Kaw Nation

Wind Energy Feasibility Study 1

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Feasibility Analysis:

I. Site Assessment

The Kaw Nation has about 1,445 acres of land that it manages as fee and trust land in Kay County. Out of this total acreage the Kaw Nation is looking into the suitability of each site to install a wind turbine.

I.1 Newkirk

The Kaw Nation has an open ground approximately 2.5 acres west of the clinic to put a 50 – 100 Kw turbine. This site has no wind obstruction. It is very close to electric grid lines that go to the casino. The site does not pos any height limit. The Kaw Nation electrical lines areas are connected to the City of Newkirk Utility Services.

(See fig 1)

1.2 Washunga Bay/Green House

This site is behind the greenhouse storage. It is across the street of the Pow Wow field. The total area under this site is over 10 acres.

The only obstruction for wind turbine could be the surrounding trees. The wind turbine should be installed higher than the surrounding trees. There is an electric line running by it at approximately 50 – 100 ft. The area is managed by Kay Electric. (See fig.2)

1.3 Kaw City

In Kaw City, the wind turbine can be put east of the museum and south of the title 6 building. This site is also close to the electric lines. The only obstructions to the wind turbine are the surrounding buildings and trees on the northern side. (See fig. 3)

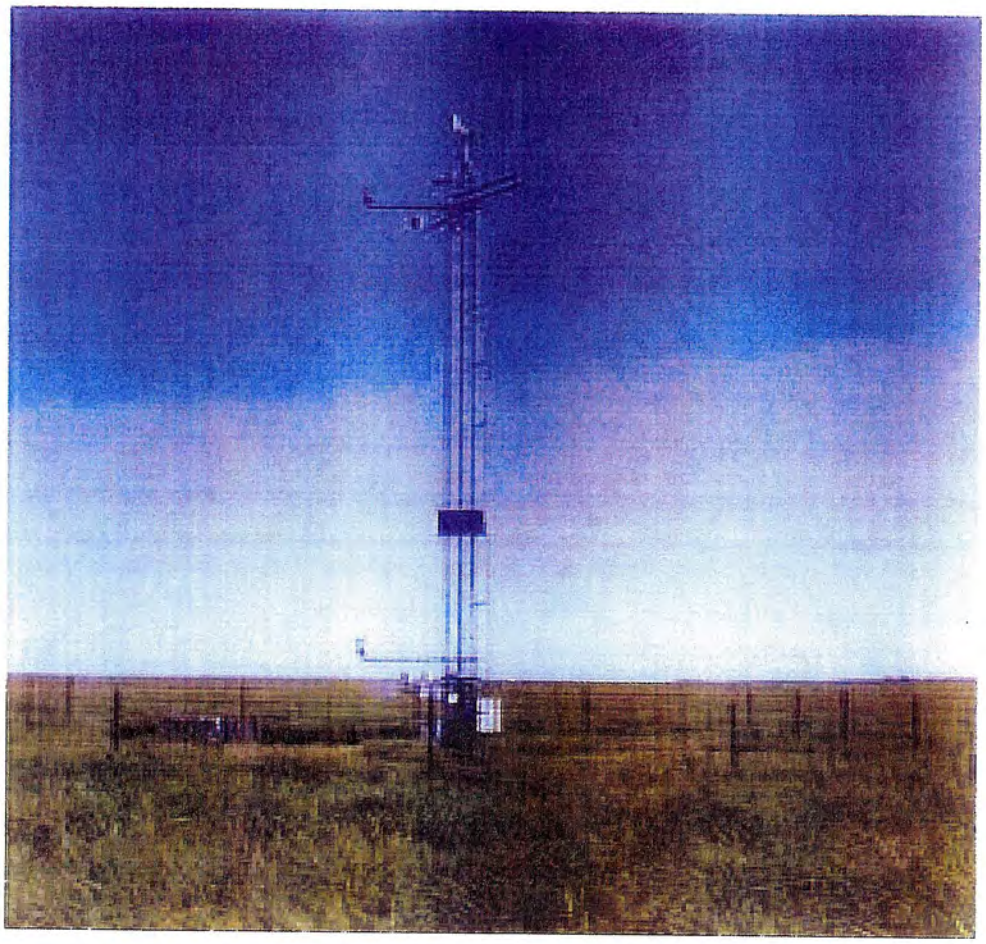
General Observation

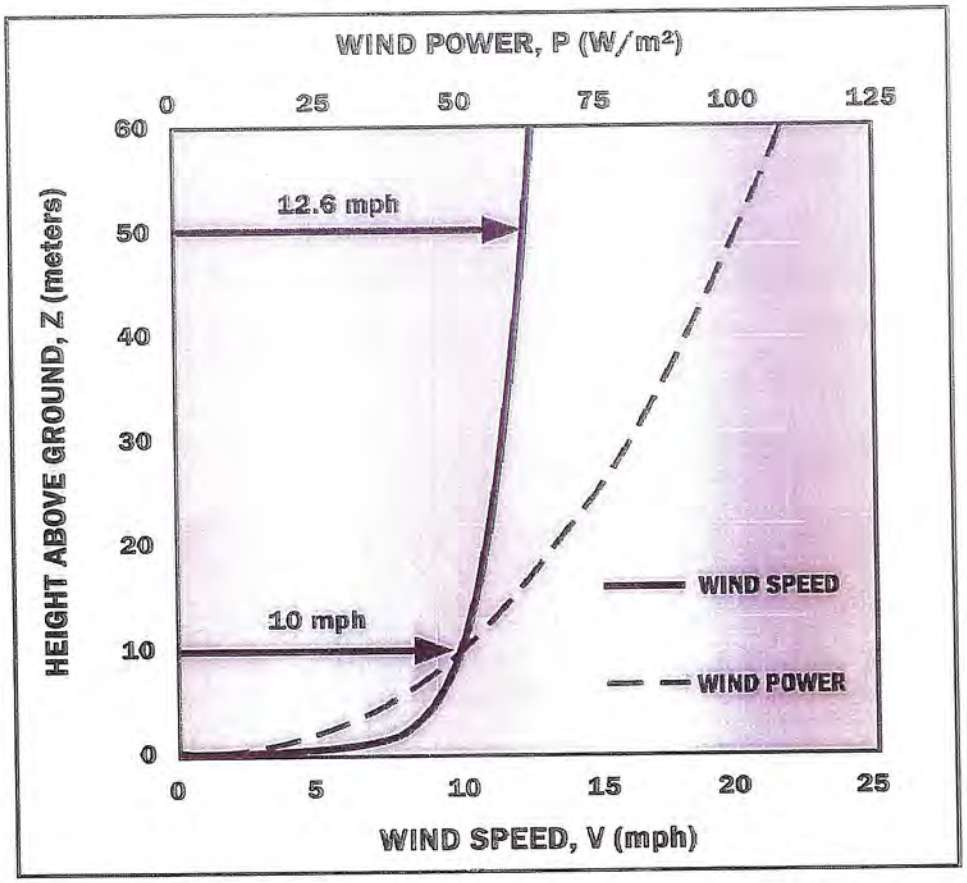
There are three potential sites to install wind turbines. These three sites do not have significant biological, visual, grading, soil stability, or feasibility issues. All of these sites can be accessed through the existing roads. None of them need new road construction. All of the sites are close to electric lines. Washunga and Kaw City are under Kay Electric while the Newkirk is under the city of Newkirk for electric distribution. At Washunga Bay and Kaw City the wind turbine should be higher than 120 feet (tree

height) preferably at 150 feet. In Newkirk the wind turbine should be higher than the surrounding buildings.

2. Wind Resource Assessment

The Oklahoma MESONET in Newkirk has been collecting climatological data for several years. The Newkirk MESONET station is located 8 miles east of Newkirk and 6 miles north of Kaw City. The climatological data was collected at 10 meters (30 feet) high. The station has collected temperature (daily minimum, maximum, average data points), humidity (maximum, minimum, and average), rain, pressure, wind speed (average, maximum, and wind direction), solar and soil temperatures. The climate data were collected from year 2000 – 2010. (See table 1 and fig. 4)



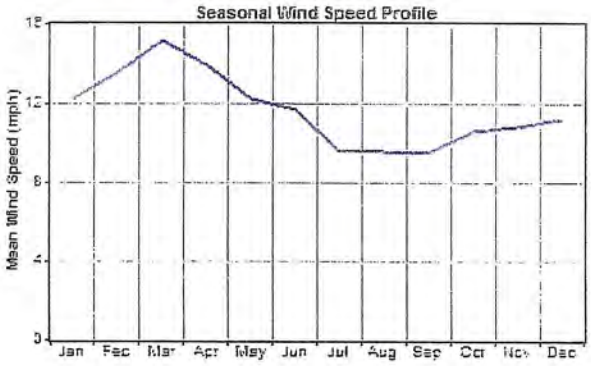


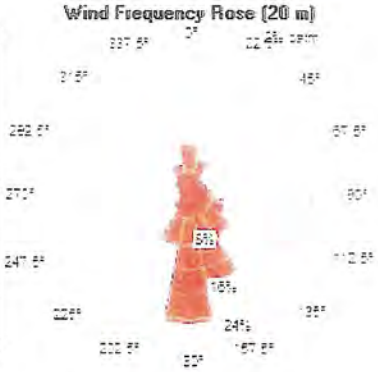
Typical Wind Shear Profile – Speed and power available in the wind increases with increasing elevation. The relationship is commonly referred to as the one seventh power law (a=1/7).

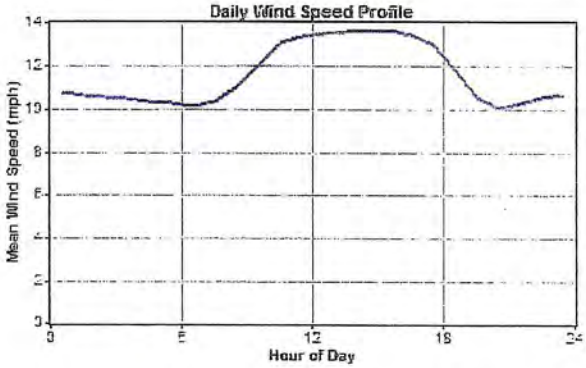
Wind speed increases with height, and gaining even a small increase in velocity boosts a turbine's generating potential significantly (see graphic). Some survey respondents feel that there should be no restriction on height, provided that engineering safety requirements are met and the tower can be accommodated within property lot lines. However, other survey respondents acknowledge that tower heights should be limited according to property dimensions, with setback considerations as well as general consideration for neighbors, sound, and visual impacts given as the reasons for such restrictions. In more remote or less
Populated areas, these considerations may not apply.

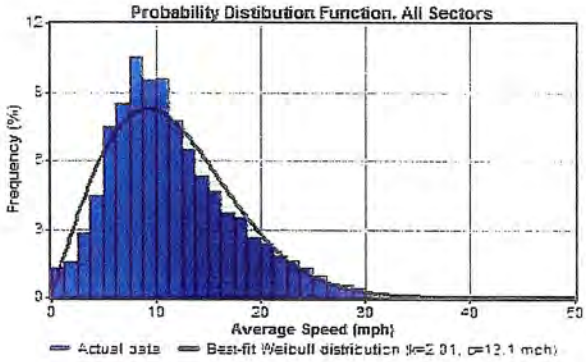
According to the Newkirk Mesonet, the average daily wind speed at 10 m (30 feet tower height) is greater than or equal to 10 mph. The maximum wind speed recorded is greater than or equal to 30 miles per hour at 30 feet tower. If the tower had been at 50 or 100 feet, the wind speed would have been at much higher speed. Most 50 – 100 Kw turbines produce good energy output at 7 – 10 mph wind speed.

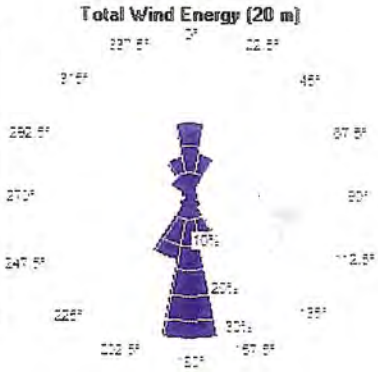
Wind Speed and Direction





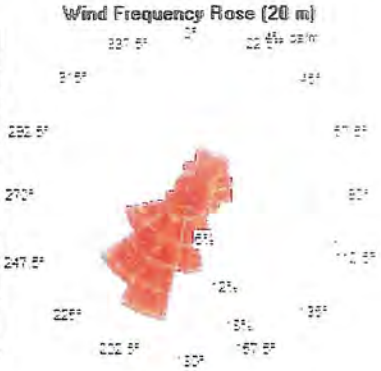


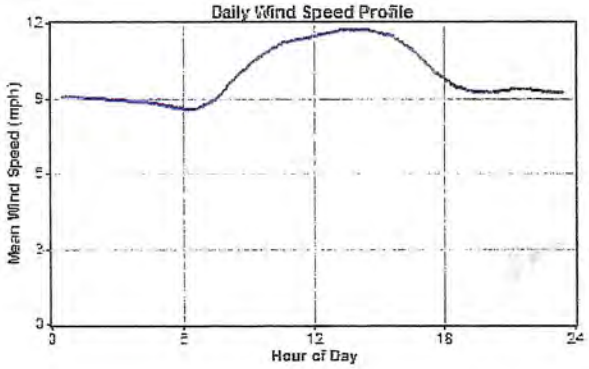


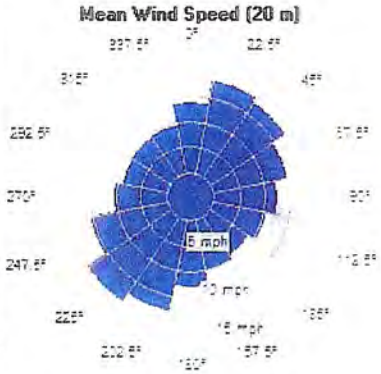


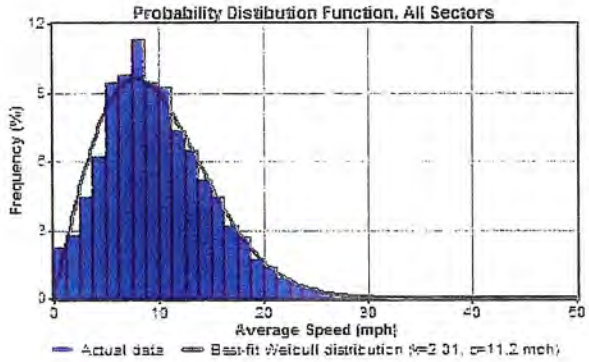
Pow WoW Ground/Washunga Bay

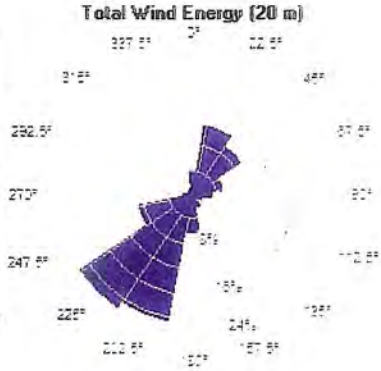
Wind Speed and Direction











Discussion

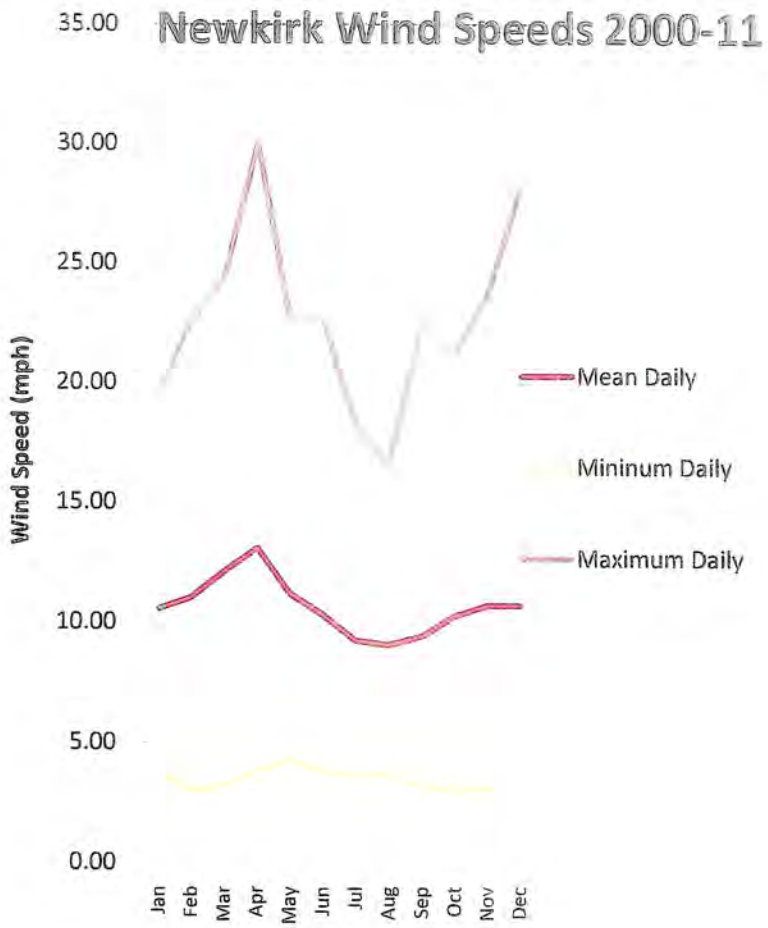
If the wind turbine is installed at 120 feet high more energy will be produced throughout the year. During the winter and fall, the wind direction is from NW or NE and in summer time it is from the south. In general for higher energy output, location, location, location is very vital. The rule of thumb for any energy production is to critically evaluate the wind speed, direction, and surrounding wind obstacles. A 10% change in wind speed can result in as much as a 30% change in available power. **Putting a turbine on too short a tower is like putting a solar panel in the shade (Mike Burgey).**

Precaution should be made in evaluating wind speed in that, the average wind speed is not always the best indicator of site's suitability due to daily or seasonal variation.

(See fig.5, and table 2)

Average Daily Mesonet wind speeds for Newkirk from 2000-2011 were used. Day with equipment failure was eliminated. The average monthly and average annual wind speeds from January 2000 through February 2011 are shown in the table and figure below

Newkirk Average Daily Wind Speeds (mph)			
Period	Minimum	Average	Maximum
Jan	3.8	10.54	19.66
Feb	3.04	11.00	22.58
Mar	3.2	12.08	24.33
Apr	3.85	13.07	30.07
May	4.31	11.17	22.67
Jun	3.83	10.27	22.7
Jul	3.62	9.20	18.19
Aug	3.69	9.03	16.57
Sep	3.18	9.39	22.31
Oct	3.05	10.24	21.12
Nov	3.09	10.67	23.59
Dec	3.22	10.66	28.1
Average	3.04	10.60	30.07
*Source: Mesonet			



The average annual daily wind speed came to 10.6 mph or 4.74 m/s.

3. Energy Estimates

To calculate energy net production, one should take into account all the obstacles that hinder energy production. IN this study limitations are:

1. Minimal Topographic effect
2. Electrical loss due to internal losses in the transforming
3. High Wind hysteresis

4. Ice losses
5. Wind loss due to change in wind direction
6. Availability due to turbine being shut down for service or any turbine fault.
7. High wind hysteresis due to the time taken by the turbine in re starting due to high wind shut-off.
8. Icing loses due to likelihood accumulated ice on blades

The net capacity factor for 50Kw, considering all these losses is minimal (<25%). Daily and Annual pattern of wind generation.

It is more than 10 years since the Newkirk Mesonet station started collecting climatological data. There is much more variation in daily wind speed and the average. The daily wind speed varies from 3.2 to 30.9 mph per month depending on the season. The wind speed varies with hours. Usually the night time, morning hours, and late afternoon produce high wind speed during fall and winter seasons. The minimum and maximum wind speed varies within a season.

4. Construction Costs

Based on recent quotes collected from Burgey, Endurance, and Northern power wind turbine companies an estimate and total project costs was prepared which includes:

1. Construction
2. Equipment
3. Financing
4. Legal
5. Transmission and inter connection cost as well as on site project costs

The total project cost for 10Kw Burgey turbine is $66,000 while the 50Kw Endurance is $366,000.

This cost includes wind turbine cost, construction, integrate, electrical system and pole costs.

Other Costs

- No off-site road access cost needed
- No off-site improvements needed
- No off-site transmission easement rights

Net Metering

The concept of net metering programs is to allow the electric meters of customers with generating facilities to turn backwards when their generators are producing more energy than the customer's demand. Net metering allows customers to use their generation to offset their consumption over the entire billing period, not just instantaneously. This offset would enable customers with generating facilities to receive retail prices for more of the electricity they generate. If the net metering requirements define Net Excess Generation (NEG) on a monthly basis, the consumer can only get credit for their excess that month. But if the net metering rules allow for annual NEG, the NEG credit can be carried for up to a year. This is an advantage to the consumer because of more wind availability in the winter than the summer.

Tax Credits and Exemptions

Exemption: You will receive exemption for processing machinery and equipment and electricity, fuel, and other tangible property used in manufacturing

Zero Emission Tax Credit: To apply for this incentive, you will need to complete a one page form for the DEQ. The form is called Zero Emission Facility Determinate Request.

Net Metering Incentive: The Oklahoma corporation commission (OCC) requires investor-owned utilities and electric cooperatives under its jurisdiction to file net metering tariffs for customer owned renewable-energy system combined heat and power (CHP) facilities up to 100 kW in capacity

Freeport inventory benefit: Oklahoma's Freeport law exempts for taxation goods, wares, and merchandise that come from outside the state and leave the state with nine months of such goods and held for assembly, storage, manufacturing, processing or fabricating purpose with the state. www.oktax.state.ok.us

Foreign Trade Zone: If you conduct international business, locating in one of Oklahoma's four FTZ, saves your money and helps you take advantage of effectiveness in custom proceedings.

American Indian Lands Tax Credits provide an accelerated federal property depreciation schedule; federal employment tax credit of up to $4,000 per qualifying employee per year; and savings up to 35% to 40% in depreciation equipment

Production Tax Credit: The current PTC value is 2 cents/kwh of electricity produced. The PTC was renewed for 3 years through the end of 2012 by Congress as part of the 2005 stimulus package. The package offers an option to the elect a 30% investment tax credit (ITC) in place of the PTC; an option to cover the ITC into grant for projects placed in service in 2009, or 2010, or placed in service before 2013 provided contraction beginning in 2009 or 2010; and a new $6 billion DOE renewable energy and transmission loan guarantee progress, which should feed around $60 billion in principal amount of guaranteed loans.

DSIRE Federal Incentive Database provides details on corporate depreciate exemption; corporate tax credits; and federal grant and loan progress. www.dsireusa.org

Wind Energy projects rely extensively on federal tax credits to encourage development and successful production of electricity. The 1992 Energy policy includes enactment of a production tax credit (PTC) under Section 45 of the internal revenue 1986. This credit was available to corporate entities owning and operating renewable energy products including wind energy. The tax credit in 1992 was $0.015/Kwh and has increased each year by the rate of inflation of the previous year for the first 10 years of operation of the equipment. The current PTC rate is $0.09/KwH. After 2003, the value of the PTC to project owner's that pay corporate income tax is equal to 19% of the total value wind project.

Indian Tribes cannot utilize the PTC, because they do not have a significant corporate federally taxable income.

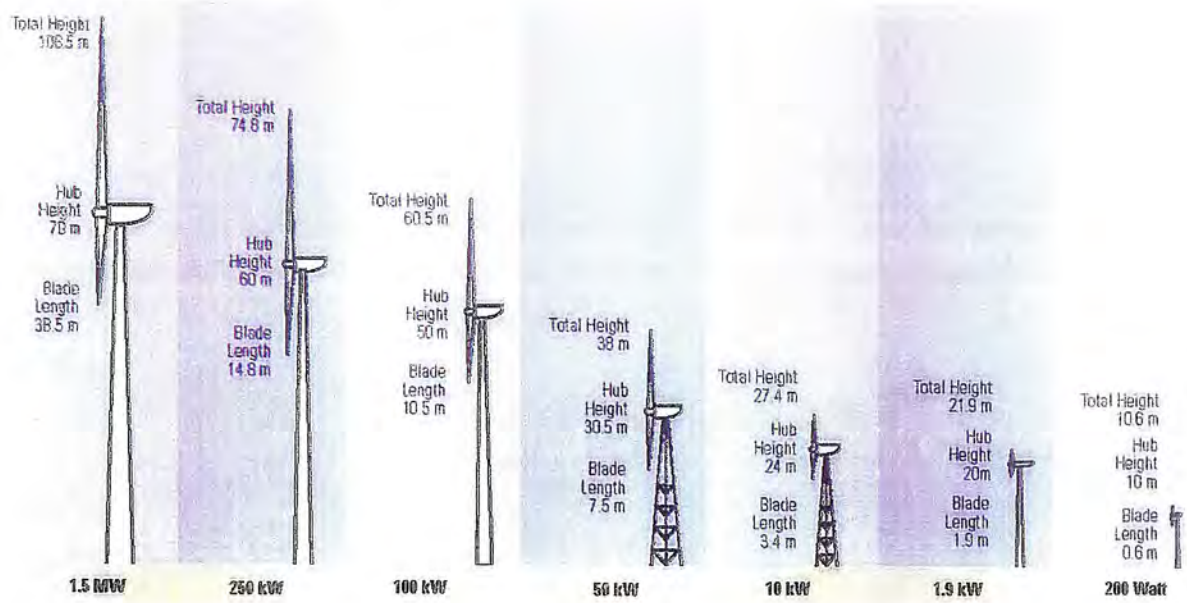
6. Wind Turbine Selection

The wind turbine selection was made based on energy output, the minimum wind speed requirement to produce energy, cost, maintenance, land use compatibility, size of the turbine, and sweeping area, height limit and recommendation based on past performance.

Types	Minimal Ht.	Size	Hub at	Output	Cost
Burgey	27.4m	10Kw	24m	15,000KwH	66,000
Endurance	38m	50Kw	30.5m	172,000KwH	338,000
Northern Power	60.5m	100Kw	50m	192,000KwH	700,000

The size of the turbine depends on the wind resources and the power needed to generate. In general the larger the rotor swept area (diameter of the rotating blades), the more power a turbine will produce at a given wind speed and the higher the price will be. (See Fig. 6)

Examples of different sizes of wind turbines, to scale



7. Siting Considerations

A plot plan will be prepared. This plan will be used for quantity estimates. Detail design for the foundation, size and types of transformers, underground or overhead electrical lines, road, gates, fencing, and maintenance of building and substation will be determined at a later date. Visual inspections of the ground surface, experience in installing met tower, and other building construction indicates soil conditions are likely to be easily workable.

8. Permitting

The key regulatory bodies involved with rules, standards, application, and permits for wind power products or wind equipment manufacturing are:

Federal Energy Regulatory Commission (FERC) regulates and oversees energy industries in the economic, environmental, and safety interests of the American people.

The National Wind Coordinating Collaborative (NWCC) monitor FERC activities and regularly publish updates on its website www.nationalwind.org

Southwest Power Pool (SPP) is regional transmission organized that oversees power distributor for nine states including Oklahoma. Wind power products developers must apply for interconnection with SPP before they can add their power output to the transmission grid www.spp.org

Oklahoma Corporate Commission (OCC) regulates all investor-owned utilities and elective cooperatives in the state, approving their rate and monitoring all generation, transmission, and distribution activities. www.occ.state.ok.us

Oklahoma Department of Environmental Quality (DEQ) handles permitting processing for energy production and manufacturing facilities in al industries; operates emergency response and environmental complaints program; and conduct regulation inspections. To apply for zero emission tax credit, companies need to complete a one page form (zero emission facility determinant requests) provided and processed by DEQ. There is no fee for determination. www.deq.state.ok.us

Discussion with the Kay Electric Mr. Doug Worley and Newkirk City Manager Mr. Jerald Stone have confirmed that the city nor the county does not claim jurisdiction in the installation of a wind generating project, especially on tribal lands. The State of Oklahoma would also do not exercise jurisdiction for permitting nor environmental quality act. If the funding comes from the federal government, DOE, BIA, U.S. FWS, they may be involved in the NEPA process. The federal government agencies would be consulted under NEPA to determine if any federally listed endangered species and wetland site that would be affected. Typically a NEPA study will take about 1 – 3 year costing about $100 - $150,000.

As per the email correspondence between the Newkirk City Manager and OMPA, the City of Newkirk does not allow wind generators to be interconnected with the city systems nor have they purchase anything from them.

9. Federal Aviation Administration Review

Structures taller than 200 feet are required to be reviewed by the federal aviation administration (FAA) and usually require lighting per FAA standards. Wind Turbines that exceed 200 feet has the potential to obstruct air traffic under FAA 7460. The Newkirk, Washunga Bay and Kaw City are about 15, 25, and 15 miles away from the Ponca City Airport respectively. This concern may not be a significant issue, since the height of the proposed wind turbines are less than 200 feet. However, it is highly recommended to have a day time white strobe and night time red blinking lighting.

10. Land Use Compatibility

The primary considerations in installing wind turbines are noise, public safety, visual impacts, and low frequency vibration. Modern turbines produce low levels of noise and can be installed anywhere close to noise sensitive sites.

Existing land use where the wind turbines to be installed includes clinic, tribal offices, 50 residential houses, wellness center.

Wind turbines may have a risk of blade loss (in most instances unlikely) and should be located less than a distance equal to the total height of the turbine. Careful consideration should be taken in case major mechanical failure happens on habitable buildings or human use area.

For some big turbines, it is recommended to keep turbines at least 500 feet away from residential areas or traffic sites.

11. Insurance for Installers and Owners

All small wind systems should have property coverage in the event of damage due to weather, fire, or vandalism, as well as liability coverage for property and personal injury. One method of insuring the system is to add it to an existing Kaw Nation's policy.
Commercial owners, such as farms, Tribes have had no reported problems with insurance. Prospective owners of wind turbines are encouraged to check with their insurance company prior to having the turbine installed. In some areas utilities require small wind turbine owners to maintain liability insurance in amounts of $1 million or more. In seven states including Oklahoma laws or regulatory authorities prohibit utilities from imposing any insurance requirements on small wind system that qualify for met metering.

12. Transmission Access

The Newkirk site is served by the City of Newkirk, which gets it electricity from the Oklahoma Municipality Power Authority (OMPA). The City of Newkirk provides water and discharge waste water from all Kaw Nation facilities.

The Washunga Bay Greenhouse, the POW WOW ground and the City of Kaw City are served by Kay Electric Cooperative. The Kay Electric Cooperative gets its electricity from the Western Farmers Electric Cooperative.

13. Training

1. The Oklahoma City Community College www.occc.edu offers wind turbine technician certification program.
2. Oklahoma State University-OKC www.osuokc.edu offers a 2 year course for wind technician in associate degree.
3. High plains Technology Center in Woodward www.hptc.net offers a wind energy technician certificate program.
4. Most of Oklahoma's higher education systems and Oklahoma nationally recognized career Tech www.okccareertch.org campuses offer technician trainings.

14 Economic Analysis

1. Endurance 50 Kw Wind Turbine

Project: Kaw Nation

Site Location: Kaw City, Oklahoma

Proposed Solution: (Prices Quoted in US dollars)

1 X Endurance E 3120 – 50 KW Wind Turbine System

Includes: Turbine, Galvanized Steel Tower, 3-Phase Electrical Control Package and Enhanced Remote Monitoring and Data Logging system, Lightning Protection package

Warranty:	5 Year Limited
O&M Service Plan:	5 years - $ 10,000 ($ 2,000 per/yr)

E3120 Turbine Cost:	$ 197,500
Tower Cost:	$ 38,000 (140 Ft Lattice Tower)
Installation Cost:	$ 80,000 **
Shipping:	$ 7,000 (estimate only – exact shipping costs will be charged)
Site Specific Review & Engineering	$ 2,000 (includes Geo Tech Survey, Stamped Foundation Drawings)
Turbine Commissioning	$ 3,900.00
Total Project Cost:	$ 338,400.00 US
Delivery	120 days

Recommended Actions:

Kaw Nation reviews our proposed system solution and determines if any additional information is needed before proceeding

Kaw Nation requests Endurance Wind Power to initiate Phase 2 by providing 30% deposit on project.

30% Deposit on project is DUE upon acceptance of agreement to start project and keep the production slot for 120 days.

35% Due 45 days before delivery of E-3120 Turbine

35% Due before turbine leaves warehouse

**Due to the E-3120's exceptionally large rotor diameter and swept area design of 3120 square feet along with other efficiencies the E 3120 is able to produce the highest energy output of any other turbine in its class. Its production excels in moderate wind locations wind classes 2-3-4-5.

2. Bergey 10 Kw Wind Turbine

	Federal	Kaw Nation	Total
A. Personnel	$0.00	$0.00	$0.00
B. Fringe Benefits	$0.00	$0.00	$0.00
C. Travel and Training	$0.00	$0.00	$0.00
D. Equipment			$48,566.00
BWC XL-S60 Turbine	$15,885.00	$15,885.00	
90 ft. Lattice Tower	$8,398.00	$8,398.00	
E. Supplies			$3,236.00
Wiring Kit	$1,618.00	$1,618.00	
F. Contractual			$15,000.00

Installation of Turbine	$7,500.00	$7,500.00	
G. Construction	$0.00	$0.00	$0.00
H. Other	$0.00	$0.00	$0.00
I. Direct Costs	$33,401.00	$33,401.00	$66,802.00
J. Indirect Costs	$0.00	$0.00	$0.00
K. Total Project Costs	$33,401.00	$33,401.00	$66,802.00

* no wind data for Kaw City

Endurance 50kw Cash Flow Without Tax Credit

Date: 3/17/2011

Cash Purchase

Assumptions (Inputs)

Total Installed Cost ($):	$338,000
Allocation to Business (%):	0
Annual Energy Output (kWh):	175,000
Electricity Cost ($/kWh):	$0.0970
Electricity Inflation Rate (%):	2
Loan Downpayment (%):	100
Down Payment ($):	$338,000
Amount of Loan ($):	$0
Interest Rate (%):	0
Loan Term (Years):	0
Month Installed:	0
Net Federal Tax Rate (%):	0
Net State Tax Rate (%):	0
O & M Cost ($/kWh):	$0.005
O & M Inflation Rate (%):	3
State Rebate (%):	0
State Tax Credit (%):	0
Federal Tax Credit (%):	0

Results

Loan Payments

Monthly Payment ($):	#NUM!
Value of Interest Deduction ($):	#NUM!
Net Monthly Payment ($):	#NUM!

Ave. Monthly Savings on Bill

Year 1 ($):	$1,415
Year 10 ($):	$1,724
Year 20 ($):	$2,102
Year 30 ($):	$2,562

Internal Rate of Retrurn

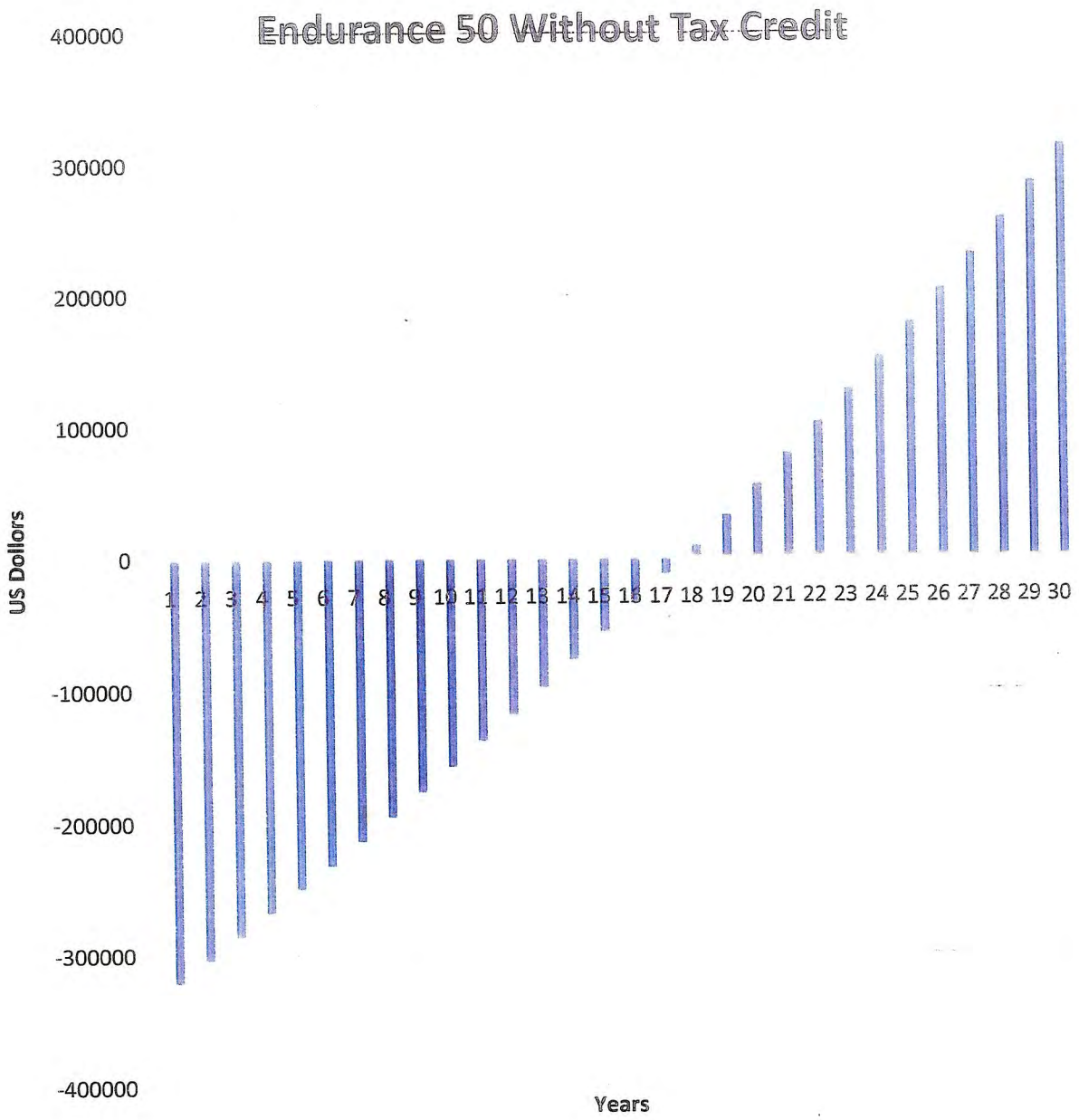
Years 1 - 30:	4.4%

Annual Cash Flow Model

Year	Net Energy	O&M Costs	Net Deprec.	Net Loan Payments	Annual Cash Flow	Total Cash Flow
0					($338,000)	($338,000)
1	$16,975	$0	$0	$0	$16,975	($321,025)
2	$17,315	$0	$0	$0	$17,315	($303,711)
3	$17,661	$0	$0	$0	$17,661	($286,050)
4	$18,014	$0	$0	$0	$18,014	($268,036)
5	$18,374	$0	$0	$0	$18,374	($249,661)
6	$18,742	($1,014)	$0	$0	$17,727	($231,934)
7	$19,117	($1,045)	$0	$0	$18,072	($213,862)
8	$19,499	($1,076)	$0	$0	$18,423	($195,439)
9	$19,889	($1,108)	$0	$0	$18,780	($176,659)
10	$20,287	($1,142)	$0	$0	$19,145	($157,514)
11	$20,692	($1,176)	$0	$0	$19,517	($137,997)
12	$21,106	($1,211)	$0	$0	$19,895	($118,102)
13	$21,528	($1,248)	$0	$0	$20,281	($97,821,
14	$21,959	($1,285)	$0	$0	$20,674	($77,147)
15	$22,398	($1,324)	$0	$0	$21,075	($56,073)
16	$22,846	($1,363)	$0	$0	$21,483	($34,590)
17	$23,303	($1,404)	$0	$0	$21,899	($12,691)
18	$23,769	($1,446)	$0	$0	$22,323	$9,632
19	$24,244	($1,490)	$0	$0	$22,755	$32,387
20	$24,729	($1,534)	$0	$0	$23,195	$55,582
21	$25,224	($1,580)	$0	$0	$23,644	$79,225
22	$25,728	($1,628)	$0	$0	$24,101	$103,326
23	$26,243	($1,677)	$0	$0	$24,566	$127,892
24	$26,768	($1,727)	$0	$0	$25,041	$152,933
25	$27,303	($1,779)	$0	$0	$25,525	$178,458
26	$27,849	($1,832)	$0	$0	$26,017	$204,475
27	$28,406	($1,887)	$0	$0	$26,519	$230,994
28	$28,974	($1,944)	$0	$0	$27,031	$258,025
29	$29,554	($2,002)	$0	$0	$27,552	$285,577
30	$30,145	($2,062)	$0	$0	$28,083	$313,660

Conservative assumption of no scrap value after 30 years.

Cash flow analysis is pre-tax.


Endurance 50 Without Tax Credit
400000
300000
200000
100000
0
-100000
-200000
-300000
-400000
US Dollors
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30
Years

Kaw Nation Wind Power

	2008	2009	2008	2009		(50 kw Endurance)		
Locations	Total kWh/yr	Total kWh/yr	Expenses/yr	Expenses/yr	Rate	Wind Turbine Costs	kw % Savings (y)	Payoff time (y)
Casino	5,646,028	4,990,656	$373,938.12	$395,568.53	$0.07	$338,400	3%	26.6
Kanza Health Clinic	114,680	102,880	$10,718.01	$11,342.72	$0.09	$338,400	167%	19.6
Wellness Center	255,600	224,680	$20,846.25	$20,852.72	$0.08	$338,400	77%	21.6
Clinic + Wellness	370,280	430,440	$31,564.26	$32,195.44	$0.09	$338,400	40%	20.7
Braman	577,760		$60,428.17		$0.10	$338,400	30%	16.9
Washunga	28,645		$5,600.52		$0.20	$338,400	600%	11.5
Kaw City	269,166		$33,634.04		$0.12	$338,400	64%	14.1

Feasibility Assessment 2

Wind Power Project

Dejene Alemayehu, PhD

Kaw Nation Environmental Department

3/16/2011

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Executive Summary

Kaw Nation Environmental Department has been engaged by Kaw Nation Executive Council members to prepare a wind energy feasibility study, and to develop a Business Plan based on the potential for a wind energy generation for Newkirk, Washunga Bay, and Kaw City areas.

This study is being funded under the Department of Energy's Tribal Energy Program, DOE Program number DE-000 136. The following is the business plan developed to provide Kaw Nation with economically- based plan that provides multiple benefits to the tribe and its members.

Several meetings and discussions have been conducted with the Kaw Nation Executive Council members to select one of the most feasible options of renewable energy resources.

INTRODUCTION

Commercial wind energy projects are dependent on their ability to deliver energy to a credit worthy purchasers of wholesale electricity without incentive fees to deliver the power over transmission lines.

The Kay Electric gets its whole sale electric city from Western Farmers Cooperative while the City of Newkirk gets from Oklahoma Municipal Power Authority (OMPA) and retail to Kaw Nation and surrounding residents. In this transaction the price of electricity in Kay County is about $0.10/Kwh.

According to the Kay Electric and City of Newkirk Utility Companies, Kaw Nation Consumes a total of 625,000 Kwh for its offices, clinic and wellness centers excluding the Casino.

The total energy output for a 50Kw Endurance Wind turbine is 172,000 Kwh/y while a 10Kw Burgey turbine only produces 15,000 Kwh/y.

If Kaw Nation puts a 10Kw Burgey Turbine in Kaw City it only covers 5.5%. If the same turbine is put at the Pow Wow grounds it replaces the current consumption by 52%%.

If the 50Kw Endurance Turbine is put at the Clinic in Newkirk it will cover 150% of the current consumption. The 50% can be net metered. If the same Turbine is put by the Wellness center it will only cover the current consumption by 67%. If the same 50 Kw Endurance Turbine is put at Washunga Bay (Pow Wow ground) it will cover by 614%.

Energy Pricing

Viability of a wind development is highly dependent on how windy the site is. This determines the project revenue and major cost of the project. The revenue or electricity generation increases as the wind speed increases. This can be achieved at higher wind tower. The Newkirk and other sites have moderate wind speed of 10 mph at 30 feet height of anemometer. If the wind tower is built at a greater than or equal to 120 feet, it may produce a reasonable wind speed to generate electricity. One has to understand the wind speed we get during the day and nights are not the same. Wind speeds vary within 24 hours. It also varies from season to season. According to the Mesonet anemometer the Newkirk site has a wind speed ranging from 3mph per day to 30 mph per day. Hence, the ability of a wind project to meet market pricing is the main determining factor whether or not a project can be built.

With the current wind turbine price it is hard to determine profitability without any federal assistance in the form of production tax, investment tax or credit for renewable resource (creb) tax.

According to the cash flow analysis prepared by Endurance and Burgey, the pay off period will not be shorter than 10 to 15 years.

The conclusion is that the project could be potentially feasible, but marginally so, and must be developed with reasonable overall costs in order to be viable.

Business Approach

1. Place a 50Kw Endurance turbine at the Washunga Bay (Pow Wow ground) or at the Greenhouse and connect to the Kay Electric Coop Utility and make a deal for net metering to use it for both the POW WOW grounds and Kaw City.

In general wind turbines are not high profitable unless and otherwise subsidized by the government.

Problems

Putting the turbine in Kaw City has some limitations:

1. Placing the turbines close to the office may have a safety problem to nearby buildings and employees if the turbine falls for some uncontrollable reasons.

2. The turbine should be built at a higher tower at least 120 feet high in order to overcome the obstruction of the wind speed from the surrounding trees. Since there was no anemometer, we are not sure of the wind speed in Kaw City.
3. The total Electric load at the pow wow is small. Agreement should be made with Kay Electric if the surplus electricity can be transferred to the Kaw City complex to offset the electric consumption. Since both the Pow Wow ground and Kaw City are under Kay Electric a Power Purchase Agreement can be drafted and signed by both parties.

Project Ownership

If order to make the project economics more favorable, the Kaw Nation must be able to utilize federal product tax credit (PTC). This tax credit accounts for approximately up to 30% of the value of the wind project and can be utilized by the companies who sale the turbines to Kaw Nation, or Kaw Nation should find companies who can make use of the tax credit.

Recommended Strategies

The following are recommendation for Kaw Nation to create a long term benefit.

1. Kaw Nation should look into different options other than wind energy to save energy cost. Kaw Nation should give more emphasis to carry out energy efficiency by replacing all its appliances with EPA approved Energy saving retrofit.
2. Kaw Nation should get tax credit in order to have a profitable scheme.
3. No wind turbines should be placed near existing houses or buildings.
4. Kaw Nation in close cooperation with the utility companies should setback a minimum distance for homes and buildings.
5. All the wind turbines should meet the standard of noise and safety set by the manufacturers.
6. Turbines that may be built should have at least less than 15 years pay off period.
7. Kaw Nation should consider insurance rate before installing.
8. Make sure no permit required. If the turbine is bought with the federal grant, Environmental Assessment will be required.
9. If the fund is to come from non federal government, permit may not be a requirement.
10. Agreement must be made with the City of Newkirk and Kay electric for net metering.
11. The price of buying surplus electric by Kay Electric is 1.72 cents whether it is summer or winter This should be negotiated.

12. If Kaw Nation is going to own a turbine, it should train its own staff members, and be responsible for the maintenance and management cost.
13. If no subsidy from the government, the wind projects may not be a profitable business.

Payback Period = 16 years

Step 1: Financial Assummptions

Please make a selection using the radio buttons t

○	○	◉	○

	Mortgage	Loan	Cash	User-Defined Financing
Downpayment Percentage (%)	10%	10%	100%	
Interest Rate (%/year)	6.5%	10.0%	0.0%	
Marginal Effective Income Tax Rate (%/year)	30%	0%	0%	
Debt Term (years)	30	15	0	

Payback Period = 16 years

Step 2: Site Characteristics

Please make a selection using the radio buttons belo

	Great Plains Site	Class 6 Site	Class 4 Site	Class 6 High Elevation
Site Properties				
Average Wind Speed (meters/second)	8.0	6.7	5.8	6.7
Anemometer Height (meters)	50.0	10.0	10.0	10.0
Wind Shear Exponent	0.143	0.143	0.143	0.143
Weibull k	2.3	2.0	2.0	2.0
Site Elevation (meters)	800	0	0	2,000
Avoided Energy Costs				
Average Cost of Electricity ($/kWh)	0.07	0.07	0.07	0.07
Nominal Electricity Escalation Rate (%/year)	2.00%	2.00%	2.00%	2.00%

w:

Class 4 High Elevation	Kaw Nation, Newkirk

5.8	4.7	Average site wind speed, expressed in m/s.
10.0	10.0	Anemometer height is in meters and is height at which the average wind speed was measured. If unk
0.143	0.200	Wind shear exponent may be assumed to be "1/7" or 0.143 for smooth terrain. For flat terrain with so
2.0	2.0	If Weibull k is not known, use k = 2 for inland sites, use 3 for coastal sites, and use 4 for island sites
2,000	351	

0.07	0.1	Average price of electricity from current provider.
2.00%	2.00%	Expected rate of electricity price increase, includes inflation.

Payback Period = 16 years

Step 3: System Properties

Please make a selection using the radio buttons below:

	AOC 15/50 Wind Turbine	BW Excel - S/60	WTIC Jacobs 29-20	Whisper H175 (WPT 3000)	NewKirk Endurance E3120
System Costs					
Total Installed Cost ($)	$101,742	$33,504	$28,392	$8,214	$236,880
Variable Costs ($/kWh)	$0.015	$0.005	$0.005	$0.005	$0.005
Nominal Variable Cost Escalation Rate (%/year)	2.00%	2.00%	2.00%	2.00%	2.00%
Fixed Costs ($/kW)	$0.000	$0.000	$0.000	$0.000	$0.000
Nominal Fixed Cost Escalation Rate (%/year)	2.00%	2.00%	2.00%	2.00%	0.00%
Physical Characteristics					
Rated Power (kW)	50	10	17.5	3	50
Rotor Hub Height (m)	24	30	30	24	42.67
Availability (%)	98%	98%	98%	98%	98%
Performance Margin	0.0%	0.0%	0.0%	0.0%	15.0%
Performance Derating	10.0%	10.0%	10.0%	10.0%	10.0%

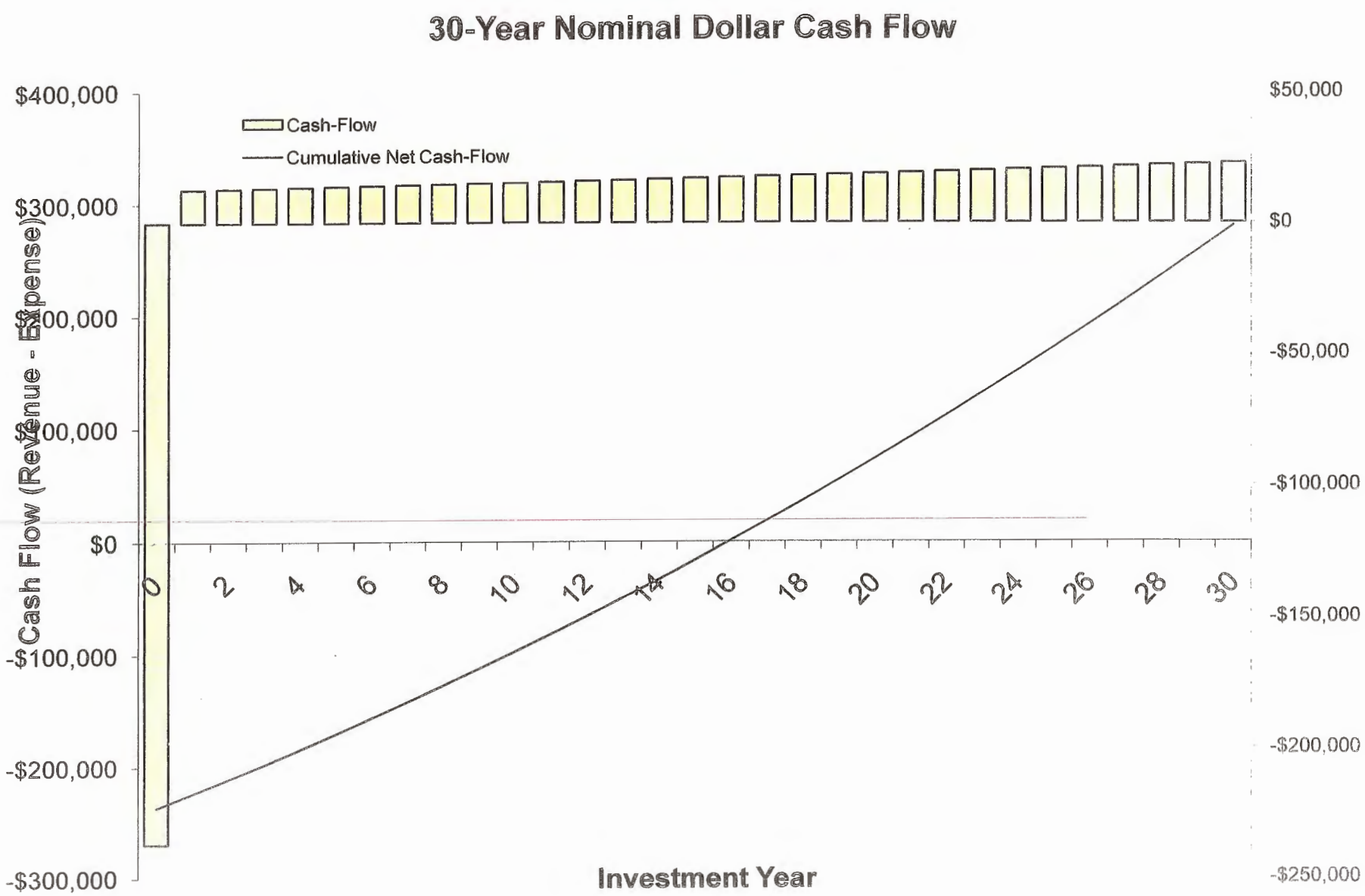
Power Curve (Wind Turbine Power (kW) @ x m/s)

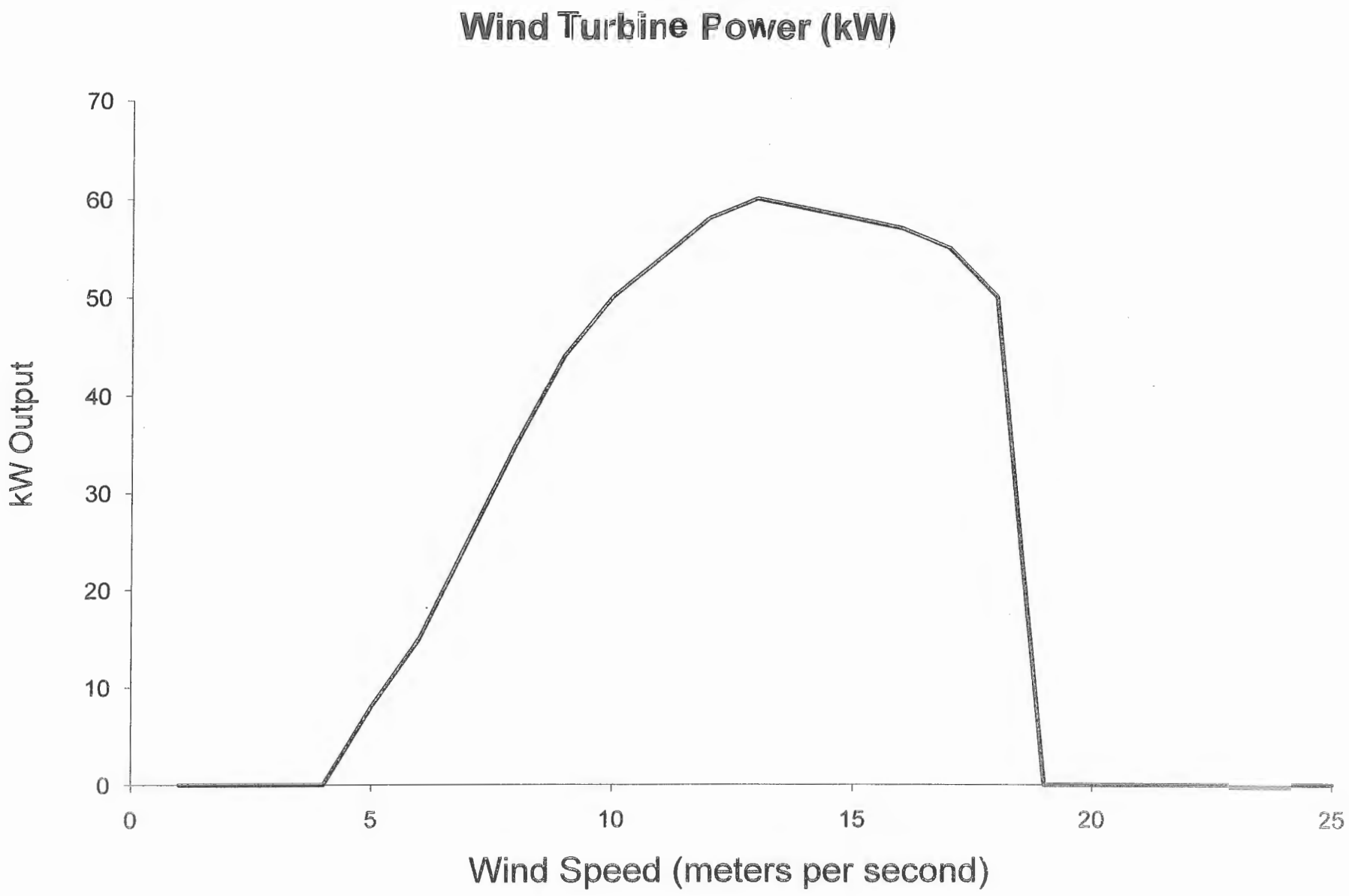
If expressed in miles/hour, convert to meters/second by multiplying by 2.24.

1 m/s	0.00	0.00	0.00	0.00	0
2	0.00	0.00	0.00	0.00	0
3	0.00	0.00	0.00	0.00	0
4	0.00	0.25	0.70	0.16	0
5	4.40	0.80	1.30	0.39	8
6	8.90	1.65	2.30	0.72	15
7	15.60	2.55	3.40	0.99	25
8	24.40	3.65	5.10	1.41	35
9	33.00	4.85	7.40	1.86	44
10	44.00	6.15	10.30	2.52	50
11	50.00	7.50	13.70	3.12	54
12	55.00	9.00	17.50	3.39	58
13	58.00	9.50	17.50	3.54	60
14	62.00	10.00	17.50	3.60	59
15	64.00	8.00	17.10	3.54	58
16	66.00	6.00	6.10	3.48	57
17	65.00	2.70	5.40	3.33	55.00
18	64.00	3.00	5.40	3.27	50.00
19	64.00	3.00	5.40	3.21	0.00
20	64.00	3.00	5.40	3.12	0.00
21	63.00	3.00	5.40	3.12	0.00
22	63.00	3.00	5.40	3.12	0.00
23	63.00	3.00	5.40	3.12	0.00
24	63.00	3.00	5.40	3.12	0.00
25	63.00	3.00	5.40	3.12	0.00

Total installed cost including applicable sales tax.
Initial variable production costs. Typically $0.015/kWh for large grid-connected wind turbines, and lower for small wind turbines with fewer moving parts.
Variable production cost escalation rate, includes inflation. 0-5% if typical.
Initial fixed production costs.
Fixed production cost escalation rate, includes inflation. 0-5% is typical.

Availability is an allowance for wind turbine downtime. Availability of 95 - 98 % is typical.
Performance margin is a derating that accounts for unusable energy (e.g. when batteries are full) and adds a margin of safety in satisfying load requirements. Use 0.0 for grid-connected applications. Use 0.05 (5%) for remote homes a
Performance Derating is a derating of the wind turbine power curve for wind turbulence, product variability, and other factors that affect performance.


30-Year Nominal Dollar Cash Flow
Cash-Flow
Cumulative Net Cash-Flow
$400,000
$300,000
$200,000
$100,000
$0
-$100,000
-$200,000
-$300,000
$50,000
$0
-$50,000
-$100,000
-$150,000
-$200,000
-$250,000
0
2
4
6
8
10
12
14
16
18
20
22
24
26
28
30
Investment Year
Cash Flow (Revenue - Expense)


Wind Turbine Power (kW)
kW Output
70
60
50
40
30
20
10
0
0
5
10
15
20
25
Wind Speed (meters per second)

Result

Payback Period (SPB)	16	*Number of years before initial investment is fully recovered*
Rate of Return (IRR)	5%	*Annual return on initial investment*
Net Present Value (NPV)	$280,151	*Present-day investment value if discounted at the after-tax interest rate.*

Summary Assumptions

Power Output (kWh/year)	131,525
Average Cost of Electricity ($/kWh)	$0.10
Nominal Electricity Escalation Rate (%/year)	2.00%
Total Installed Cost	$236,880
Downpayment (%)	100.00%
Debt Term (years)	0
Interest Rate (%/year)	0.00%
Marginal Effective Tax Rate (%/year)	0.00%
Variable Cost ($/kWh)	$0.01
Nominal Variable Cost Escalation Rate (%/year)	2.00%
Rated Power (kW)	50
Fixed Cost ($/kWh)	$0.00
Nominal Fixed Cost Escalation Rate (%/year)	0.00%

30-Year Nominal Cash-Flow (All units are expressed as dollars unless otherwise noted)

	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
Revenue																															
Power Output (kWh/year) (A)		131,525	131,525	131,525	131,525	131,525	131,525	131,525	131,525	131,525	131,525	131,525	131,525	131,525	131,525	131,525	131,525	131,525	131,525	131,525	131,525	131,525	131,525	131,525	131,525	131,525	131,525	131,525	131,525	131,525	131,525
Avoided Cost of Electricity ($/kWh) (B)		$0.102	$0.104	$0.106	$0.108	$0.110	$0.113	$0.115	$0.117	$0.120	$0.122	$0.124	$0.127	$0.129	$0.132	$0.135	$0.137	$0.140	$0.143	$0.146	$0.149	$0.152	$0.155	$0.158	$0.161	$0.164	$0.167	$0.171	$0.174	$0.178	$0.181
Total Revenue (A*B)		$13,416	$13,684	$13,958	$14,237	$14,521	$14,812	$15,108	$15,410	$15,718	$16,033	$16,353	$16,681	$17,014	$17,354	$17,702	$18,056	$18,417	$18,785	$19,161	$19,544	$19,935	$20,333	$20,740	$21,155	$21,578	$22,010	$22,450	$22,899	$23,357	$23,824
Expenses																															
Initial Capital Expenditure (Downpayment)	$236,880																														
Amount Financed	$0																														
Total Debt Payment		$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Before-Tax Debt Interest Payment		$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Debt Principal Payment (C)		$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
After-Tax Debt Interest Payment (D)		$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Variable Costs (E)		$671	$684	$698	$712	$726	$741	$755	$771	$786	$802	$818	$834	$851	$868	$885	$903	$921	$939	$958	$977	$997	$1,017	$1,037	$1,058	$1,079	$1,100	$1,122	$1,145	$1,168	$1,191
Fixed Costs (F)		$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Total Expenses (C+D+E+F)		$671	$684	$698	$712	$726	$741	$755	$771	$786	$802	$818	$834	$851	$868	$885	$903	$921	$939	$958	$977	$997	$1,017	$1,037	$1,058	$1,079	$1,100	$1,122	$1,145	$1,168	$1,191
Net Cash-Flow	-$236,880	$12,745	$13,000	$13,260	$13,525	$13,795	$14,071	$14,353	$14,640	$14,933	$15,231	$15,535	$15,847	$16,163	$16,487	$16,816	$17,153	$17,496	$17,846	$18,203	$18,567	$18,938	$19,317	$19,703	$20,097	$20,499	$20,909	$21,327	$21,754	$22,189	$22,633
Cumulative Net Cash-Flow	-$236,880	-$224,135	-$211,136	-$197,876	-$184,351	-$170,556	-$156,484	-$142,132	-$127,492	-$112,559	-$97,328	-$81,793	-$65,946	-$49,783	-$33,296	-$16,479	$673	$18,169	$36,015	$54,218	$72,784	$91,722	$111,039	$130,742	$150,840	$171,339	$192,248	$213,575	$235,329	$257,518	$280,151

= Calculated Values
= User Selected Values

Financial Assumptions

Downpayment Percentage (%)	1
Interest Rate (%/year)	0
Marginal Effective Income Tax Rate (%/year)	0
Debt Term (years)	0

Site Characteristics

Site Properties

Average Wind Speed (m/s)	4.74
Anemometer Ht (m)	10
Wind Shear Exponent	0.2
Weibull k	2
Site Elevation (m)	351

Avoided Energy Costs

Average Cost of Electricity ($/kWh)	0.1
Nominal Electricity Escalation Rate (%/year)	0.02

System Characteristics

System Costs

Total Installed Cost ($/kW)	338400
Variable Costs ($/kWh)	0.005
Nominal Variable Cost Escalation Rate (%/year)	0.02
Fixed Costs ($/kW)	0
Nominal Fixed Cost Escalation Rate (%/year)	0

Physical Characteristics

Rated Power (kW)	50
Rotor Hub Height (m)	42.67
Availability (%)	0.98
Performance Margin	0.15
Performance Derating	0.1

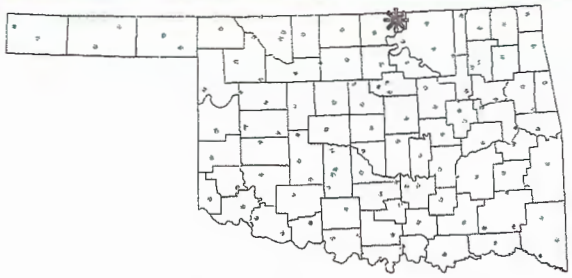
Hub Height Average Wind Speed (m/s)	6.34
Air Density Factor	0.97
Average Annual Power Output (kWh)	131525
Implied Capacity Factor	30%

Wind Speed (m/s)	Wind Turbine Power (kW)	Wind Speed Probability (%)	Contribution to Average Wind Turbine Power
1	0	3.87%	0.00
2	0	7.29%	0.00
3	0	9.91%	0.00
4	0	11.51%	0.00
5	8	12.05%	0.70
6	15	11.64%	1.27
7	25	10.50%	1.90
8	35	8.93%	2.27
9	44	7.18%	2.29
10	50	5.49%	1.99
11	54	3.99%	1.56
12	58	2.76%	1.16
13	60	1.83%	0.79
14	59	1.16%	0.49
15	58	0.70%	0.29
16	57	0.40%	0.17
17	55	0.22%	0.09
18	50	0.12%	0.04
19	0	0.06%	0.00
20	0	0.03%	0.00
21	0	0.01%	0.00
22	0	0.01%	0.00
23	0	0.00%	0.00
24	0	0.00%	0.00
25	0	0.00%	0.00
Totals		99.67%	15.01

Wind Climatology
Newkirk Mesonet Station
Station ID: NEWK

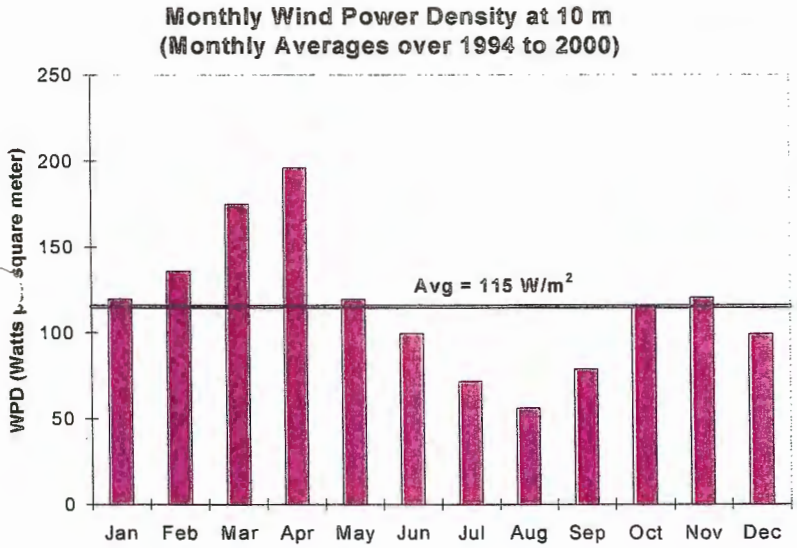
owpai Oklahoma Wind Power Assessment Initiative

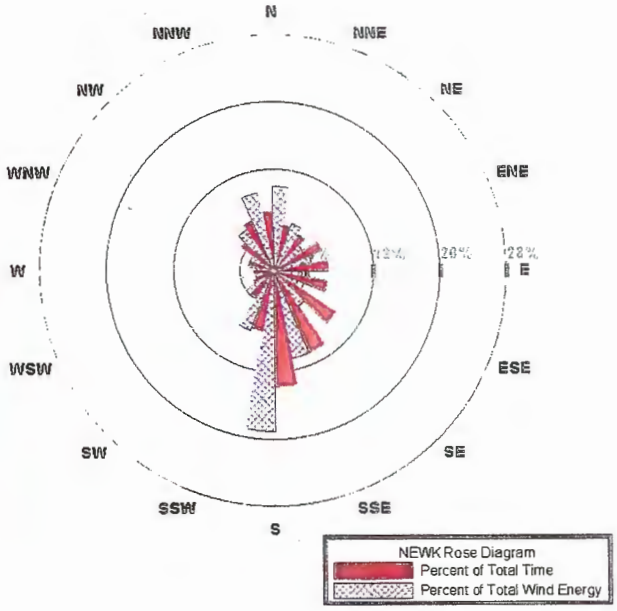
Class 2 Site (January '94 – December '00)
Average 10 m Wind Speed = 4.76 m/s (10.6 mph)
Average 10 m Power Density = 115 W/m^2

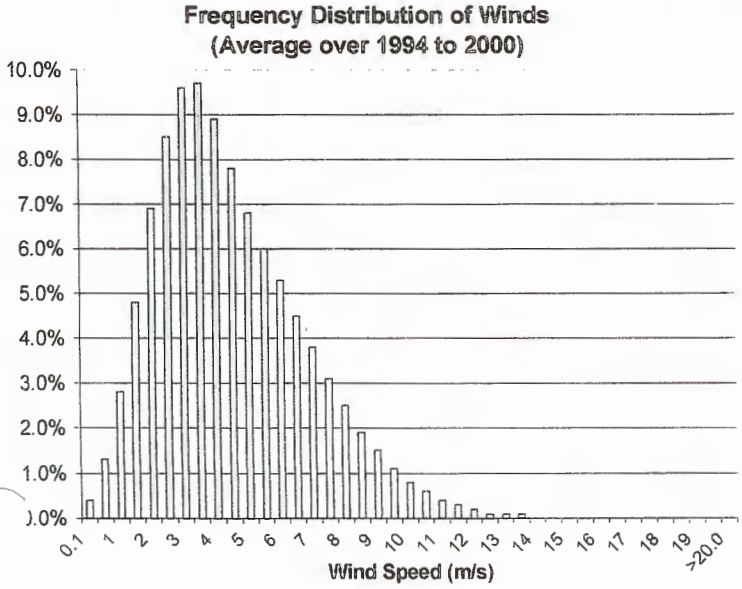


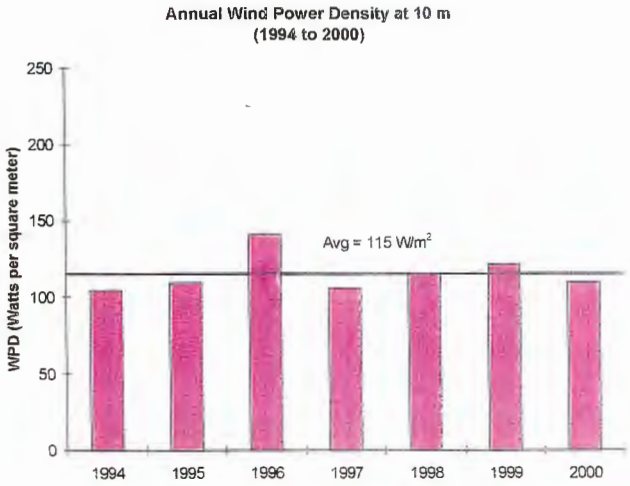
Site Conditions: The station's fetch conditions are rated "excellent". The terrain exposure at the site is +9 meters to the north and +26 meters to the south.

Other wind Statistics: The five-minute averages for ten-meter wind speeds exceeded 9 m/s (20.1 mph) approximately 5.2% of the time, while winds were less than 4.5 m/s (10.1 mph) approximately 52.9% of the time.







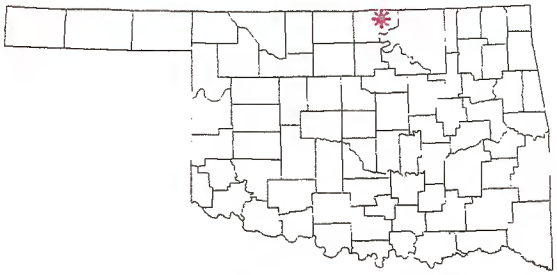


Version Date: 6/22/01

Kaw Tribe 20-m Tower
Winter 2001 - 2002 Wind Summary

Oklahoma owpi Wind Power Initiative

Month	Average Wind Speed	Wind Power Density	%Intervals Used
December '01	4.97 m/s (11.1 mph)	146 W/m^2	100%
January '02	5.46 m/s (12.2 mph)	158 W/m^2	94%
February '02	6.07 m/s (13.6 mph)	256 W/m^2	92%

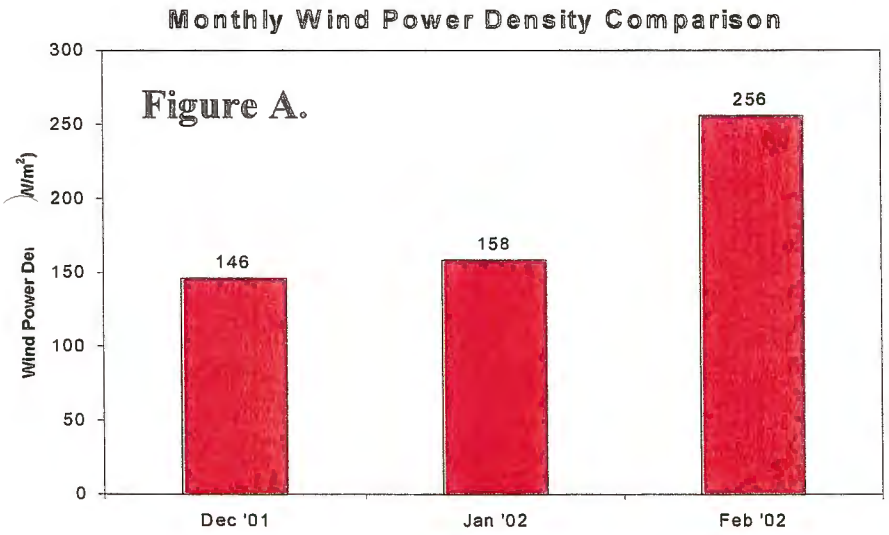


BACKGROUND - On October 19th 2001, the Oklahoma Wind Power Initiative assisted the Kaw Tribe with the installation of a 20-meter tilt-up wind resource tower near the town of Newkirk, Oklahoma. The tower and instrumentation were obtained from the U.S. DOE's National Renewable Energy Laboratory (NREL) as part of their Native American wind instrument loan program.

SUMMARY – (Figure A.) The average wind power density (WPD) is plotted for each month in the season. WPD is used to gauge the amount of energy in the wind, and its computation is independent of turbine type.

(Figure B.) The wind rose shows the directional distribution of wind speeds and wind energy. For the winter of 2001-2002 the winds were from the south-southeast, south, and south-southwest approximately 37% of the time, while these directions accounted for 45% of the wind energy.

(Figure C.) Categories or bins are labeled with the center point and have a width of 2 mph. For example, the 11 mph bin has a frequency of 15%, so wind speeds between 10 and 12 mph occur 15% of the time.



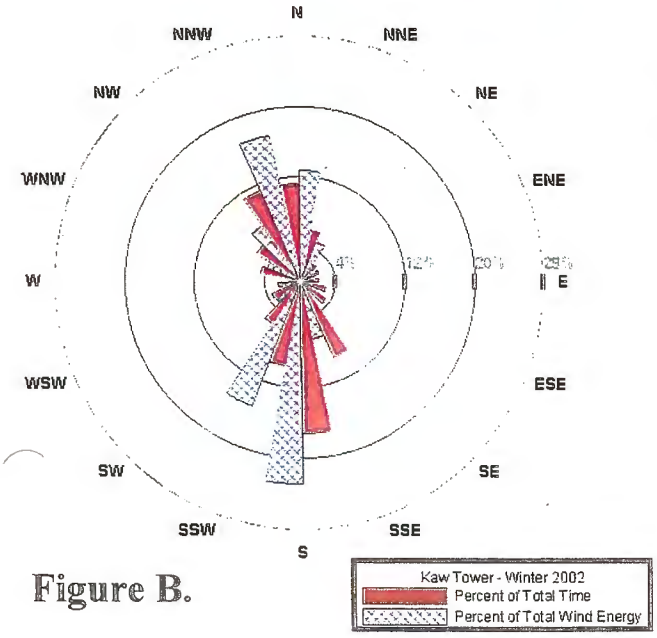
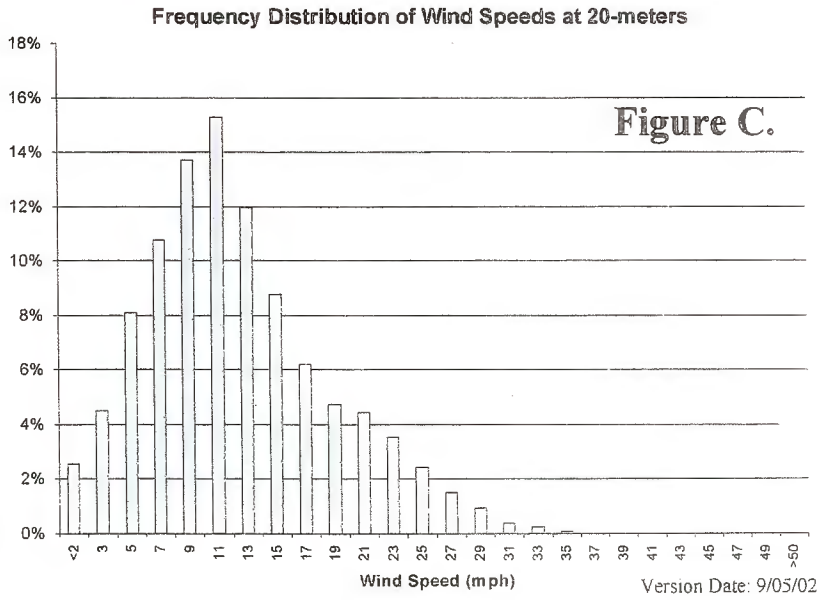


Figure B.



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