviewed and the conclusions in this report have been modified or verified in writing.

Patrick would be happy to discuss this report with you in more detail. If you have further questions or comments, please call us at 217-391-3500.

Report Prepared by:	Report Reviewed and Approved by:
Matthew Minder, P.E. **Project Engineer**	Chris Burger **Vice President**

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