Wind Energy Site Assessment
Report Form

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Consultant contact information:
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Date of Consultation: January 17, 2007

Time Spent on site: 1:30 hrs Mileage: 260 miles RT

Latitude: 44.54576 Longitude: -87.78545 Elevation: 800'

Name of Client: XXXXX Pallet Co.
Contact Information:
Scott
N. County Road
WI
phone
e-mail

County: Brown
Utility: WPS

Project Overview

The XXXXX Pallet company has a great location for a wind system, likes the idea of renewable energy, and is interested in finding out if it makes financial sense to install a wind system to alleviate some of their high utility bills.

CLIENT INFORMATION

1. Why is the client interested in renewable energy?
The client is interested in determining if a wind system will lower electricity costs for the business.

2. What types of system(s) is the client interested in?
Wind

3. Is the system being installed as part of a new construction, or as a retrofit?
Retrofit.

4. What is the client's timeline for installation? Will it be installed all at once or incrementally?
If the economics make sense, they would consider installing in 2007.

5. How involved is the customer willing to be with the system?
Is interested in being involved in the installation of the system.
Will take full responsibility for the maintenance of the system.
Will perform basic maintenance, but wants technical back up for problem situations.
X Wants maintenance performed by outside contractor.

Comments: The client would like the installer to be responsible for maintenance.

6. Description of Site and Property:

A. Are there any airports located nearby?
The closest airport is Austin Staubel International Airport in Green Bay and there is an air strip near Rio Creek. Both of these are well over 4 miles away from the XXXXX Pallet company and so no FAA application is required.

B. Soil type and depth of bedrock:
Mr. XXXXX indicated that the soil was clay. This should pose no difficulties when digging the tower foundation. . The septic and well are to the north of the building and so will not interfere with trenching to the electrical box.

C. Electrical Service
There is currently three phase 480v service at the site. The breaker box and meter are located in the southwestern corner of the shop. There are plenty of open slots.


D. Electrical Usage

XXXXX Pallet has an unusual situation in that they have a high energy demand and low energy use facility. The high demand puts them into the utility rate category called CG-20. They get a reduced energy use charge with this rate, but high system and high customer demand charges. Unfortunately, XXXXX Pallet does not use that much electricity and so the demand charges far outweigh the energy use rate savings. In fact, the demand charges cause the overall energy rate to exceed the maximum amount that WPS is allowed to charge ($0.153/kwh in 2006 and $0.166/kwh in 2007) and WPS must refund the excess. This means that XXXXX Pallet is paying the maximum rate for electricity that is legally permissible every month; 16.56¢/kwh in 2007![1]

The high demand charges are caused by 1 large 300 HP machine that grinds pallets up into bedding. This machine is used about 3 times per week for 2-3 hours. Other than this machine, there is a 15 HP air compressor that is heavily used, and three 5-10 HP power tools used for 8 hours/day; also about 14 High Intensity Discharge (HID) lights. The office part of the building has some florescent lighting, a small refrigerator and a small 10 gallon water heater. The fuel for the space heat is wood and LP.

For XXXXX Pallet the following WPS rates apply:

Summer June 1 – Sept 30 On Peak: M-F 8:00am – 6:00pm
Winter October 1 – May 31 On Peak: M-F 8:00am – 1:00pm and 5:00pm-9:00pm

The charges are as follows: Energy Use On-peak: $0.05722/kwh Energy Use Off-peak: $0.03265/kwh System Demand Charge: $6.524/kW every 15 mins. - peak demand for the billing month, sampled only during on-peak hours.
Customer Demand Charge: $1.30/kW - peak demand over 12 months

	Jan '06	Feb '06	Mar '06	April '06	May '06	June '06	July '06	August '06	Sept '06	Oct '06	Nov '06	Total 11 mo.
Energy Use On Peak (kwh)	2400	3200	2560	2080	2880	5120	5120	4960	4000	3360	3040	38,720
Energy Use Off Peak	7680	6240	4160	3840	2720	1920	2080	1920	2240	2720	3520	39,040
Demand Charge kW	150 $954	160 $1044	142 $926	212 $1383	169 $1102	172 $1452	184 $1751	174 $1656	185 $1761	184 $1256	222 $1448	
Customer Demand Charge kW	241 $313	241 $313	241 $313	241 $313	241 $313	241 $313	241 $313	241 $313	212 $276	212 $275	222 $289	

[1] WPS is trying a new program called Response Reward starting in 2008 that may help the situation.

Because wind is intermittent, it is likely that the demand charges will remain the same even with a wind system that offsets 100% of the kilowatt hour energy usage. Utility customers with these types of demand charges will experience a longer pay-back time on renewable energy systems because these charges can not usually be avoided. All the customer can do is to try and reduce their peak demand, perhaps by scheduling different times for various high energy processes or activities. For example, in the summer months, the 300 HP shredder could be run between 1:00pm and 5:00pm and avoid the expensive system demand charges which are only recorded during on-peak hours.

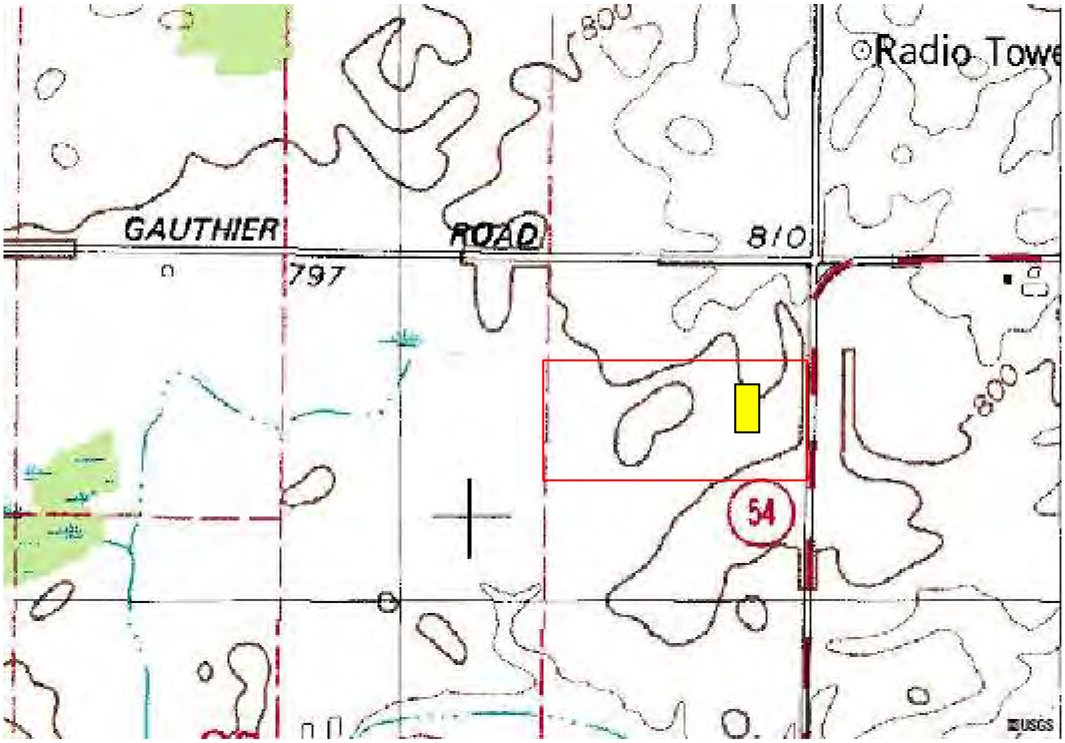
E. Physical Description of site and property:

XXXXX Pallet is located on 10 acres in a flat rural area. There is one building which consists of a small front office area and a large shop. There are no trees or other obstructions within ½ mile. The electrical meter is behind the building on the southwest corner. The large 300 HP pallet grinding machine is positioned outside on the south side of the building next to the meter. . This machine is blocking a straight line run to the electrical box so the wire run from the wind system will have to be routed around this large machine.

Looking northwest at the XXXXX Pallet Company from Hwy P

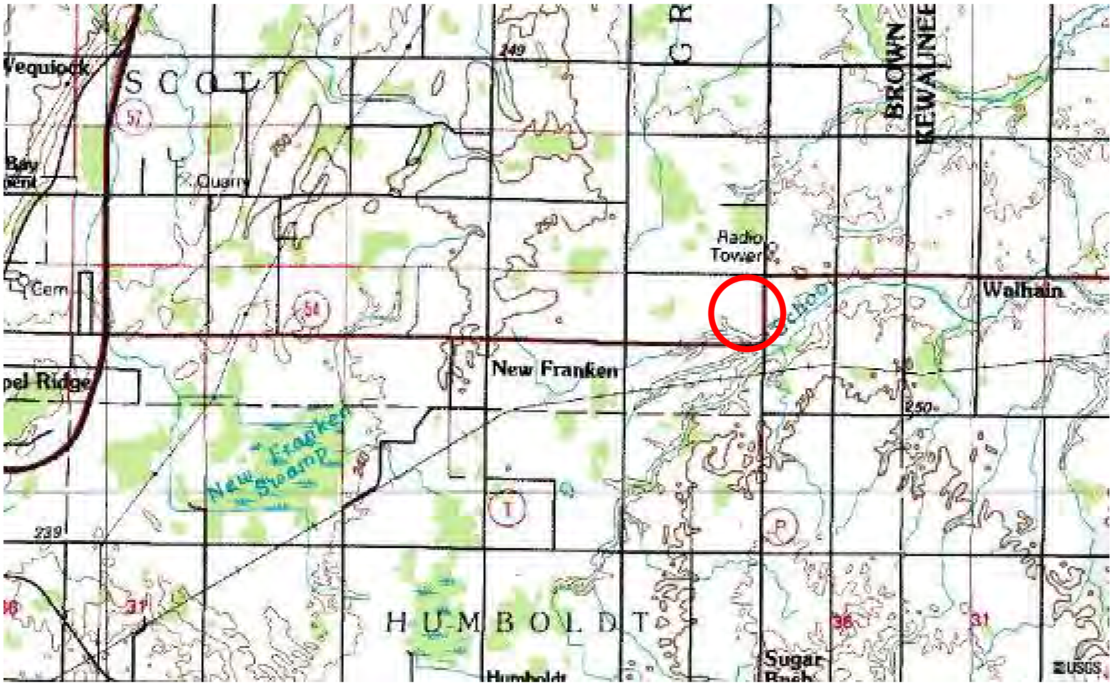
Aerial Photo and Topo maps of Property

1" ~ 200yd 1992



1" ~ 200yd **(Gauthier Rd is now Algoma Rd)** 1978

1” ~ 1 mile 1992



1” ~1 mile **1978**

360 degree photos from Site 1

South

Southwest

West

Northwest (Red machine is pallet grinder)

North

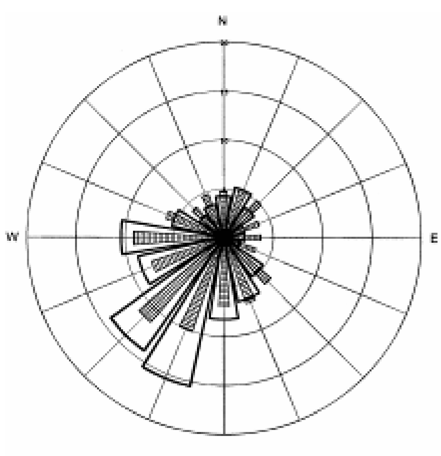
Northeast

East

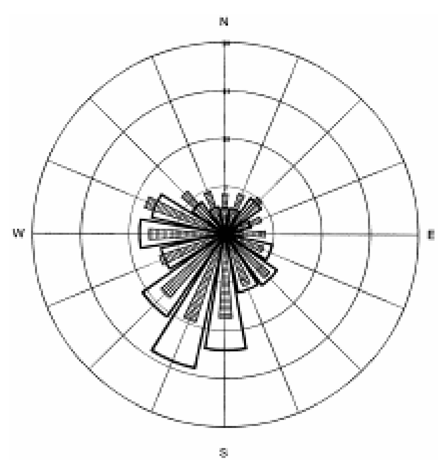
Southeast

F. Prevailing wind direction: When siting a turbine, it is important to know what kind of wind resource is available. From 1997 to 2001 a study called the Wind Resource Assessment Program (WRAP) was conducted in Wisconsin by a consortium of utilities. The purpose of the study was to measure the wind resource in the state based on 14 monitoring stations. The wind speed and wind direction were recorded at 60 meters (197') above ground level at all stations for 3 years. The report, released in January 2002, resulted in a "wind map" of Wisconsin. The wind map provides estimates for average annual wind speeds (at a height of 197') for all areas of the state. This map can be found at the Focus on Energy website www.focusonenergy.org and is attached at the end of this report. A diagram illustrating the prevailing wind directions was also created for each station. This diagram is called a **wind rose.** The monitoring stations that were closest to this site are #410 in Brown County approximately ten miles south of Green Bay, 15 miles southwest of this site; and #411: approximately two miles north of Clay Banks, approximately 25 miles northeast of this property. The wind roses for the monitoring stations are shown below. From these diagrams, we can see that predominant winds from the southerly and westerly directions.

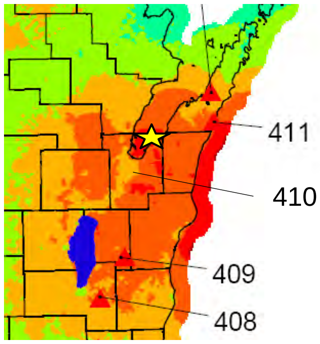
This **wind rose** graph illustrates the percent time and percent energy in each direction sector. The wide, outlined bars represent the percent of total energy and the narrower, shaded bars illustrate the percent of total time in each of the sixteen direction sectors. (Wind rose from Wisconsin Wind Resource Assessment Program (WRAP) 2002 report).



Monitoring Station #410



Monitoring Station #411



Wisconsin Wind Map.
XXXXX Pallet Company
indicated by yellow star

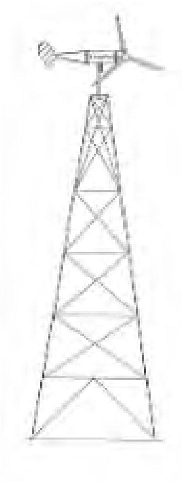
7. Description of Potential Wind System

A. Tower Choices

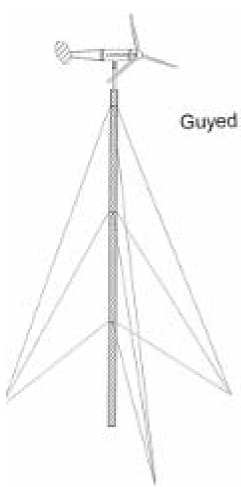
XXXXX Pallet is interested in a larger turbine so a free standing tower would be used. Free-standing towers

- Have no guy wires.
- Small footprint (about 12'-15' square), which is good for tight spaces.
- More expensive than guyed towers because it contains the most steel and weighs more than the other types.
- Most visible on the landscape because of all this steel.
- Can accommodate larger, heavier turbines than guyed and tilt-up.
- Requires climbing the tower for maintenance.

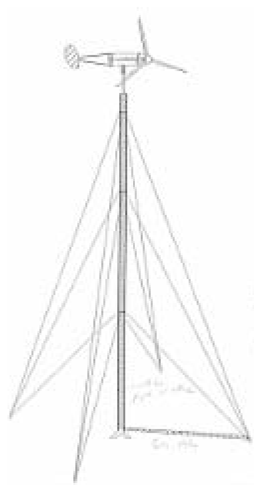
For small commercial wind systems, 35kW to 90kW, a free-standing tower is used and will provide the strength necessary to handle not only the weight of the turbine, but also the torque as the winds push on the rotor. **Monopoles** are usually used for larger commercial turbines.



Freestanding



Guyed Lattice



Guyed Tilt-Up

Photo credit: American Wind Energy Association - AWEA

Monopole

B. Potential Sites for Wind System:

The turbine should be located where it can intercept the most wind, based on the prevailing wind directions and the locations of the highest obstructions. The more wind the more electricity. Obstructions, such as buildings, rough terrain, and tall trees disrupt the flow of the wind and create turbulence. Turbulence not only reduces the amount of energy that can be extracted, but also creates a harsher environment for the wind turbine, especially the rotor blades, and this may shorten the life of the system. The best sites for wind systems are on wide open land and on the tops of ridges. To reduce the effect of turbulence, the turbine should be sited farther away from the obstructions and/or on a higher tower where the turbine and the rotor can be above the turbulence. According to the wind rose that most closely represents this site; the prevailing winds are from the southern and western directions. If wide open land is not available, it is best to site the turbine where the obstructions do not block the wind from these prevailing wind directions, and/or significantly above the tallest obstruction. For the XXXXX Pallet location there are really no obstructions of concern.

Possible Wind System Locations:

There are several factors to be taken into account when siting a wind system. The primary requirement is that the turbine is able to intercept the most wind with the least turbulence as stated above. The other considerations include the length of the wire run to the meter, and, the convenience of location to the property owner to make sure that the wind system does not interfere with the day to day activities. Local setbacks requirements from roads and property lines must also be met.

Site 1) Taking the above factors into account, the best site for the wind system is due south of the shop about 300’ from the electrical meter. This location meets all the necessary criteria: it has good access to the winds from all directions, it has a fairly short wire run to interconnection point with the grid, and it is in an easily accessible location, and out of the way for the client’s activities. This location also meets the common setback requirements from the road or property lines (usually 1 or 1.1 times the total height of the wind system).

It is always a good idea to educate any neighbors about the plans for the wind system and perhaps even offer to take them to see a similar installation so they can be reassured and put any concerns to rest. While state statute 66.0401 legally prevents anyone from stopping the installation of a wind system for any reasons other than public health and safety, it is always good to have the support of the community if possible. A copy of the state statute is attached at the end of this report.

In addition to working with the neighbors, it is also important to work with the zoning authorities to make sure they understand the logistics of a wind system, e.g. why it has to be on a tall tower, why it needs to be near the tie in point to the grid, etc. This education should be done before any hearings have begun. A model zoning ordinance is included with this report. This model can be suggested as a starting point for the town if they do not already have an ordinance for wind systems.

Mr. XXXXX does not anticipate any problems with the neighboring property owners or the zoning authorities.

C. Turbine possibilities:
Wind turbines that are rated at under 20kW can take advantage of what is called “net metering”. Net metering means that when the turbine is generating more electricity than your needs, your electrical meter simply runs backward, thus the utility is “crediting” you at retail rates ($/kwh) for the power. In Wisconsin net metering is generally limited to a maximum of 20kW rated power for renewable energy sources connected to the grid.

Wind turbines with ratings higher than 20 kW cannot take advantage of “net-metering”. Instead, any excess electricity that the wind turbine feeds back onto the grid will be credited at the WPS buy-back rates of $0.103/kwh on-peak and $0.0327/kwh off-peak, for an average of $0.063kwh. No one can predict at what times of day the wind will be blowing so the average rate is generally used in any pay-back calculations.

The larger the turbine, the more the energy output per installed cost. XXXXX Pallet has 3 phase electrical service and can therefore also look at turbines that are larger than the V15-35. Listed in the table below are the most appropriately sized turbines to meet the energy load and that Focus on Energy currently funds. All of the wind turbines are subject to availability. Contact one of the installers listed at the end of the report to determine the time lines for availability.

Turbine	Rated Output	Rotor Diameter Ft
WTI Jacobs 31-20 1ϕ	20kW	31’ (10m)
EMS Vestas 15-35 3ϕ	40kW	49’ (15m)
Halus Vestas V17-90 3ϕ	90kW	56’ (17m)

The **Jacobs** 31-20 turbine is the only residential turbine with a gear box located at the top of the tower. It is a good medium duty turbine but, because of the gear box, there are more moving parts which means more maintenance; probably a lot more maintenance. With this type of turbine, you (or your service contractor) should plan on climbing the tower at least every 4-6 months to inspect the wind turbine for wear and tear on the blade assembly, the gearbox and shafts, etc… and to grease parts.

The EMS **Vestas V15-35** comes in both a single phase and a three phase version. In its 3 phase configuration it has a slightly higher rating of 40kW. These Danish turbines were first installed in the California wind farms in the 1980’s and have been completely remanufactured by Energy Maintenance Service (EMS) in South Dakota, making them a good value. They are currently the most popular turbine for small businesses and technical colleges in Wisconsin.

The **Vestas V-17-90** is slightly larger in size than the V-15 and produces almost double the power. Remanufactured versions of the machine may be available from suppliers, such as Halus Power Systems of San Jose, CA. It would be best to contact one of the local installers on the attached installer list to ask about these turbines. There are none of these installed in Wisconsin as of today, although the Midwest Renewable Energy Association (MREA) is offering a workshop in 2007 to install this turbine at MATC in the Mequon area.

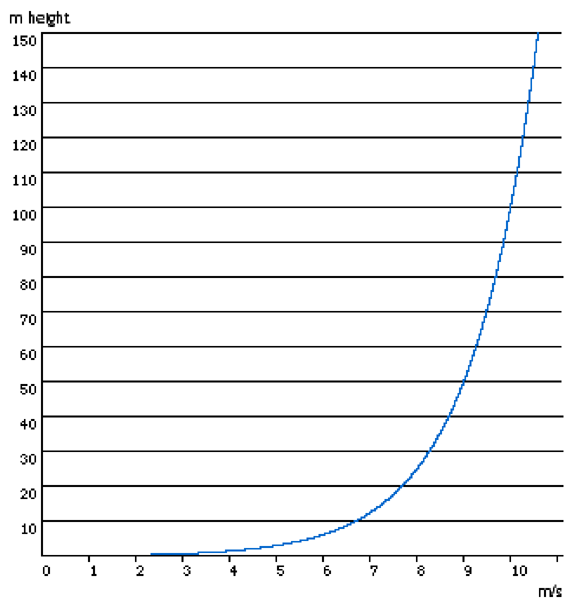
Turbines

Jacobs 31-20 (note gear box)

EMS Vestas V15 35kw (V17-90 looks similar)

D. Minimum Tower Height

There are several factors to take into account when determining a minimum tower height for a wind system. The goal is to position the rotor (the area swept out by the blades) in an area of consistent wind. If the wind speed and/or wind direction is not consistent on the blades as they spin from the lowest position to the highest, then the energy in the wind is not being used effectively and it also imposes more wear and tear on the wind turbine. This inconsistency in wind speed/direction is called **wind shear** and is caused by the natural friction of the wind with the ground (**ground drag**), and by **turbulence** which is created when the wind encounters local obstructions such as trees, buildings, etc. The graph below shows that as the height above the ground increases, the wind speed increases exponentially. It is important to note that closer to the ground (under 20m or 60') the wind speed changes very rapidly (high wind shear) with minor changes in height. As height increases above 20m, the rate at which the wind speed changes is much less (lower wind shear).



Wind Shear graph from Danish Wind Association

Therefore, adding height to the tower reduces the wind shear on the blades and will allow the turbine to operate more efficiently and with less maintenance. The larger the turbine, the longer the blade length, and the more critical it is to have the rotor even further away from the ground onto the more vertical (and so more consistent) part of the wind shear curve.

To ensure the rotor is above the worst of the wind shear, a general rule of thumb is to always position the bottom of the lowest blade at 60' or higher for blade lengths of around 15' or less, and 80' or higher for blade lengths 15' > blade length <= 30'.

A second rule of thumb is used to avoid the wind shear due to turbulence. When the wind encounters obstacles, such as trees or buildings, turbulence is created causing significant and rapid changes in both the wind speed and wind direction. To keep this turbulence from affecting the wind turbine, the bottom of the rotor should be positioned at least 30' above the tallest obstruction within 500'. So, for example if there were some 40' trees in the area: Minimum tower height = 40' (obstruction height) + 30' (rule of thumb) + blade length. Again this is a general rule for a **minimum** tower height. An even taller tower will further ensure that the rotor is out of the turbulence and operating more efficiently.

A wind turbine is a big investment and so it makes sense to pay for a tower that will minimize the wind shear and allow the wind system to operate efficiently and possibly extend the life of the system.

For XXXXX Pallet, a look at the panoramic pictures taken from Site 1 clearly shows that the site has virtually wide open exposure to the winds from all directions. The only obstruction is the shop itself which is 25' tall. Therefore, the minimum tower height recommended would the maximum value determined by the 2 rules of thumb:

Minimum Tower Height = 60' or 80' (rule of thumb) + (blade length)

and

Minimum Tower Height = 25' (highest obstacle) + 30' (rule of thumb) + (blade length)

In this case, because the tallest obstacle within 500' is only 25' tall, the first rule of thumb becomes the determining factor. The minimum tower heights for the selected turbines are shown in the table below along with the tower heights commonly available for these turbines.

Turbine	Rated Output	Rotor Diameter Ft	Minimum Tower Height	Available Tower Height
WTI Jacobs 31-20 1ϕ	20kW	31' (10m)	75'	80', 100', 120'
EMS Vestas 15-35 3ϕ	40kW	49' (15m)	105'	110'
Halus Vestas V17-90 3ϕ	90kW	56' (17m)	108'	132'(40m)

E. Wind resource estimate:

How well the wind turbine performs is based on the speed and the consistency of the wind intercepted by the turbine; a continuous high-speed wind being the best condition. Knowing the average annual wind speed at a specific site will enable us to determine how various turbines will perform at this site.

As mentioned previously, the Wisconsin Wind Resource Assessment Program (WRAP) study provided a wind map of Wisconsin which provides estimates of the average annual wind speeds for all areas of Wisconsin at a height of 60 meters (197 ft.). Actually 2 maps were made using different modeling software. Copies of these maps are included with this report.

Looking at both wind maps, the values of wind speed for this location is 14.0 – 14.5 mph on one map, and 15.5 – 16.0 mph on the other. To be conservative, the lower end of these ranges will be used. Averaging the wind speed estimates from the 2 wind maps gives an annual average wind speed of 14.7 mph at 60meters.

Since the wind speed increases with increasing height above ground, we must do some calculations to extrapolate this wind speed of 14.7 mph taken at 197', down to our chosen tower heights.

The following equation (ref. *The Wind Power Book* by Jack Park) is used to compute the wind speed at the turbine height:

$V = (H/H_0)^{\alpha} V_0$ where:

V = the wind speed at the desired height (the tower height)
Vo = 14.7 mph - the wind speed at the original height (from the map and adjusted downward)
H = 80', 110', 132'- the tower height/ turbine hub height
Ho = 197' - the original height that the original wind speed was measured
α = .20 the wind shear coefficient

The wind shear coefficient is variable used to adjust for the type of ground clutter at a site. For this site it will be set at .20 which indicates "hilly country with open ground". The wind speed is calculated for each of the turbine options at their different tower heights. These wind speeds will then be used to calculate the average annual energy output of the wind turbine choices. Using the above equation the wind speeds are:

Turbine	Rated Output	Rotor Diameter Ft	Tower Height	Wind Speed at Hub Height (mph)
WTI Jacobs 31-20 1ϕ	20kW	31' (10m)	80'	12.3
EMS Vestas 15-35 3ϕ	40kW	49' (15m)	110'	13.1
Halus Vestas V17-90 3ϕ	90kW	56' (17m)	132'(40m)	13.6

F. Energy Outputs
To determine the expected power output of the turbines at this site we use our wind speed as calculated above.

The estimated energy outputs in the table below were calculated by using the "Wind Turbine Estimated Energy Output Calculator v. 9.4", which is an Excel spread sheet developed by Seventh Generation Energy Systems. Taken into account are factors such as: the elevation of the site, the air density, the wind speed from the wind map, the probability of the distribution of wind speeds the site is likely to get, the turbine rotor area, the tower height, and the manufacturers' power curve for the turbine. The energy output calculated is also de-rated by 20% to account for turbulence and other losses.

The table below shows the estimated monthly and annual energy outputs that could be expected for the turbines listed at the tower heights indicated in the table above. Note that the Jacobs turbine is also shown, and highly recommended, on a 100' tower versus the minimum 80' tower.

Turbine	Tower Height	Wind Speed at Hub Height (mph)	Est. Monthly Energy Output (kWh)	Est. Annual Energy Output (kWh)
WTI Jacobs 31-20	80'	12.3	1,955	23,465
WTI Jacobs 31-20	100'	12.8	2,200	26,450
EMS Vestas V15-35	110'	13.1	7,000	84,100
Halus Vestas V17-90	132'(40m)	13.6	11,000	131,900

The wind speeds and turbine output values presented here should be taken as rough estimates, and should not be interpreted as a guarantee of the average wind speed or the average output of a particular wind turbine at your site.

XXXXX Pallet uses about 84,830kwh/yr or about 7,070 kwh/mo, so it looks like the V15-35 on a 110' tower would be a good fit. If XXXXX Pallet wanted to produce an excess of electricity, it would be credited back to them at the WPS buy back rate which is about $0.063 on average. Selling lots of cheap energy to the utility is usually not a good economic strategy.

G. Incentives and System Cost

The estimated installed system costs are listed below, as well as the Focus on Energy financial incentives and the USDA grant.

1. Focus on Energy

a. Cash Back Reward

The Focus on Energy Cash Back Reward incentive is used for turbines 20kW and under. It is based on an estimate of the amount of electricity (in kilowatt-hours) that the wind system will produce in an average year:

Cash Back Reward = (estimated annual electricity produced in kilowatt-hours) x (Reward Factor),

where **Reward Factor** is based on how the wind turbine should perform at a good site and on the installed cost. Cash Back Rewards are limited to 25% of the installed cost or $35,000, whichever is less.

b. Implementation Grant

Wisconsin's Focus on Energy program offers Implementation Grants for Renewable Energy installations from 35kW up to 250 kW. The implementation grant is computed in a similar way to the Cash Back Reward, and the grant is limited to 35% of the installed cost or $45,000.

Focus on Energy's policy limits awards to no more than $85,000 to any individual or business during each fiscal year. This includes projects contracted between July 1, 2006 and June 30, 2007.

2. USDA - Renewable Energy & Energy Efficiency Program

The USDA Rural Development program offers guaranteed loans and grants for farms and rural businesses. Because this is a rural business, you may qualify for one of these USDA grants which could save you as much as 25% if the installed cost (up to $500,000). The USDA will guarantee fixed rate loans of up to $10M; however, loan amounts (including grant funds, if applicable) cannot exceed 50% of the eligible project cost. Shelly Laffin at lsassoc@mhtc.net (608-588-7231), who works for Focus on Energy, is a great source of information on USDA grants. It may be a lot of paperwork, but if it can save up to 25% on the cost of a wind system, then it is well worth it. The installer will be able to help with the paperwork as well. Applications for the grants are due in May. According to Shelly, priority is given to clients who apply for grants and loans combined, and, in this case, applications can be submitted any time of the year. A summary document is attached at the end of this report which summarizes the USDA program.

Look at the following web site for more information on this grant.
2002 Farm Security Act, Section 9006; U.S. Department of Agriculture—Rural Development
Go to www.renewwisconsin.org/wind/windtoolbox.html and look under Funding Opportunities.

For more information on any of these incentives go to:
http://www.focusonenergy.com/page.jsp?pageId=905
For questions regarding these grants, contact:

Shelly Laffin	or	Mick Sagrillo
E-mail: lsassoc@mhtc.net		E-mail: msagrillo@itol.com
Voice direct: 608-588-7231		Phone: 920-837-7523
Toll free: 888-476-9534		

The approximate installed system cost is listed below for the wind systems mounted on free standing towers. The table shows the maximum possible incentives available from both Focus on Energy and from the USDA. It does not include the tax benefits from using MACRS.

Turbine	Installed Cost of System	Est. Annual Energy Output (kwh/yr)	Max. Focus on Energy Cash Back/ Implementation Grant	Maximum USDA Farm Bill Grant 25%	Minimum Total Installed Cost
Jacobs 31-20 80'	$58,539	23,465	$9,800	$14,885	$33,854
Jacobs 31-20 100'	$60,860	26,450	$11,485	$15,215	$34,160
Vestas V15-35 110'	$130,000	84,100	$45,000	$33,750	$56,250
Vestas V17-90 132'	$180,000	131,900	$45,000	$45,000	$90,000

Note that these costs and incentives are ball park estimates only. An installer will be able to give actual installation costs. A list of full-service installers is provided with this report. Focus on Energy and the USDA will determine the exact amount of their incentives once your application is received.

The installation cost includes such things as having the foundation for the tower poured, the tower assembly, turbine assembly, crane rental for raising the tower and turbine and attaching the blades, trenching, and all the wiring and the electronics.

H. Other Economic Considerations.

- **Maintenance**: In addition to the installation costs, the owner of a wind system should expect to put aside 1% of the installed cost (2% for the Jacobs) for ongoing maintenance. This amount may not be used every year, but down the road there may be some replacement parts needed, e.g. new blades or electronic components.

- **Insurance:** When the wind system is rated between 20kw and 200 kW, the insurance required is $1 million dollars. For turbines rated between 200kw and 1 MW the level of insurance required is $2 million. This is usually the level of insurance that is held on a business. No special policy for a wind turbine is required, only standard business insurance w/ liability coverage.

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- **Income Tax:** Another factor to take into account is that income tax must be paid on the income received when the utility is paying for the excess generation. If the size of the turbine is matched well with the load, than this should not be significant.

- **Tax Write Offs:** Currently there are no federal tax credits for wind systems. However, as a business, you should be able to take advantage of the tax benefits for depreciating the cost of the wind system. One method of depreciation that is commonly used is the Modified Accelerated Cost Recovery System (MACRS). This is a depreciation method that is used to maximize most of the depreciation benefits in the first few years of a 5-6 year total "class life"[2] period. There are other methods of depreciating property, such as the "straight line" method where an equal deduction is taken every year. The exact amounts of the depreciation, and the type and duration of the depreciation, will depend on many factors including your tax bracket, the amount of the incentives that you receive, the "class life" that is assigned to the wind system, etc. It is best to check with your accountant for the best method to use for your situation.

[2] Class life is assigned by the federal government to different types of property and indicates the length of time over which it can be depreciated. For wind systems it is often 5-6 years.

Simple Payback

The following table is a ***very*** simple version of the payback period for an installed wind system assuming an annual energy use of 84,830 kwh/yr. It assumes that the electricity rate for energy use of the utility is $0.045/kwh (average of the on-peak and off-peak rates) and that the buy-back rate for excess energy is $0.063. It uses 18% of the total installed cost as a ballpark value for the overall tax benefit from using the MACRS tax depreciation method. It does not take into account financial factors including the effect of increasing energy rates, the cost to borrow money, the cost of any service upgrade requirements, etc. An accountant is recommended for a more detailed analysis.

Manufacturer	WTIC	EMS	Halus
Model	31-20	V-15	V-17
Rated Capacity (kW)	20	40	90
Output Voltage	240	480	480
Phase	1	3	3
Rotor Diameter (m)	9	15	17
Rotor Diameter (ft)	31	49	56
Tower Type	multiple	Lattice	Lattice
Tower Height (ft)	**100**	**110**	**135**
Tower Height (m)	30	33	40
Total Structure Height AGL (ft)	116	135	163
PERFORMANCE			
Wind Speed at Hub Height (mph)	12.8	13.1	13.6
Annual Energy Output (kWh)	26,446	84,108	131,862
Monthly Energy Output (kWh)	2,204	7,009	10,989
Wind Percent of Facility Energy Use	31.2%	99%	155%
Excess Energy Production (kWh/yr)	0	0	47,032
Net Turbine Capacity Factor	15%	27%	17%
SYSTEM COSTS			
Installed Capital Cost ($)	$60,860	$130,000	$180,000
O&M - $ per turbine per year	$1,217.20	$650.00	$1,800.00
INCENTIVES			
FOE Reward Factor (see notes)	$0.43	$0.65	$0.40
Max FOE Rebate	$11,483.14	$45,000	$45,000
FOE Percentage of Total Cost	19%	35%	25%
System Cost After FOE Rebate	$49,377	$85,000	$135,000
MACRS (see notes)	$10,955	$23,400	$32,400
USDA Farm Bill	$15,215	$42,500	$45,000
Total Incentives	$37,653	$110,900	$122,400
FINANCIAL SUMMARY			
Net System Cost After Incentives	$23,207	$19,100	$57,600
Energy Bill Savings per Year	$1,190	$3,785	$3,817
Revenue from Excess Power Sales	$0	$0	$2,963
Total Annual Savings (less O&M)	($27)	$3,135	$4,980
Simple Payback (yrs)	-	6.1	11.6

Notes:

Installed capital cost is an estimate. Consult with a qualified system installer for actual costs

Focus on Energy Reward Factor is an estimate. Please refer to Focus on Energy published installed cost estimates for the specific turbine-tower combination.

Focus on Energy Rebate limited to 35% of actual cost or $45,000 -- whichever is less
Annual savings based on net metering at retail rate for systems up to 20 kW
Revenue from excess power sale based on retail rate for systems < 20kW or Avoided Cost (PG) rate for turbines > 20kW
O&M assumes 1% of installed cost per year except for Jake 31-20 at 2% per year
Simple payback excludes cost of capital, inflation and utility rate increases
MACRS assumes full eligibility of benefit. MACRS value equals sum of 5 yr schedule @ 38% tax bracket
USDA Farm Bill equals 25% of total system cost
Wind speed value is an estimate. Actual turbine performance may differ

From the table above, it would appear that the V15-35 is the best choice. The Jacobs 31-20 would cost more to maintain than would be saved in energy bills. The larger Vestas V17-90 would take longer to pay back due to the increased cost; however, once the payback period was over, this turbine would produce more energy. Remember that these tables assume the maximum Focus on Energy grant amount as well as the full 25% grant from the USDA, and the maximum tax benefits.

Turbine life is expected to be 25-30 years. Purchasing a wind system is like **pre**-paying for electricity for the length of the payback period. The payback time will actually be shorter as the electrical rates increase. After the payback period, the electricity generated for the remaining life of the turbine would be free, except for maintenance costs.

If WPS comes up with another rate option for XXXXX Pallet that is based on higher energy use charges and lower demand charges, the payback period would shorten.

8. Summary

XXXXX Pallet has an excellent location for a wind system and a simple calculation of the economics for a 35kW or a 90kW wind turbine looks pretty good. The economics would be much more favorable if the wind system could offset the demand charges as well as the energy use charges; unfortunately the demand charges will likely stay the same. Fortunately, because XXXXX Pallet is a rural business, it should qualify for the USDA Rural Development grant which could decrease the installed cost by 25% and/or provide a guaranteed fixed rate loan of up to 50% of the system cost. These incentives, combined with the Focus on Energy grant and the possible tax depreciation benefits, makes the economics of installing a wind system much more appealing.

9. Follow Up

A. Analyze the timing of your energy usage. The high system demand charges are based only on on-peak demand. In the winter, on peak is only from 8:00am – 1:00pm during the 8-5 business day, so if the large 300 HP grinding machine could be used in the afternoon, you may be able to reduce this demand charge. Also, note that in the summer, when on-peak is all day from 8am - 6pm, you are using more electricity on-peak than off peak. If there is a way to switch to a non time-of-use rate during the summer, you may save there.

B. Contact several of the qualified full-service wind installers in the area (list provided in this report) to determine turbine/tower availability, get actual price estimates for installation and maintenance, to choose system components, determine delivery timelines, as well as discussing what permits may be needed.

C. It would be a good idea to go see the turbines in operation and talk to an owner. The installers should be able to direct you to some locations.

D. Complete the Implementation Grant application (for turbines 0ver 35kW) and submit it to Focus on Energy. They will let you know the exact the amount of the grant that you will receive. This amount is guaranteed to you for 1 year. Once the installation is completed, you will need to submit a Notice of Installation (NOI) including the receipts, and then Focus on Energy will send out the check. If you need to get another copy, contact Wisconsin Focus on Energy at (800)762-7077, or go to their web site www.focusonenergy.com.

E. Contact Shelly Laffin at lsassoc@mhtc.net (608-588-7231) to see if you qualify for a grant through the USDA Renewable Energy & Energy Efficiency Program for rural businesses. If so complete the application and submit.

F. Talk to your accountant to see how best to take advantage of the tax depreciation benefits on the cost of the wind system and to do a more detailed analysis which also takes into account the demand charges, projected increase in electricity rates, etc.

G. Decide if the economics work out to your satisfaction based on all the costs and incentives, and the energy savings/income from the estimated energy output of the wind systems provided in this report for this site. Remember that electrical rates will probably continue to rise.

H. Check with the township building and zoning offices to make sure that there are no local ordinances or other problems with installing wind systems (including set backs from the road and property lines), and begin the permitting process. Begin to inform the neighbors of the desire to install the system, to educate them on wind systems in general, and to meet with the local zoning authorities. This will help to avoid problems and get the support of your neighbors, and pave the way for continued contact with local authorities to identify and address any building permit or zoning issues such as required set backs. There are several helpful articles on zoning issues in the "small wind toolbox" at www.renewwisconsin.org. Look for the link to "small wind toolbox" on the left side of the home page. You can also contact Mick Sagrillo for help with zoning issues msagrillo@itol.com phone: 920-837-7523.

I. Contact your insurance agent about insuring the wind system. If they are unfamiliar with wind systems and unwilling to offer insurance, you may try calling Randee Block from Block Insurance (888-536-2441) who has experience with insuring these types of wind system.

J. Check with **WPS** to discuss the grid intertie procedures and requirements, insurance issues, and to verify buy-back rates. The renewable energy inter-connection contact at WPS is John Christiano at 920-433-1869. If you have difficulties with WPS contact Mick Sagrillo msagrillo@itol.com. He has experience dealing with WPS on interconnection issues.

K. Insure that all zoning, utility agreements, financial incentive and any other required approvals are in hand prior to making any commitment to purchase.

9. Educational Resources

- Focus on Energy web site (www.focusonenergy.org) great for lots of information on Renewable Energy.
- Fact sheets covering all issues with small wind in: toolboxes at www.renewwisconsin.org
- Home Power Magazine/Website (www.homepower.com) – Case studies and stories of renewable energy installations around the country.
- Midwest Renewable Energy Association (www.the-mrea.org) – Hands-on workshops in Wind, PV, Solar Hot water, and more.
- American Wind Energy Association www.awea.org
- Danish Wind Industry Association www.windpower.org
- Turbine manufacturer's web sites: Performance ratings, price lists, informative articles.
  www.windturbine.net for the Jacobs 31-20
  www.energyms.com for the Vestas V15-35
  www.halus.com for Vestas V15s and Vestas V17's

10. Materials Included in Site Assessment Report:

1. Aerial Photos of Property for wind site - courtesy USGS and terraserver.com
2. Digital pictures in all compass directions for proposed sites.
3. Topographical Maps of the Surrounding Area- courtesy USGS and terraserver.com
4. Wind Rose graphs from nearest monitored site(s)
5. Photos of turbines.
6. Websites for more information including for Focus on Energy

11. Materials Enclosed with Site Assessment Report:

1. Wisconsin Wind Maps
2. Full service wind installer list
3. State Statute 66.0401
4. Model Wind Ordinance
5. Implementation Grant reward spreadsheet
6. Brochure on USDA Rural Business Development

12. Materials Provided during Site Visit:

1. Apples and Oranges article on choosing a wind system.
2. Implementation Grant application.