City of Carson City
Agenda Report

Date Submitted: February 22, 2011

Agenda Date Requested: March 3, 2011
Time Requested: 60 minutes

To: Mayor and Board of Supervisors

From: Public Works - Planning Division

Subject Title: Action regarding an appeal of the Planning Commission's denial of a Special Use Permit for variations of height, setback and noise standards pursuant to 18.05.080 for the installation of a wind energy tower at 160 feet and a request to lower the proposed height to 111 feet, on property zoned Single Family 6000 (SF6), located at 7300 Schulz Dr., APN 010-671-02. (MISC-11-009/SUP-10-114) (Lee Plemel)

Staff Summary: The Planning Commission denied a Special Use Permit for the installation of a wind energy tower at 160 feet. The applicant is proposing to lower the height of the wind energy tower to 111 feet. Decisions of the Planning Commission may be appealed to the Board of Supervisors. The Board of Supervisors may uphold, modify or reverse the Planning Commission's decision.

Type of Action Requested:

- ☐ Resolution
- ☒ Formal Action/Motion
- ☐ Ordinance
- ☐ Other (Specify)

Does This Action Require A Business Impact Statement: ( ) Yes (X) No

Planning Commission Action: Denied the Special Use Permit on January 26, 2011, by a vote of 3 ayes and 1 nay.

Recommended Board Action: I move uphold the Planning Commission decision to DENY Special Use Permit, SUP-10-114, for variations of height, setback and noise standards pursuant to 18.05.080 for the installation of a wind turbine of 160 feet and a request to lower the proposed height of 111 feet, on property zoned Single Family 6000 (SF6), located at 7300 Schulz Dr., APN 010-671-02, based on the inability to make the required findings for approval.

Explanation for Recommended Board Action: See the attached staff memo and Planning Commission staff report for more explanation on the proposed action.

Applicable Statute, Code, Policy, Rule or Regulation: CCMC 18.02.060 (Appeals), 18.02.080 (Special Use Permits) and 18.05.080 (Private Use Wind Energy Conversion Systems).

Fiscal Impact: N/A

Explanation of Impact: N/A

Funding Source: N/A

Alternatives:

1. The Board of Supervisors refer SUP-10-114 back to the Planning Commission for re-evaluation of the wind turbine at the proposed 111 foot height and the re-evaluation of the required standards pursuant to 18.05.080 Private Use Wind Conversion Systems.

2. If the Board of Supervisors finds that the Planning Commission erred in denying SUP-10-114, the Board of Supervisors reverse the Planning Commission's decision and approve the Special Use Permit for a wind turbine of 111 feet in height, based upon findings for approval and subject to the amended conditions of approval in the staff report.

Supporting Material:

1) Staff Memo to Board of Supervisors
2) Appellant's letter of appeal and justification
3) Planning Commission Case Record
4) Planning Commission minutes for 1-26-11
5) Planning Commission packet

Prepared By: Janice Brod, Management Assistant V

Reviewed By:

(Planning Division Director) Date: 2-22-11

(Public Works Director) Date: 2-22-11

(City Manager) Date: 2/22/11

(District Attorney's Office) Date: 2/22/11

Board Action Taken:

Motion: _____ 1) _____ Aye/Nay
2) _____

_____
(Vote Recorded By)

Carson City Planning Division

108 E. Proctor Street
Carson City, Nevada 89701
(775) 887-2180
www.carson.org
www.carson.org/planning

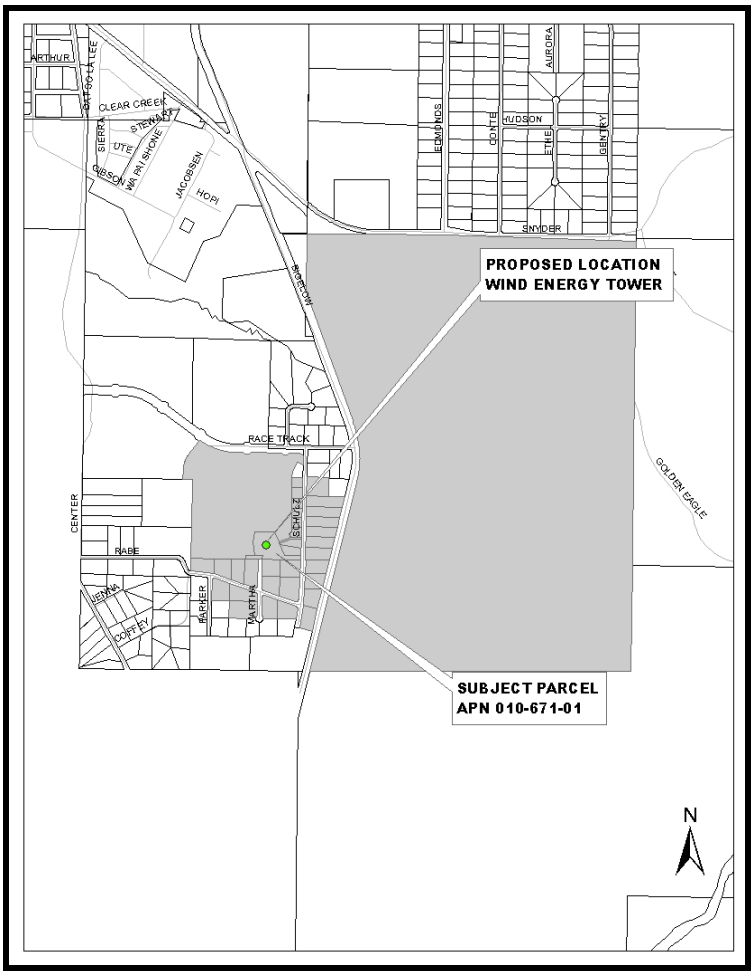
MEMORANDUM

TO: Mayor and Board of Supervisors

FROM: Planning Division

DATE: March 03, 2011

SUBJECT: MISC-11-009 (SUP-10-114) – Appeal of the Planning Commission's decision to DENY the installation of a 160 foot wind turbine with variations to height, setback and noise standards pursuant to 18.05.080, on property zoned Single Family 6,000, located at 7300 Schulz Drive, Assessor's Parcel Number 010-671-02, based on the inability to make the required findings for approval.



BACKGROUND:

On January 26, 2011, the Planning Commission conducted a public hearing regarding a Special Use Permit application, SUP-10-114, from Rainbow Conservation Corp. on behalf of Joseph Goni. The applicant now proposed to install a 10KW wind turbine of approximately 111 feet in height with variations of height, setback and noise standards pursuant to 18.05.080. The sunject wind turbine was proposed to be centrally located on the subject parcel.

The subject site is located in the southern portion of Carson City on a 2.48 acre parcel zoned Single Family 6,000 which is currently improved with a 1,008 square foot mobile home that was placed on site in 1979. The site also has an existing barn structure of 2,400 square feet and a 3,400 square foot accessory farm structure constructed in 2008. The site was also improved in 2008 and 2009 with two ground mounted photovoltaic arrays.

DISCUSSION:

The application noted above was reviewed and DENIED by the Planning Commission based on the inability to make the required findings for approval. At the January 26, 2011 meeting, public testimony was also solicited by the Planning Commission and there were several comments related to the proposed project, identifying concerns and opposition from property owners in the immediate area.

The basis for appeal is pursuant to the submittal requirements of CCMC 18.02.120 (Appeals).

The applicant's letter of appeal is attached; the following are staff responses to the appellant's basis for appeal.

1. The appellants claim a lower height of 111 feet was proposed at the meeting during the discussion process.

Staff response:
The applicant is correct; there was discussion from the applicant related to the possibility of lowering the height of the proposed wind turbine from 160 feet to 111 feet. A Planning Commissioner noted that the applicant agreed to reduce the height to 111 feet during discussion under the motion to deny the application. However, the other Commissioners did not wish to entertain approval of the project at 111 feet. The Planning Commission took action on the proposal and a motion was made for DENIAL at the 160 foot height.

2. The appellants claim the 111 foot tower height will meet the setback requirements at **all** property lines.

Staff response:
That statement is incorrect, pursuant to the Carson City Municipal Code Private Use Wind Energy Conversion Systems 18.05.080(2ci):

A minimum of 1.1 times the total extended height from the project property lines adjacent to a residential, Conservation Reserve or Agricultural zoning district.

The proposed wind turbine at a height of 111 feet would require a setback of 122 feet in all directions. Per the plan provided by the applicant, the northern setback is only 120 feet. However, the turbine could probably be relocated to meet this setback.

3. The applicants maintain that a noise level of less than 50 dBA will be the result of a 111 foot wind turbine on site.

Staff response:
That statement may be correct. However, pursuant to the Carson City Municipal Code (CCMC) Private Use Wind Energy Conversion Systems 18.05.080(h):

Noise. All wind machines shall comply with the noise requirements in this section. These levels, however, may be exceeded during short-term events such as utility outages and severe wind storms. A manufacturer's sound report shall be required with a building permit application.

> *i) No wind machine or combination of wind machines on a single parcel shall create noise that exceeds a maximum of 25 decibels (dBA) at any property line where the property on which the wind machine is located or the abutting property is one acre or less or a maximum of 50 decibels (dBA) at any other property line. Measurement of sound levels shall not be adjusted for, or averaged with, non-operating periods. Any wind machine(s) exceeding these levels shall immediately cease operation upon notification by Carson City and may not resume operation until the noise levels have been reduced in compliance with the required standards and verified by an independent third party inspector, approved by Carson City, at the property owner's expense. Upon review and acceptance of the third party noise level report, Carson City will allow operation of the affected wind machine(s). Wind Energy Conversion System(s) unable to comply with these noise level restrictions shall be shut down immediately and removed upon notification by Carson City, after a period established by Carson City.*

As noted in the staff report the noise levels related to the proposed turbine are required to be less than 50 dBA for all lots abutting the subject site, with the exception of the two vacant residential parcels to the immediate east and one parcel to the immediate south, which require noise levels not to exceed 25 dBA. The wind turbine would still exceed the 25 dBA requirement.

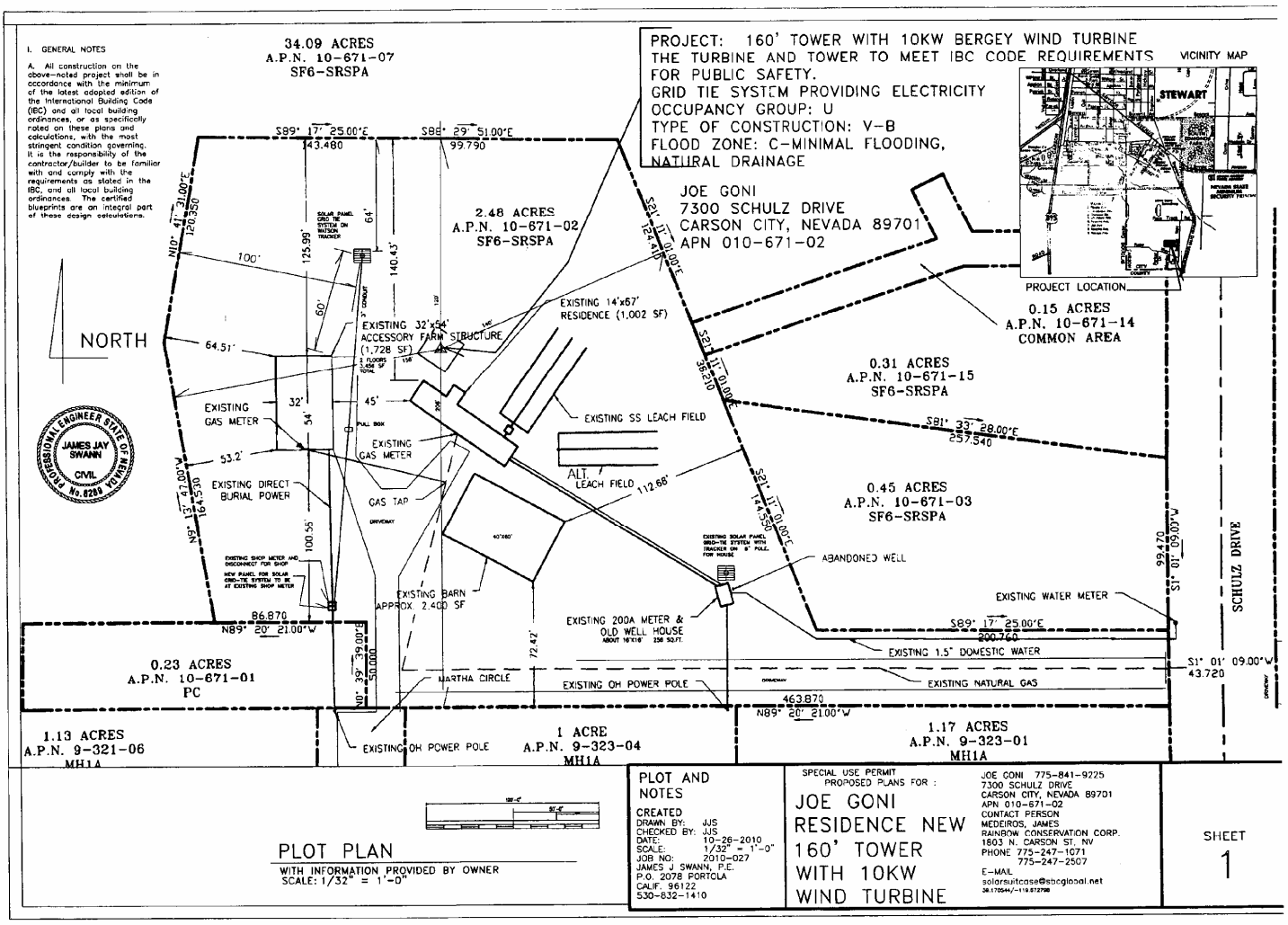
4. The applicant notes the ambient noise of the neighborhood is well above the thresholds adopted by the City ordinance.

Staff response:
This statement may be true in this case. However, it is important to note, pursuant to the CCMC 18.05.080, the adopted code's noise level is specifically related to the noise created by the wind turbine and NOT the ambient noise at the site.

5. The applicant notes the Planning Commission erred claiming a procedural motion was on the table, while discussion was continuing about the reduction of the wind turbine height from 160 feet to 111 feet. The applicant noted that the motion should have been tabled to allow additional discussion related to the reduced height of 111 feet and then a call for a revised motion. The applicant notes the item was denied solely upon a 160 foot tower height by a vote of 3-1.

Staff response: At the Planning Commission meeting there was discussion related to a reduced height. The Planning Commission did DENY the Special Use Permit on the inability to make the required findings for approval taking into consideration the new information related to the reduced wind turbine height. However, the motion for denial was based on the 160 height proposed in the application.

The one dissenting vote, Commissioner Shirk, at the Planning Commission meeting did inquire about a wind turbine of a lower height of approximately 111 feet. The remaining Commissioners clearly did not wish to entertain approval of the turbine at 111 feet.



STAFF RECOMMENDATION:

Per the Carson City Municipal Code Section 18.02.060(2), the Board of Supervisors may affirm, modify or reverse the decision of the Planning Commission. Staff recommends that the Board of Supervisors uphold the Planning Commission decision to DENY Special Use Permit, SUP-10-114, for variations of height, setback and noise standards pursuant to 18.05.080 for the installation of a wind turbine of 160 feet and a request to lower the proposed height to 111 feet, on property zoned Single Family 6000 (SF6), located at 7300 Schulz Dr., APN 010-671-02, based on the inability to make the required findings for approval.

ALTERNATIVE

The Board of Supervisors may consider the following alternative actions in deciding the appeal of the Planning Commission's decision to DENY the installation of a 160 foot wind turbine, on property zoned Single Family 6,000, and located at 7300 Schulz Drive, Assessor's Parcel Number 010-671-02, based on the inability to make the required findings for approval:

1. The Board of Supervisors refer SUP-10-114 back to the Planning Commission for re-evaluation of a wind turbine of 111 feet in height and the re-evaluation of the required standards pursuant to 18.05.080 Private Use Wind Conversion Systems.

2. If the Board of Supervisors finds that the Planning Commission erred in denying SUP-10-114, the BOS may reverse the Planning Commission's decision and approve the Special Use Permit for a wind turbine of 111 feet in height, based upon findings for approval and subject to the amended conditions of approval in the staff report.

Rainbow Corp. Conservation

The Solar store

Solar Hot Water - Radiant Heating - Wind Power
Solar Electricity - Renewable Energy Devices

MISC - 11 - 009

February 2, 2011

RECEIVED
FEB 04 2011
CARSON CITY
PLANNING DIVISION

Mr. Lee Plemel, AICP
Planning Division Director
108 E. Proctor Street
Carson City, NV 89701

Re: Special Use Permit #10-114
Proposed at Jan 26, 2011 Planning Commission Meeting

Dear Mr. Plemel,

This request for an appeal is being made as per the appeal filing procedures outlined:

4. An appeal is filed by way of submitting a letter to the Planning Director. The letter must include:

a. The appellant's name, mailing address, daytime phone number;
- 4.a). Rainbow Conservation Corp, 1803 N. Carson Street, Carson City, NV 89701, 775 841 9225

b. Must be accompanied by a **$250 filing fee + noticing fee (to be paid at the time of application)** + $60/hr over 4 hours; if paid by check, please make check payable to Carson City
- 4b) Advised by J. Pruitt this requirement would be waived as we are applying within the 10 day period.

c. Shall specify the project or decision for which the appeal is being requested;
- 4c) Special Use Permit # 10-114 denied by Carson City Planning Commission at Meeting on January 26, 2011

d. SHALL INDICATE WHICH ASPECTS OF THE DECISION ARE BEING APPEALED. No other aspect of the appealed decision will be heard.
- 4d) A lower height of 111 feet was proposed by the applicant during the discussion process.
- 4d) As a direct result of allowing a lower tower height (to 111 feet) the setback requirements at all property lines will be met.
- 4d) The applicants maintain that a noise level of less than 50 DBA at the property line. This can be met 95% of the time as per the ordinance requirement.
- 4d) The applicants maintain the ambient noise of the neighborhood is well above thresholds adopted by the city ordinance.

e. MOST IMPORTANT: Shall include necessary facts or other information that support the appellant's contention that an error was made by the Planning Division staff or the Planning Commission, etc., in consideration of findings supporting a decision
- 4e) A procedural motion was on the table, while a discussion was continuing about reducing the proposed tower height. The motion should have been tabled to allow the discussion including the applicants, then call for a vote on the revised motion. Instead of doing that the chair called for a vote on the original height. The project was then denied based solely upon a 160 foot tower height.

We respectfully request that this special use permit be re-evaluated for a height variance of 51 feet above the 60 foot level.

Sincerely,

Rainbow Conservation Corp

Leslie, Dennis & James Medeiros
Joseph Goni, property owner

January 30, 2010

TO: The Honorable Members of the Board of Supervisors
FROM: Joseph R. Goni

Our neighborhood is a growing, living, thriving community. I have lived in the neighborhood for 30 years plus. I love my neighbors and the former T-Car race track, although I've only attended one race. The Minimum Security Prison has a live ammunition firing range which has live fire throughout the year, sometimes live fire at night, i.e. (Prison Guards, Capitol Police, Stewart Indian Police, Carson City Police Department, BLM, Highway Patrol, and the Police and Highway Patrol Academy), as well as light poles in excess of 60 ft. and guard towers. I love my neighbors with their small diesel trucks, several neighbors who have small businesses and use large diesel trucks. small earth moving equipment, as well as those neighbors who have ATV's and motocross bikes. I love those neighbors who have built a dirt track complete with dirt berm jumps. The neighbors built the dirt track in the Spa area for big/small kids in the neighborhood, and the surrounding area so they could keep them off the street and out of trouble.

I love my neighborhood, but as you can see, we are not a typical neighborhood; we are growing and have a robust life-style. Of course with all that living going on in our neighborhood things change; as a result, background sound is a part of our neighborhood. ***It matters not if a large lot is next to a small lot, the surrounding air is background sound and does not discriminate.*** The wind turbine doesn't run 24/7, **(only when the wind blows)**; therefore when it's turning often the wind itself masks the sound of the wind turbine, and the wind itself exceeds the city ordinance. The code allows for the louder sound in the neighborhood like all those activities mentioned above. The wind turbine does not operate day and night; however when it does it will be within the ordinance *95%* of the time.

THANK YOU FOR YOUR TIME!

Sincerely: Joseph R. Goni

P.S. *Like the community, life, and* **my neighborhood** *we are all evolving and progressing.*

I live in close proximity to the wind turbine not hundreds, or one-thousand ft. away. If it is the cause of the noise people and neighbors say. Whopping, whizzing, whirring at the level and the extent that contributes to (My Sleep pattern, My Sickness, My Illness). Then why would I leave it up and operating, whether the wind is blowing or not?

CARSON CITY PLANNING COMMISSION

CASE RECORD

MEETING DATE: **January 26, 2011** **AGENDA ITEM NO.: H-3**

APPLICANT(s) NAME: Rainbow Conservation Corp **FILE NO. SUP-10-114***
PROPERTY OWNER(s): Joseph Goni

ASSESSOR PARCEL NO(s): 010-671-02
ADDRESS: 7300 Schultz Dr.

APPLICANT'S REQUEST: Action to consider a Special Use Permit request for a height variance for the installation of a wind energy tower at 160 feet on property zoned Single Family 6000 (SF6).

COMMISSIONERS PRESENT: **[ ] KIMBROUGH** **[X] MULLET** **[X] SATTLER**

[ ] DHAMI **[X] SHIRK** **[ ] VANCE** **[X] WENDELL**

STAFF REPORT PRESENTED BY: Jennifer Pruitt **[X] REPORT ATTACHED**
STAFF RECOMMENDATION: **[X] CONDITIONAL APPROVAL**
APPLICANT REPRESENTED BY: Leslie Medeiros and Dennis Medeiros (powerpoint presentation given), James Medeiros, Joe Goni

__X__ **APPLICANT/AGENT WAS PRESENT AND SPOKE**

APPLICANT/AGENT INDICATED THAT HE/SHE HAS READ THE STAFF REPORT, AGREES AND UNDERSTANDS THE FINDINGS, RECOMMENDATIONS, AND CONDITIONS, AND AGREES TO CONFORM TO THE REQUIREMENTS THEREOF.

___ **PERSONS SPOKE IN FAVOR OF THE PROPOSAL** __5__ **PERSONS SPOKE IN OPPOSITION OF THE PROPOSAL**

DISCUSSION, NOTES, COMMENTS FOR THE RECORD:

Public Comment:

Anne Essex Bankston: (also wrote letter)- Solar Store information is not correct. Wind tower will generate 45-80 dB. Information in packet is not the same information presented by the Solar Store. Did not have presentation to look at before the meeting. Planning Commission should have more time to address conflicting noise information. 160' is too high and not necessary. Tower will go down in an earthquake. Tower is more than 2 ½ times the permitted height by code. My daughter has problems sleeping with noise. Not against a 60 foot tower.

Dale Biasee: Former sound engineer. Attending meeting with cub scout for project. Questioned sound chart for ambient noise submitted by applicant. Frequency of sound should be considered, too.

Ron Cobb: Bank representative- Land Strategies- owns adjacent parcel ("bank"). Represents multiple properties in future Schulz Ranch development. Possible 521 future homeowners will be effected by this tower. Support thoughts of renewable energy. Requests continuance and public workshop on alternative energy systems.

Sandra Reed: property owner in neighborhood. Height is "frightening" as well as noise. We are used to quiet

evenings. Birds migrate here.

Keith Barnett: It is a very quiet neighborhood. (Rents across the street from the subject property).

Joe Goni: (applicant)- Trying to use sustainable energy measures on the property. We need to decide which direction to go in. I thought I was doing a good thing. I was looking for a win/win and doing my part.

[End of public comment]

James Madeiros: Solar Store manager.- would agree to 100 foot tower, 111 foot maximum overall height. But goal is to use a larger turbine that generates less noise than the smaller wind turbine that have already been permitted by right.

Wendell: A great deal of time and effort went into current City's ordinance. Noise is an issue.

Sattler: Even at a lower height, they are asking for variation to two standards.

Mullet: Reducing oil consumption can be accomplished within ordinance requirements. This is solar vs. wind. Why not a 100' tower?

Shirk: Would consider 100 foot tower. Can this be done on site another way?

APPEAL PROCESS MENTIONED AS PART OF THE RECORD

MOTION WAS MADE TO DENY

MOVED: Wendell SECOND: Sattler PASSED: 3/AYE 1/NO 0/ABSTAIN 3/ABSENT

A regular meeting of the Carson City Planning Commission was scheduled for 5:00 p.m. on Wednesday, January 26, 2011 in the Community Center Sierra Room, 851 East William Street, Carson City, Nevada.

PRESENT: Vice Chairperson Craig Mullet
Commissioner Mark Sattler
Commissioner James Shirk
Commissioner George Wendell

STAFF: Lee Plemel, Planning Division Director
Jennifer Pruitt, Principal Planner
Jeff Sharp, City Engineer
Randal Munn, Chief Deputy District Attorney
Kathleen King, Deputy Clerk / Recording Secretary

NOTE: This excerpt is prepared at the request of Planning Division staff. A recording of the entire proceedings, the commission's agenda materials, and any written comments or documentation provided to the recording secretary during the meeting are part of the public record. These materials are available for review, in the Clerk's Office, during regular business hours.

A. CALL TO ORDER, DETERMINATION OF A QUORUM, AND PLEDGE OF ALLEGIANCE (5:01:30) - Vice Chairperson Mullet called the meeting to order at 5:31 p.m. Roll was called; a quorum was present. Chairperson Kimbrough and Commissioners Dhami and Vance were absent. Commissioner Shirk led the pledge of allegiance. (5:03:05) Vice Chairperson Mullet welcomed Commissioner Sattler. At his request, Commissioner Sattler provided background information on his employment and community service experience.

H-3. SUP-10-114 ACTION TO CONSIDER A SPECIAL USE PERMIT REQUEST FROM THE RAINBOW CONSERVATION CORPS (PROPERTY OWNER: JOSEPH GONI) FOR A HEIGHT VARIANCE FOR THE INSTALLATION OF A WIND ENERGY TOWER AT 160 FEET, ON PROPERTY ZONED SINGLE FAMILY 6000 (SF6), LOCATED AT 7300 SCHULZ DRIVE, APN 010-671-02 (5:29:24) - Vice Chairperson Mullet introduced this item. Ms. Pruitt provided an overview of her presentation and the applicant's presentation and proposed a method by which to provide the same. Ms. Pruitt oriented the commissioners to the subject property, using displayed slides, and reviewed the agenda materials in conjunction with additional slides. She reviewed the public noticing process, as outlined in the agenda materials, and advised of having received numerous telephone calls. She listed the names of those persons who had telephoned the Planning Division, and noted correspondence and informational materials provided. She referred to the written comments provided by the City's Engineering Division, Health and Human Services Department, Fire Department, Parks and Recreation Department, and Building Division. She noted the findings for approval and for denial incorporated in the staff report.

Vice Chairperson Mullet noted that the Schulz Ranch subdivision had been approved for 6,000 square-foot lots "which would all be to the north and west" of the subject property. "Since that subdivision approval is still active," he inquired as to the reason for not considering the less-than-one-acre lots "in the vicinity

of this project." Ms. Pruitt read from Carson City Municipal Code Section 18.05.080(h)(i) relative to noise, and advised that the parcels to the north are currently larger than one acre. "In the future, ... if there are final maps recorded and they are smaller, that would be the case. But, currently, the lots are not less than one acre." Mr. Plemel noted that development of the subdivision is not guaranteed, "so we just have to go by what the parcel size is now pursuant to the code."

(5:46:02) Co-Owner of the Solar Store and Rainbow Conservation Corps Leslie Madeiros introduced her husband, Dennis, and narrated a PowerPoint presentation, copies of which were included in the agenda materials. Mr. Madeiros narrated those portions of the presentation relative to height and noise considerations. Ms. Madeiros reviewed the results of an independent measurement of ambient sound at all property lines, conducted by a Nevada-licensed engineer on January 22nd between 4:00 and 5:00 p.m. She requested the commission's consideration of the special use permit.

In response to a question, Ms. Madeiros suggested that the proposed 160-foot height is "reasonable" in consideration of the "mixed-suburban area." In response to a further question, Mr. Madeiros advised that the proposed wind turbine has built-in automatic and manual speed controls "for very high winds." He explained the furling concept where "if the winds reach a time and speed that exceeds what is considered unsafe or higher than its rated value, the turbine will furl out of the wind and tip in an upward direction. There is also a manual mechanism at the base of the tower where that can be done manually and not depend upon the automatic mechanism." Mr. Madeiros provided background information on the Bergey founder's experience with manufacturing airplane propellers.

In response to a question, Mr. Plemel advised that the two residential wind turbines installed since adoption of the ordinance are located in neighborhoods zoned greater than one acre where the decibel level is 50. In response to a question, Mr. Madeiros provided additional clarification of that portion of the applicant's presentation relative to noise. He acknowledged the possibility of installing two wind turbines at lower heights, noting the possible difficulty associated with finding two appropriate locations. He further acknowledged that wind turbine performance would decrease with less height. "... there's some practical limitations to this. You can go as big as you want. It's probably cost prohibitive and then, once you get over 200 feet, you violate FAA rules just based on the height independent of glide path. And if it's less, you're not even meeting the minimum national average which is about 10 kilowatt hours per year.

(6:17:13) Solar Store Manager James Madeiros advised of a grant from Nevada Energy for $30,000 to purchase one wind generator. "We want to make the best use of our client's money that we can." Ms. Madeiros advised of the requirement for the grant funding to be used by July 2011. Mr. Madeiros acknowledged that as the height of the tower is decreased, the decibel level increases slightly. In response to a question, Ms. Madeiros advised that the two residential wind turbines installed in Carson City are 45 feet tall.

Commissioner Wendell advised that one of the residential wind turbines was installed approximately 100 to 150 feet from his residence, and that he can hear it even inside his home. Ms. Madeiros expressed the opinion that a lower height "for this particular machine is not an option at all. The manufacturer doesn't even sell it ..." In response to a further question, Mr. Madeiros provided additional clarification of the

anticipated decibel level. He advised that "the bigger the turbine, there's a tendency to be lower [decibels], mostly because they can turn a lot slower. ... and then you worry about low frequency noise." He acknowledged that the independent test data indicates that the proposed wind turbine will move slower and emit less noise. (6:23:37) James Madeiros advised that the Bergey wind generator "is designed to operate at a lower rpm, creating less noise."

Commissioner Sattler suggested considering that the noise from a wind turbine is continual. "You may have 50 or 60 decibels briefly [such as from a passing truck] and it's gone where this is going to be there constantly." Vice Chairperson Mullet noted that Mr. Goni currently has solar panels, and inquired as to the reason for the additional power generation. He suggested reducing the proposed wind turbine height to 100 feet would then meet the setback requirements and also provide for 12,000 kilowatt hours of energy production. Ms. Madeiros advised of "another option between the 100 and the 140. There is a 120-foot tower by this manufacturer as well and that possibly would also meet the setbacks and some of the other requirements. So, it's not an either / or. There are other options." Vice Chairperson Mullet discussed concerns relative to noise for the adjacent residents. Mr. Madeiros provided additional clarification relative to sound measurement. In response to a comment, Mr. Madeiros referred to informational materials included in the applicant's presentation relative to wind energy generation. In reference to the applicable municipal code, Commissioner Sattler expressed the opinion that Carson City is "not unreasonable." He noted the proposed height at "2 2/3 taller than the 60-foot limit and it still doesn't meet the setback." Discussion followed.

Commissioner Shirk commended the project as "something we need to do as a community," but expressed concern over the anticipated noise and the proposed height in consideration of the adjacent residents. He suggested amending the proposed project "or look[ing] at it in a different perspective if you want to go forward." He expressed the opinion there are "ways of doing it that would accommodate what you're looking for and the neighbors could well adjust to this direction that we're headed ..." In response to a question, Mr. Madeiros advised that more technical data could be provided to Mr. Goni, but that the decision is his to make. Mr. Madeiros acknowledged the possibility of decreasing the proposed height with Mr. Goni's concurrence. In response to a question, Ms. Madeiros suggested that a 100-foot tower would meet the setback requirement. Mr. Madeiros noted that the 120-foot tower "would miss by two feet." He acknowledged that the decibels would increase by approximately 2, if the height of the tower was decreased.

Vice Chairperson Mullet entertained public comment, and provided direction with regard to the same. (6:38:49) Ann Essex-Bankston referenced her correspondence and the Lawrence University study, included in the agenda materials. She requested the commission to table the item "because there are some very important issues that have not been addressed." In response to a question, she advised that some of the Solar Store information is incorrect. She further advised that the wind tower decibels will be "anywhere from 45 to 80 ..., and that is not at the point of the tower. That is out further." Ms. Essex-Bankston advised that "a great deal of the Solar Store's information that was up here on the board tonight, no one got in the packet. ... This is all new information that I'm not able to address." Ms. Essex-Bankston distributed, to the commissioners and staff, and reviewed informational materials from Bergey and from the National Renewable Energy Laboratory. She suggested that an independent analyst "check the information with

Solar Store because it is so completely different from the information that I've received and some of the questions that you also asked." Ms. Essex-Bankston advised that her residence and that of a neighbor is "directly in front of that tower ..., and there is housing all the way down that road ..." She described the area as "rural," and advised "there is no commercial traffic out there whatsoever." She advised that she does not work outside her home due to caring for a handicapped daughter. She described her street as "very peaceful [and] quiet ... It's a whisper compared to Carson City." She expressed the opinion that the 160-foot tower is unnecessary. "Wind power is a back up for solar. It always has been." She noted that Mr. Goni lives at his property alone, and advised that the 13,000 kilowatts of energy would be more appropriate for a family of four. She expressed the opinion that with the existing solar panels and "a 60-foot tower ..., he would have plenty of power." She expressed support for renewable energy, and the opinion "that this is just a little overboard for the neighborhood." She advised of earthquake faults in the area, and expressed concern over the wind turbine collapsing during an earthquake. She distributed additional informational materials to the commissioners and staff, and advised of "several elderly couples that live very close to Mr. Goni's property. Plus there are two disabled residences; one is mine and there's another one that's two houses down that's also in the direct line of this tower." She described the photographs included in the applicant's presentation as "a very bad misrepresentation of our neighborhood." She distributed, to the commissioners and staff, photographs she had taken and narrated the same. She reviewed the Lawrence University informational materials she had previously distributed. She emphasized that "the most important thing [she's] learned from this whole experience is that no human being hears the same way that another one does. You may hear that wind tower and I may not. We won't know 'til it goes up." Ms. Essex-Bankston also distributed to the commissioners and staff a conference paper, entitled *Acoustic Tests of Small Wind Turbines* from the National Renewable Energy Laboratory. She advised that her handicapped daughter is required to take many medications and doesn't sleep well at night. She further advised that the biomass facility installed at the Nevada State Prison could be heard inside her residence "upwind ... with all [her] windows and doors and shut and [her] swamp cooler on ..." She reminded the commissioners that the height of the proposed wind turbine would be "over 2 and a half times the 60-foot allotted amount." She expressed the belief that the City's requirements were "for good reason," and requested the commissioners to make their decision "so that it protects everyone and not just one person on one property."

(6:52:31) Del Biassi, introduced two Cub Scouts in the audience who were working on their citizenship badges. Mr. Biassi advised that he was a formerly "uninformed party," and that he was a "former sound engineer" with a degree in electrical engineering. He provided background information on his experience with Maytag and General Electric "where we had to deal with minimizing sound for appliances." He questioned the applicant's data "on ambient decibels that they took and get some independent information." He advised of not having been "in the field" for several years, "but the chart they showed did not look right to me." He noted the importance of frequency when considering sound levels.

(6:53:43) Ron Cobb, representing Land Strategies, advised of having served as a planning commissioner in both Washoe County and the City of Reno for a combined period of 12 years. He expressed understanding for the commission's responsibility over the subject decision. "These kinds of issues, when we're starting to integrate things into our neighborhoods and our rural areas, are very sensitive ..." He expressed the opinion that Planning Division staff has the responsibility to educate the commissioners "in

these sensitive, integrated type of things." He suggested that the method by which new technology is integrated is the most important consideration. He advised that the special use permit, which was the subject of item F-1, includes an "active, ... tentative map. There's ... 525 future residents of Carson City and we only have one time to do it right." He expressed support for renewable energy and, in consideration of the information presented, asked the applicant to request a continuance. "And during the postponement, I would ask that the staff and Planning Commission have a workshop done for wind turbines or renewables ..." He advised that First Bank and FB Holdings intends to hold the adjacent property until the real estate market recovers. He reiterated the importance of "do[ing] it right."

(6:58:22) Sandra Reid described the location of her property "across from Mr. Goni's property ..." She expressed the opinion that the height of the proposed wind turbine is "rather frightening" to a neighbor, Mr. Robey, "as well as the noise." She advised that Mr. Robey spoke to Ms. Pruitt by telephone. She expressed the belief that the direction of the wind was "stated in error ... because we've had the property since 1994 and many of the storms come from the south to the north." She advised of having six trees blown down in the past few years. She agreed with earlier descriptions of the area as rural and advised "we are used to quiet evenings." She discussed concerns relative to the wind turbine harming birds, and advised there are several property owners in the area who keep horses. She described the appearance of the wind turbine as "about 15 stories high," and wondered "about the wind ... in the afternoon." She expressed the opinion that the wind direction was erroneously represented by the applicants "because ... it really goes straight down 395." She expressed the further opinion that the ambient noise in the area "is really lower than stated ... especially in the evening. A regular conversation level can be heard about four houses away because it is quite quiet most of the time." She expressed the opinion that some of the elderly neighbors would be opposed to "that big wind turbine ..." She acknowledged the need for "other ways to generate our electricity ..., but one can tell that ... Mr. Goni also has a very extensive solar system on his property and he could possible expand his solar energy and not have to use a wind turbine." Ms. Reid thanked the commission for the opportunity to testify.

(7:07:20) Keith Barnett advised that he lives across the street from the subject property, and hadn't realized the item was agendized "because [he] rent[s]." In consideration of the quietness of the area, he advised of having been inside his home and hearing his next door neighbors just walking on the gravel. He expressed concern over a "constant noise." He further advised of being able to hear the cows on the prison property behind his residence. He emphasized the quietness of the neighborhood "particularly at night."

(7:09:11) Joseph Goni apologized to his neighbors, and discussed the importance of "decid[ing] as a nation and as a community and private land owners what direction we'd like to go in. Depending on oil, foreign countries, or get involved and try to correct solutions instead of complaining about everything." Mr. Goni expressed the belief that he "was doing a good thing here by recycling ... water, saving 20,000 gallons of potable water for our community to grow; generate electricity." He thanked the Planning Division staff and the commissioners for their hard work. He discussed the intent to use "a 14,000 gallon recovery tank so [he] can get ... 47 to 50 percent of the ... potable water to water ... 200 trees which hopefully will take out the carbon dioxide that [he] exhales as a human being and those cows ..." He explained the reason for the wind turbine, and discussed the need "to make hard decisions." He discussed differences between the Bergey and Skyfire wind turbines. In response to a previous suggestion, he advised of a willingness to

install two wind turbines at a decreased height. "You can't do that ..., but now you're encroaching closer and closer to the border which we have a conflict of ordinance, number one. Number two, because of the turbulence of the two machines in relationship placing the two turbines on my single two and a half acre property, with buildings, if my ... representatives ... can come up with a solution, I'd be more than happy to go along with it." Mr. Goni discussed his desire to "get off oil. This renewable energy comes from the sun and the wind." He expressed no desire to upset his neighbors. "They're protecting their investment. I understand all of that." In consideration of the neighbors' concerns, he expressed apology for having "upset people. ... I just want to give back what I take out."

Vice Chairperson Mullet entertained additional public comment and, when none was forthcoming, entertained rebuttal from the applicant's representatives. (7:16:39) James Madeiros emphasized the importance of "minimiz[ing] the amount of collateral damage that this proposed unknown wind turbine can cause. Therefore, we are willing to concede to stay within the 1:1 height restriction. That would mean you giving us permission for a 100-foot tower, tip to blade, 111 feet. A two-foot variance, consistent with the SPA Schulz Ranch project, there's a minimum of 30-foot easements there so I don't think safety will be any issue should you make your decision tonight to allow for us to have a 100-foot tower with an 11-foot tip to blade. So, 111 feet. We would be glad to accept that. Also, because this is a different machine than what we have normally seen here in Carson City, it would be a very important step forward for wind generation to see how this wind generator is much, much different." Mr. Madeiros reiterated that the NV Energy grant funding will expire in July, and advised that installation will take approximately four months to accomplish.

(7:18:30) Ms. Madeiros advised that the letter certifying the decibel level "was a scientific letter and the data is scientific. It's not an opinion or what they think or what they heard. This was from James J. Swan, who is a professional engineer. The letter was given to Jennifer [Pruitt]. It was just done last Saturday so it was not in the original packet. So this is not a subjective situation. It was measured with a decibel meter and certified by this engineer. It was not an opinion." Ms. Madeiros offered copies of the letter to any interested party, and provided a copy to Ms. Pruitt.

Vice Chairperson Mullet entertained additional questions or comments of the commissioners. Commissioner Sattler noted that a 111-foot wind turbine would be "55 feet above what is in the municipal code." In response to a question, Mr. Plemel advised there are two lots to the east that would require 25 decibels. In response to a further question, Ms. Pruitt advised that the lots "on the other side" will be smaller than one-acre lots. She acknowledged the potential of the proposed wind turbine affecting 100 lots. Vice Chairperson Mullet inquired as to recourse once the wind turbine is installed. Mr. Plemel noted that "sound is a difficult thing to get a real good understanding of, and especially as it relates to background noise at the same time." He advised of having relied on certified information and calculations of how the sound degenerates with distance to property lines. He noted that the municipal code doesn't say "you can't hear it. You hear 50 decibels. There's no question about that." In consideration of the 25-decibel standard, he agreed that "you could stand anywhere in Carson City, on the most rural street where there's not a wind turbine in sight, it's never going to be 25 decibels with ambient noise. But what we would look for, with those coming in, is either that unit has to be quieter to start with or it's much farther from the property line." He advised that staff is struggling with enforcement due to the ambient noise issue. "It's difficult after the

fact. We rely on certified ... information up front that these units produce a certain amount of noise and, by the degeneration of noise, it's going to meet that standard at the property line."

Commissioner Sattler reiterated that a 111-foot wind turbine would "still not ... meet the height and if we hold true to the two bank lots, we're not going to make the noise standard." He expressed uncertainty as to how to proceed. Mr. Plemel concurred with the information presented that the wind turbine will be 50 decibels or less at the property line but not meet the 25 decibel standard. Commissioner Sattler noted that "we're still missing two of the three or four parameters of the municipal code on our third unit." Commissioner Wendell recalled the amount of commission, staff, and public meeting time spent establishing the current ordinance. In consideration of "the amount of effort and the time and expense that went into developing the ordinance," he expressed no desire "to deviate from the ordinance." Vice Chairperson Mullet commended Mr. Goni for his good intentions toward the environment, but expressed the opinion "this is a real stretch."

In response to a question, Mr. Plemel advised that the two existing wind turbines were installed according to the provisions of the ordinance. There were no variances. Mr. Plemel acknowledged having received an official complaint relative to noise associated with one of the wind turbines. He further acknowledged that the wind turbine was compliant with all code requirements at the time of installation. He further acknowledged that the special use permit process is provided "for cases where they exceed the code requirements." He referred the commissioners to the findings as part of their decision. Commissioner Shirk commended Mr. Goni's direction, expressed uncertainty that the proposed project meets the ordinance criteria, and suggested refining it "just a little bit." Mr. Goni acknowledged the understanding that he could install a 60-foot wind turbine on his property according to the existing ordinance regulations without a special use permit. He expressed a willingness to abide by the commissioners' decision.

Vice Chairperson Mullet entertained additional commissioner questions or comments and, when none were forthcoming, entertained a motion. **Commissioner Wendell moved to deny SUP-10-114, a special use permit request from Rainbow Conservation Corps (property owner: Joseph Goni) for the installation of a 160-foot wind turbine, on property zoned single-family 6,000, located at 7300 Schulz Drive, APN 010-671-02, based on the inability to make the required findings for approval as identified in the staff report. Commissioner Sattler seconded the motion.** Commissioner Shirk inquired as to the possibility of considering the Solar Store representatives' suggestion of a 111-foot wind turbine. Vice Chairperson Mullet advised that the motion states the proposed wind turbine is not in compliance. He suggested that the applicant could return with a different proposal or install a wind turbine according to the existing ordinance regulations. He suggested another option to continue the item to a future meeting with a modified height. Mr. Plemel advised of the requirement to ask the maker of the motion to amend his motion. Commissioner Wendell advised of no desire to amend his motion. Vice Chairperson Mullet called for a vote on the pending motion; **motion carried 3-1.** Mr. Plemel reviewed the appeal process. Vice Chairperson Mullet recessed the meeting at 7:34 p.m. and reconvened at 7:45 p.m.

STAFF REPORT FOR PLANNING COMMISSION MEETING JANUARY 26, 2011

FILE NO: SUP-10-114 **AGENDA ITEM: H-3**

STAFF AUTHORS: Jennifer Pruitt, Principal Planner
Kathe Green, Assistant Planner

REQUEST: A Special Use Permit to allow the installation of a 160 foot wind turbine including variations of height, setback and noise standards pursuant to 18.05.080, on property zoned Single Family 6000 (SF6), located at 7300 Schulz Dr., APN 010-671-02.

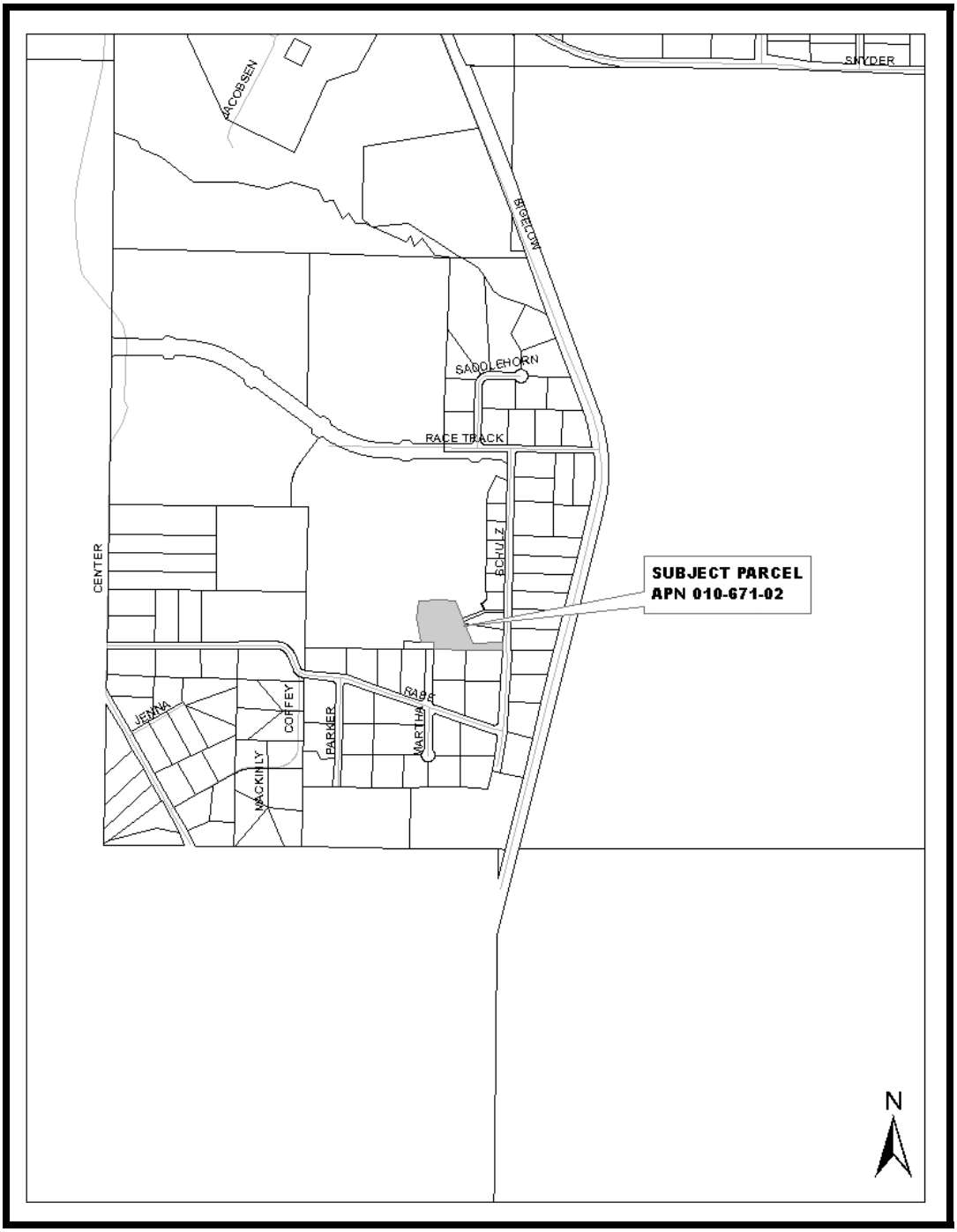
APPLICANT/OWNER: Rainbow Conservation Corps/Joseph Goni

LOCATION: 7300 Schulz Drive

APN: 010-671-02

RECOMMENDED MOTION FOR APPROVAL: "I move to approve SUP-10-114, a Special Use Permit application from Rainbow Conservation Corps (property owner Joseph Goni), to allow the installation of a 160 foot wind turbine, on property zoned Single Family 6,000, located at 7300 Schulz Drive, Assessor's Parcel Number 010-671-02, based on seven findings and subject to the recommended conditions of approval contained in the staff report."

ALTERNATIVE MOTION FOR DENIAL: "I move to DENY SUP-10-114, a Special Use Permit request from Rainbow Conservation Corps (property owner Joseph Goni) for the installation of a 160 foot wind turbine, on property zoned Single Family 6,000, located at 7300 Schulz Drive, Assessor's Parcel Number 010-671-02, based, based on the inability to make the required findings for approval as identified in the staff report."


JACOBSEN
SNYDER
BIGELOW
SADDLEHORN
RACE TRACK
SCHULZ
CENTER
SUBJECT PARCEL
APN 010-671-02
RABE
JENNA
COFFEY
PARKER
MARTHA
MACKINLY
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If a motion for approval is made, these are the required conditions of approval:

The following shall be completed prior to commencement of the use:

1. The applicant must sign and return the Notice of Decision/Conditions of Approval within 10 days of receipt of notification. If the Notice of Decision is not signed and returned within 10 days, the item will be rescheduled for the next Planning Commission meeting for further consideration.

2. The applicant shall meet all the conditions of approval and commence the use (obtain and maintain a valid building permit) for which this permit is granted within twelve months of the date of final approval. A single, one-year extension of time may be granted if requested in writing to the Planning Division thirty days prior to the one-year expiration date. Should this permit not be initiated within one year and no extension granted, the permit shall become null and void.

Conditions required to be incorporated into the proposed development plan:

3. All development shall be substantially in accordance with the development plans approved with this application, except as otherwise modified by the conditions of approval herein.

4. All improvements shall conform to City standards and requirements.

The following shall be submitted or included as part of a building permit application:

5. The applicant shall obtain a building permit from the Carson City Building and Safety Division for the proposed construction.

6. The plan submittal for the wind turbines shall comply with the prescriptive requirements outlined within the Carson City Building Division handout titled PLAN SUBMITTAL REQUIREMENTS: Wind Electrical Systems.

7. 2006 IBC Section 1803.1 requires excavations for any purpose shall not remove lateral support from any footing or foundation without first underpinning or protecting the footing or foundation against settlement or lateral translation. The proposed footing is located very close to the existing dwelling footing.

8. The electrical system shall be designed by a Nevada registered electrical engineer in order to show code compliance for tying in of the multiple electrical generating systems located on the subject property.

9. The applicant shall submit a copy of the Notice of Decision/Conditions of Approval, signed by the applicant and owner.

10. Dust control measures must be employed during the construction period.

11. Guy wire anchors may not extend closer than 10 feet to/from any property line.

12. The tower shall be designed and installed so that there shall be no exterior step bolts or a ladder on the tower readily accessible to the public for a minimum height of 12 feet above the ground. For lattice or guyed towers, sheets of metal or wood or other barrier shall be fastened to the bottom tower section such that it cannot readily be climbed.

13. All ground-mounted electrical and control equipment shall be labeled or secured to prevent unauthorized access.

14. All wind machines shall comply with applicable FAA regulations, including any necessary approvals for installations.

15. Evidence shall be submitted with a building permit application that the wind machine has been constructed in accordance with accepted industry standards and certified safe.

16. The potential ice throw or ice shedding from the proposed wind machine shall not cross the property lines of the site.

17. The only advertising sign allowed on the wind machine shall be a manufacturer's label, not exceeding one square foot in size, located on the generator housing.

18. Wind machines, unless subject to any applicable standards of the FAA, shall be a non-reflective, non-obtrusive color such as tan, sand, gray, black or similar colors. Galvanized steel or metal is acceptable for the support structures. Any painting or coating shall be kept in good repair for the life of the wind machine.

19. The wind machine shall be equipped with both manual and automatic controls to limit the rotational speed of the blade within the design limits of the rotor. An external, manual shut-off switch shall be included with the installation. The minimum distance between the ground and any protruding blades utilized on a private wind machine shall be 10 feet as measured at the lowest point of the arc of the blades.

20. The wind machine shall not create noise that exceeds a maximum of 50 decibels (dBA) at any property line.

21. Any wind machine found to be unsafe by an official of the Carson City Building Division shall immediately cease operation upon notification by Carson City and shall be repaired by the owner to meet federal, state, and local safety standards or be removed within six months.

22. Wind machines that are not operated for a continuous period of 12 months shall be removed by the owner of the wind machine.

23. When a wind machine is removed from a site, all associated and ancillary equipment, batteries, devices, structures or support(s) for that system shall also be removed.

24. Once wind machine is permitted, the owner has the option of compliance with the standards or discontinuation of operations. If the operation of the wind

machine(s) does not comply with the provisions of this article, the operator shall promptly take all measures necessary to comply with these regulations, including, but not limited to, discontinued operation of one or more wind machines.

25. The maximum overall height of the proposed wind turbine, including extended length of the blade, will be 160 feet.

LEGAL REQUIREMENTS: CCMC 18.02.050 (Review); 18.02.080 (Special Use Permits); 18.05.080 Wind Energy Conversions Systems

MASTER PLAN DESIGNATION: Medium Density Residential; Schulz Ranch Specific Plan Area

ZONING DISTRICT: Single Family 6,000

KEY ISSUES: Will the proposed 160 foot wind turbine be compatible with adjacent land uses and properties? Is this an appropriate location for the proposed use?

SURROUNDING ZONING AND LAND USE INFORMATION

NORTH: Single Family 6,000, vacant
SOUTH: Public Community/Mobile Home One Acre (MH1A), City property, vacant and residential uses
EAST: Single Family 6,000, vacant
WEST: Single Family 6,000 vacant

SITE HISTORY

- In August 2001 the applicant converted from well to Carson City water with building permit 01-1202.

- On September 26, 2001, Special Use Permit U-01/02-09 was approved by the Planning Commission to allow an accessory structure of 216 square feet on the subject site. At that time the subject site was 19.75 acres and included one modular home of 1,420 square feet, one modular home of 938 square feet, metal storage units of 144 square feet and a barn of 2,400 square feet. The 1,420 square foot modular home and the 216 square foot accessory structure have been removed from site.

- On February 27, 2002 the Planning Commission continued indefinitely MPA-01/02-4, a Master Plan Amendment application to change the Master Plan Land Use designation from Suburban Residential to Medium Density Residential to facilitate the establishment of a Specific Plan Area.

- On April 27, 2005, the Board of Supervisors approved MPA-05-044 to change the Master Plan Land Use designation from Suburban Residential to Medium Density Residential and Mobile Home One Acre to Single Family 6,000 concurrent with the adoption of the Schulz Ranch Specific Plan Area.

- On October 4, 2005 the Planning Commission reviewed and made a recommendation to the Board of Supervisors for approval of a Zoning Map Amendment by ordinance from Single Family One Acre (SF1A) and Mobile Home One Acre (MH1A) to Single Family 6,000 (SF6) on 125.8 acres in the Race Track Road vicinity, Assessor's Parcel Numbers 009-311-03,-08,-09,-10,-14,-15 & -47.

- On October 4, 2005 the Planning Commission approved a Tentative Map for a Common Open Space Development, "Schulz Ranch Development", consisting of 521 single family dwelling units,19% of land as common areas and open space on 125.8 acres in the Race Track Road vicinity, Assessor's Parcel Numbers 009-311-03,-08,-09,-10,-14,-15 & -47.

- On November 3, 2005, the Board of Supervisors approved a Zoning Map Amendment by ordinance from Single Family One Acre (SF1A) and Mobile Home One Acre (MH1A) to Single Family 6,000 (SF6) on 125.8 acres in the Race Track Road vicinity Assessor's Parcel Numbers 009-311-03,-08,-09,-10,-14,-15 & -47.

- On December 19, 2005, Parcel Map, PM-05-257 was approved by the Parcel Map Committee, which divided the 19.75 acres site into four parcels: 2.48 acre, 2.62 acre, .60 acre, and 14.11 acre. The applicant at that time retained ownership of the 2.48 acre parcel and the other parcels were incorporated into the Schulz Ranch Common Open Space Development.

- On November 19, 2008, the Planning Commission approved SUP-08-105, a request to allow an accessory structure exceeding 75% of the primary structure on site. Planning staff had recommended approval.

- In December 2009 the applicant installed a 14 panel ground mounted photovoltaic array on site through building permit 09-1062.

- In November 2010 the applicant installed a multi panel ground mounted photovoltaic array on site through building permit 10-923.

ENVIRONMENTAL INFORMATION

- FLOOD ZONE: Zone X
- SLOPE/DRAINAGE: The site is improved.
- SEISMIC ZONE: Zone II

SITE DEVELOPMENT INFORMATION

1. PARCEL AREA: 2.48 Acres
2. EXISTING LAND USE: Single Family Dwelling Unit
3. PROPOSED WIND TURBINE: 10 KW Bergey
4. MAXIMUM HEIGHT WITHOUT ADDITIONAL REVIEW: 60 Feet
   PROPOSED HEIGHT: Approximately 160 feet

REQUIRED SETBACKS WITHOUT ADDITIONAL REVIEW: Setbacks are a minimum of 1.1 times the total extended height or 176 feet, to the project property lines when adjacent to a residential, Conservation Reserve or Agricultural zoning district.

5.	PROVIDED SETBACKS:	North:	120 feet*
		South:	206 feet
		East:	140 feet*
		West:	156 feet*

* Variations to the regulations and standards may only be permitted by special use permit, approval of which shall be pursuant to Title 18, Section 18.02 (Special Use Permits).

DISCUSSION:

A Special Use Permit is required by CCMC Section 18.05.080(c) Wind Energy Conversion Systems. This code states that:

Compliance with Regulations.

c. Variations to the regulations and standards of CCMC 18.05.080 may only be permitted by special use permit, approval of which shall be pursuant to Title 18, Section 18.02 (Special Use Permits).

The applicant is proposing to install a10KW wind turbine of approximately 160 foot in height. This is proposed to be centrally located on site. Per the applicant the average American family uses between 10,000-15,000 kilowatt hours per year. The proposed turbine will generate approximately 14,000 KW annually.

The subject site is located in the southern portion of Carson City on a 2.48 acre parcel zoned Single Family 6,000 which is currently improved with a 1,008 square foot mobile home which was placed on site in 1979. The site also has an exiting barn structure of 2,400 square feet and a 3,400 square foot accessory farm structure constructed in 2008. The site was improved in 2008 and 2009 with two ground mounted photovoltaic arrays.

Carson City adopted the Wind Energy Conversion Systems ordinance in 2009. There have been two previously installed Wind Energy Conversion Systems in Carson City on one acre lots, since the adoption of the ordinance. The previously installed (WECS) met all standards identified in CCMC 18.05.080. Both projects were required to obtain building permit approval prior to installation, without Special Use Permit approval.

The proposed project is the first project submitted with the request of variations to the regulations and standards of CCMC 18.05.080.

City staff has identified three important factors that must be addressed related to the proposed project:

- *Justification for the proposed wind turbine height. Why is a height of 160 feet identified as the need in this instance?*

The applicant has noted that the 2.48 acre site is improved with an assortment of large accessory structures in addition to the mobile home on site. The following justification has been provided:

Per the applicant, the wind turbine requires a 160 foot height in order to stand above the nearby 105 foot hill and catch the wind coming off of the top of the eastern slope of the Sierras. The applicant states the proposed turbine at the proposed 160 foot height will increase performance from poor to fair.

Per the applicant a turbine of 160 feet is needed to produce good wind results and maximize energy production on site, also taking into account the existing features on site of trees and buildings.

- *Noise generation. What is the proposed noise generation at the adjacent property lines related to the 160 Bergey wind Turbine?*

  The applicant has provided estimated noise levels at all property lines abutting the subject site at wind levels of 19.5 mph:

  At northern property line at 120 feet = noise level of 47.56 dBA
  At eastern property line at 140 feet = noise level of 47dBA
  At western property line at 156 feet = noise level of 46.7dBA
  At southern property line at 206 feet = noise level of 45.25 dBA

- *Needs of the subject site. The proposed turbine is part of a wind/photovoltaic system.*

  The applicant has noted that this proposed project is part of his overall master plan for the subject site. It is the intention of the applicant to utilize the existing solar arrays, proposed wind turbine, and future grey water system for irrigation on site. The applicant has noted that wind speeds vary from month to month as shown in the applicants' submission in the three tier analysis. It is the intention of the applicant for the solar and wind component to work together to compensate for the low production periods of wind and solar production that are expected.

There is no question that the addition of the proposed wind turbine use on the subject site will increase physical activity on and to the site and increase the noise currently generated on site. Staff has offered 25 conditions of approval and modifications to this SUP to assist in the mitigation of these impacts.

In reviewing and acting on this Special Use Permit application, the Planning Commission must consider the provisions of Nevada Revised Statutes (NRS) 278.02077 regarding limitations on regulating the use of wind energy systems (see NRS 278.02077 attached to this staff report). NRS 278.02077(1)(a) states:

> *A governing body shall not adopt an ordinance, regulation or plan or take any other action that prohibits or unreasonably restricts the owner of real property from using a system for obtaining wind energy on his or her property.*

However, this section of NRS allows local governments to impose "reasonable" restrictions on such systems relating to the height, noise or safety of the system. It should be noted that the applicant is requesting variation to the height and noise requirements of the Carson City Municipal code for the installation of the wind energy system. The complete text of NRS 278.02077 follows (pertinent sections are underlined by staff for emphasis):

> ***NRS 278.02077 – Prohibition against prohibiting or unreasonably restricting use of system for obtaining wind energy; exceptions.***
>
> 1. *Except as otherwise provided in subsection 2:*
>   (a) *A governing body shall not adopt an ordinance, regulation or plan or take any other action that prohibits or unreasonably restricts the owner of real property from using a system for obtaining wind energy on his or her property.*
>   (b) *Any covenant, restriction or condition contained in a deed, contract or other legal instrument which affects the transfer or sale of, or any other interest in, real property and which prohibits or unreasonably restricts the owner of the property from using a system for obtaining wind energy on his or her property is void and unenforceable.*
> 2. *The provisions of subsection 1 do not prohibit a reasonable restriction or requirement:*
>   (a) *Imposed pursuant to a determination by the Federal Aviation Administration that the installation of the system for obtaining wind energy would create a hazard to air navigation; or*
>   (b) *Relating to the height, noise or safety of a system for obtaining wind energy.*
> 3. *For the purposes of this section, "unreasonably restricts the owner of the property from using a system for obtaining wind energy" includes the placing of a restriction or requirement on the use of a system for obtaining wind energy which significantly decreases the efficiency or performance of the system and which does not allow for the use of an alternative system at a substantially comparable cost and with substantially comparable efficiency and performance.*

The proposed wind turbine installation application is seeking variations to the regulations and standards of the Wind Energy Conversion System ordinance. The standards related to wind turbines are noted below:

Standards. All Wind Energy Conversion Systems are subject to and must comply with the following provisions of this section:

a. Location. A minimum parcel size of one acre is required for the placement of any horizontal axial wind turbine. Vertical axial wind turbines are permitted on any parcel. No part of a wind energy conversion system shall be located within or over drainage, utility or other established easements.

The parcel proposed for the horizontal axis wind turbine is more than one acre in size. The proposed wind turbine is not proposed in a location within or over drainage, utility or other established easements.

b. Number per parcel. A maximum of one wind machine per parcel is permitted on parcels less than one acre in size; a maximum of one wind machine per acre is permitted on parcels greater than one acre in size.

The applicant is proposing one wind machine on 2.5 acres.

c. Setbacks. Minimum setbacks for private use wind machines shall be:

i) A minimum of 1.1 times the total extended height from the project property lines adjacent to a residential, Conservation Reserve or Agricultural zoning district.

The applicant is proposing a variation from the required 1.1 height minimum set back required of 176 feet. The following are the variations requested :

- North 56 feet
- East 36 feet
- West 20 feet

ii) Guy wire anchors may not extend closer than 10 feet to/from any property line.

A condition of approval has been included as part of this Special Use Permit.

iii) A 10 foot minimum setback from any part of the machine, rotors or guy wires to the property line of any other non-residential zoning district.

There is a .23 acre non-residentially zoned parcel to the southwest of the subject site. The proposed setbacks will be in compliance with the standard noted above.

iv) Wind machines shall not be located within the front yard setback nor within the street-side setback of any parcel of land in residential zoning districts.

The proposed wind turbine will not be located within the front yard setback.

d. Height. The maximum total extended height of Wind Energy Conversion Systems is 60 feet.

i) Tower Height shall mean the height above adjacent grade of the fixed portion of the tower, excluding the wind turbine itself.

ii) Total Extended Height shall mean the height above adjacent grade to a blade tip at its highest point of travel and including any other portion of the Wind Energy Conversion System.

The proposed wind turbine is proposed at an overall height of 160 feet.

e. Lighting. Wind system towers shall not be artificially lighted unless required, in writing, by the Federal Aviation Administration (FAA) or other applicable authority that regulates air safety. Where the FAA requires lighting, the lighting shall be the lowest intensity allowable under FAA regulations; the fixtures shall be shielded and directed to the greatest extent possible to minimize glare and visibility from the ground; and no strobe lighting shall be permitted, unless expressly required by the FAA.

f. Access. All wind machine towers must comply with the following provisions:

i) The tower shall be designed and installed so that there shall be no exterior step bolts or a ladder on the tower readily accessible to the public for a minimum height of 12 feet above the ground. For lattice or guyed towers, sheets of metal or wood or other barrier shall be fastened to the bottom tower section such that it cannot readily be climbed; and

ii) All ground-mounted electrical and control equipment shall be labeled or secured to prevent unauthorized access.

Conditions of approval have been included as part of this Special Use Permit.

g. Rotor Safety. Each wind machine shall be equipped with both manual and automatic controls to limit the rotational speed of the blade within the design limits of the rotor. An external, manual shut-off switch shall be included with the installation. The minimum distance between the ground and any protruding blades utilized on a private wind machine shall be 10 feet as measured at the lowest point of the arc of the blades.

A condition of approval addressing rotor safety has been included as part of this Special Use Permit.

h. Noise. All wind machines shall comply with the noise requirements in this section. These levels, however, may be exceeded during short-term events such as utility outages and severe wind storms. A manufacturer's sound report shall be required with a building permit application.

i) No wind machine or combination of wind machines on a single parcel shall create noise that exceeds a maximum of 25 decibels (dBA) at any property line where the property on which the wind machine is located or the abutting property is one acre or less or a maximum of 50 decibels (dBA) at any other property line.

Measurement of sound levels shall not be adjusted for, or averaged with, non-operating periods. Any wind machine(s) exceeding these levels shall immediately cease operation upon notification by Carson City and may not resume operation until the noise levels have been reduced in compliance with the required standards and verified by an independent third party inspector, approved by Carson City, at the property owner's expense. Upon review and acceptance of the third party noise level report, Carson City will allow operation of the affected wind machine(s). Wind Energy Conversion System(s) unable to comply with these noise level restrictions shall be shut down immediately and removed upon notification by Carson City, after a period established by Carson City.

ii) Sound below 20 Hertz. No wind machine or combination of wind machines shall be operated so that impulsive sound below 20 Hertz adversely affects the habitability or use of any off-site dwelling unit, hospital, school, library or nursing home.

Conditions of approval addressing noise have been included as part of this Special Use Permit.

A*s presented the noise levels are required to be less than 50 dBA for all lots abutting the subject site, with the exception of the two vacant residential parcels to the immediate east and one parcel to the immediate south, which require noise levels not to exceed 25 dBA.*

The applicant has provided conflicting statements regarding dBA in the original submittal, which have been resolved through the information received by the Planning Division via fax on January 13, 2011 (see attached).

At northern property line at 120 feet = noise level of 47.56 dBA
At eastern property line at 140 feet = noise level of 47dBA
At western property line at 156 feet = noise level of 46.7dBA
At southern property line at 206 feet = noise level of 45.25 dBA

i. Aesthetics and Maintenance.

i) Appearance. Wind machines, unless subject to any applicable standards of the FAA, shall be a non-reflective, non-obtrusive color such as tan, sand, gray, black or similar colors. Galvanized steel or metal is acceptable for the support structures. Any painting or coating shall be kept in good repair for the life of the wind machine. In addition, any changes to the approved color shall result in notification by Carson City that the affected wind machine(s) shall cease operation until a color correction has been made. If the affected wind machine(s) are not repainted, using an approved color, within the period established by Carson City, the

owner shall remove the affected Wind Energy Conversion System(s).

A condition of approval addressing aesthetics and maintenance has been included as part of this Special Use Permit.

ii) Electrical Wires. All electrical wires leading from the tower to electrical control facilities shall be located underground.

A condition of approval addressing electrical wiring has been included as part of this Special Use Permit.

iii) Maintenance. Wind machines shall be maintained in good repair, as recommended by the manufacturer's scheduled maintenance or industry standards, and shall be free from rust.

A condition of approval addressing maintenance has been included as part of this Special Use Permit.

j. Signs/Labels. The only advertising sign allowed on the wind machine shall be a manufacturer's label, not exceeding one square foot in size, located on the generator housing.

A condition of approval addressing signs/labels has been included as part of this Special Use Permit.

k. Compliance with FAA Regulations. All wind machines shall comply with applicable FAA regulations, including any necessary approvals for installations.

A condition of approval addressing FAA regulations has been included as part of this Special Use Permit.

l. Ice Throw. The potential ice throw or ice shedding from the proposed wind machine shall not cross the property lines of the site.

A condition of approval addressing ice throw has been included as part of this Special Use Permit.

m. Certified Safe. Evidence shall be submitted with a building permit application that the wind machine has been constructed in accordance with accepted industry standards and certified safe.

A condition of approval addressing certification of safety has been included as part of this Special Use Permit.

PUBLIC COMMENTS: Public notices were mailed on January 7, 2011 to 30 adjacent property owners within 600 feet of the subject site pursuant to the provisions of NRS and CCMC. Staff has received opposition comments related to the proposed installation. Any comments that are received after this report is complete will be submitted prior to or

at the Planning Commission meeting, depending on their submittal date to the Planning Division.

OTHER CITY DEPARTMENT OR OUTSIDE AGENCY COMMENTS: The following comments were received from various city departments. Recommendations have been incorporated into the recommended conditions of approval, where applicable.

Building Division comments:
NOTE: These comments do not constitute a complete plan review, but are merely observations based on the information provided.

Building Division GENERAL PLAN SUBMITTAL COMMENTS:

1. This project requires an application for a Building Permit, issued through the Carson City Building Division. This will necessitate a complete review of the project to verify compliance with all adopted construction codes and municipal ordinances applicable to the scope of the project.

2. The plans submitted for review shall comply with the prescriptive requirements found in the Carson City Building Division handout titled: *Residential Submittal Requirements.* This handout may also be found online at: www.carson.org/building

3. Effective January 1, 2008, all new commercial submittals shall show compliance with the following codes, and adopted amendments:

    - 2007 Northern Nevada Amendments*
    - 2006 International Building Code
    - 2006 International Energy Conservation Code
    - 2006 International Existing Building Code
    - 2006 International Fire Code
    - 2006 Uniform Mechanical Code
    - 2006 Uniform Plumbing Code
    - 2005 National Electrical Code
    - 2003 ICC/ANSI A117.1 (For accessible design)

    * Carson City has adopted the 2007 Northern Nevada Amendments, which are available online at both the Carson City Building Division website and the Northern Nevada Chapter of the International Code Council (NNICC) at www.nnicc.org. With the adoption of the amendments, the snow and wind loads have increased within Carson City.

Building Division COMMENTS APPLICABLE TO THE WIND TURBINES:

4. The plan submittal for the wind turbines shall comply with the prescriptive requirements outlined within the Carson City Building Division handout titled *PLAN SUBMITTAL REQUIREMENTS: Wind Electrical Systems.*

5. *2006 IBC Section 1803.1 requires excavations for any purpose shall not remove lateral support from any footing or foundation without first underpinning or protecting the footing or foundation against settlement or lateral translation. The proposed footing is located very close to the existing dwelling footing.*

6. *The electrical system shall be designed by a Nevada registered electrical engineer in order to show code compliance for tying in of the multiple electrical generating systems located on the subject property.*

Engineering Division comments:

- The Engineering Division has no preference or objection to the special use request.

Health Department comments:

- Carson City Health and Human Services has no comments regarding the project as described in the packet received. The applicant must meet all applicable codes and ordinances as they apply to this request.

Fire Department comments:

- The applicant must meet all codes and ordinances as they relate to this request.

Parks Department comments:

- The Carson City Parks and Recreation Department does not have any comments regarding this item. We found that there are no conflicts in the areas of purview with the Parks and Recreation Department.

FINDINGS: Staff recommends approval of the Special Use Permit based the findings below, pursuant to CCMC 18.02.080 (Special Use Permits), subject to the recommended conditions of approval, and further substantiated by the applicant's written justification.

As herein described, the proposed project is consistent with the following applicable goals and policies (in italics) of the Master Plan in accordance with the seven findings (in bold) required for approval of a Special Use Permit:

1. The use will be consistent with the objectives of the Master Plan elements.

Chapter 3: A Balanced Land Use Pattern

Establishing a balance of land uses within the community promotes vitality and long-term economic stability. A balanced community is able to provide

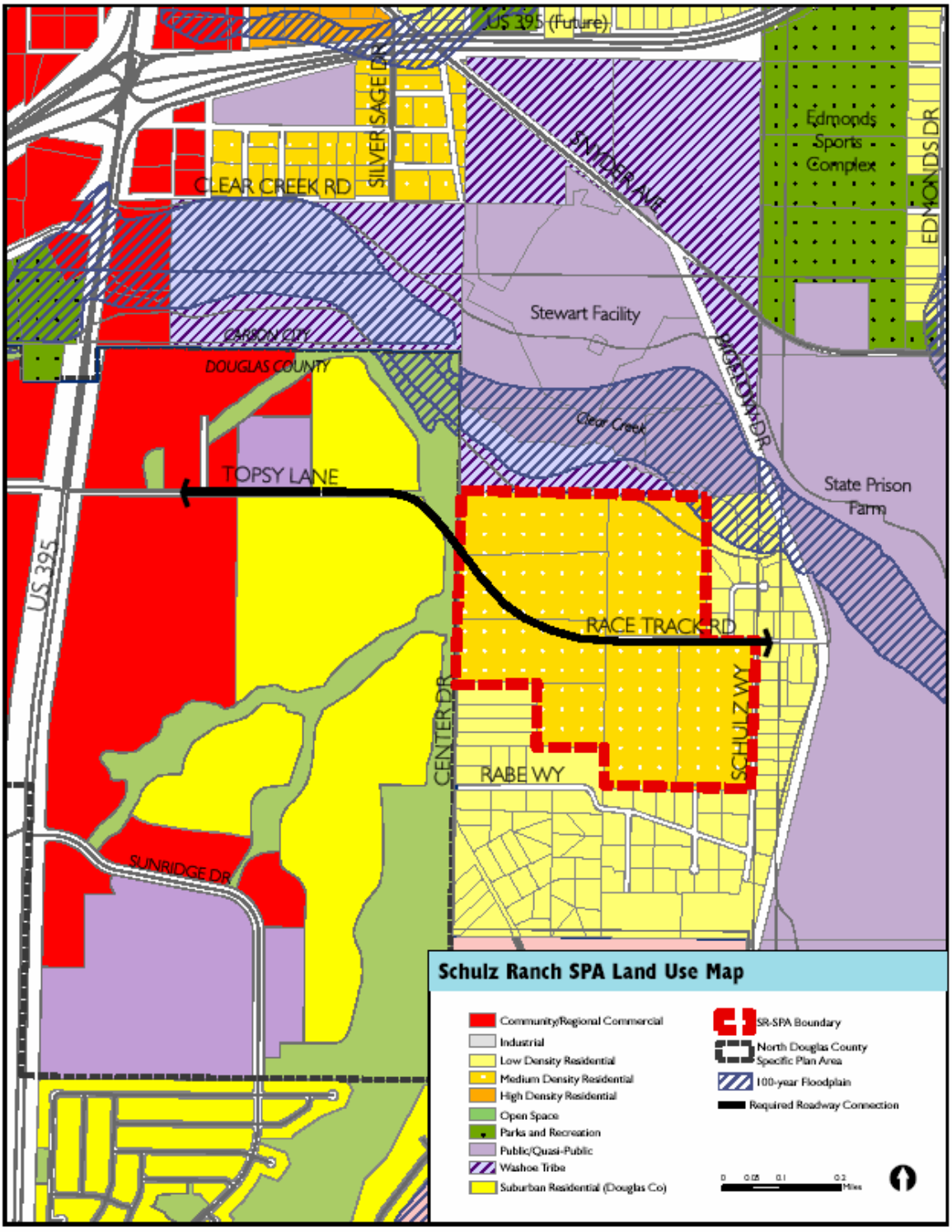
employment opportunities for its residents as well as a diverse choice of housing, recreational opportunities, and retail services. Carson City strives to maintain its strong employment base and extensive network of public lands while increasing housing options and the availability of retail services to serve residents of the City and surrounding growth areas.

The purpose of this project is to utilize alternative energy solutions (wind energy) and existing solar energy to assist in the powering of the existing single family dwelling unit and accessory structure on site, in addition to a future grey water irrigation system. Per the applicant, the proposed project could potentially attract "green" building developers to the area. Materials used in the construction will be sustainable building materials and construction techniques to promote water and energy conservation (1.le, f).

Schulz Ranch Specific Plan Area (SR-SPA)

The intent of the Schulz Ranch Specific Plan Area (SR-SPA) is to establish policies that provide a framework for the incorporation of additional housing in the area following the closure of the Race Track in a manner that: ensures the compatibility of future development with an established suburban neighborhood in the area and future development on adjacent property in Douglas County; protects the natural features of the site and of surrounding lands; provides a distinct benefit to and protects the quality of life for existing and future residents in the area; and ensures that appropriate public facilities and services will be provided to serve the area.

The applicant has stated the proposed wind turbine is compatible with the Schulz Ranch Specific Plan which is intended for a higher density neighborhood. The information provided by the applicant notes there will be no impacts to the circulation and access, infrastructure, Services and facilities, regional coordination or Environmental and Cultural artifacts related to the Schulz Ranch project.


US 395 (Future)
SILVER SAGE DR
CLEAR CREEK RD
SNYDER AVE
Edmonds Sports Complex
EDMONDS DR
Stewart Facility
CARSON CITY
DOUGLAS COUNTY
Clear Creek
RIDGELAND DR
TOPSY LANE
State Prison Farm
US 395
RACE TRACK RD
CENTER DR
SCHULZ WY
RABE WY
SUNRIDGE DR
Schulz Ranch SPA Land Use Map
Community/Regional Commercial
Industrial
Low Density Residential
Medium Density Residential
High Density Residential
Open Space
Parks and Recreation
Public/Quasi-Public
Washoe Tribe
Suburban Residential (Douglas Co)
SR-SPA Boundary
North Douglas County Specific Plan Area
100-year Floodplain
Required Roadway Connection
0 0.05 0.1 0.2
Miles

2. The proposed use will not be detrimental to the use, peaceful enjoyment, economic value, or development of surrounding properties or the general neighborhood; and will cause no noise, vibrations, fumes, odors, dust, glare or physical activity.

The proposed wind machine will be subject to the noise criteria of CCMC 18.05.080. No wind machine or combination of wind machines on a single parcel shall create noise that exceeds a maximum of 25 decibels (dBA) at any property line where the property on which the wind machine is located or the abutting property is one acre or less or a maximum of 50 decibels (dBA) at any other property line.

The applicant has provided estimated noise levels for the proposed project. The information provided by the applicant clearly notes that the two vacant parcels to the east will have noise impact of 47dBA or less and the noise impact to the immediate southern parcel will be 45.25 dBA. The adjacent parcel to the south is one acre in size and the existing house is approximately 300-plus feet south of the proposed turbine.

3. The project will have little or no detrimental effect on vehicular or pedestrian traffic.

The proposal will have little effect on traffic or pedestrian facilities.

4. The project will not overburden existing public services and facilities, including schools, police and fire protection, water, sanitary sewer, public roads, storm drainage and other public improvements.

The request is not in conflict with any Engineering Master Plans for streets or storm drainage.

The proposed project will not impact existing public services and facilities, including schools, police and fire protection, water, sanitary sewer, public roads, and other public improvements.

5. The project meets the definition and specific standards set forth elsewhere in this Title 18 for such particular use and meets the purpose statement of that district.

Pursuant to CCMC 18.04.065 Single Family 6,000 (SF6) and 12,000 (SF12) Residential Districts Purpose:

- The purpose of the SF6 and SF12 Districts is to provide for the development of single family detached dwellings in a suburban setting. The SF6 and SF12 districts are consistent with the policies of the Low Density Residential category of the Master Plan.

Pursuant to CCMC 18.05.080 Private Use Wind Energy Conversion Systems:

- In order to balance the need for clean, renewable energy resources with the protection of the health, safety and welfare of the community, the purpose of this section is to regulate private use wind energy conversion systems (WECS) for the production of electricity for use on the subject site and for net metering through the power company.

The reason for this Special Use Permit review is the inability of the proposed project to meet the standards identified in CCMC 18.05.080. Specifically, setback, height, and noise criteria.

6. The project will not be detrimental to the public health, safety, convenience and welfare.

Dust control measures must be employed during the construction period.

Guy wire anchors may not extend closer than 10 feet from/to any property line. Per the information provided by the applicant the proposed project will produce a noise level of more than 25 decibels of noise at the boundary of the parcel.

The tower shall be designed and installed so that there shall be no exterior step bolts or a ladder on the tower readily accessible to the public for a minimum height of 12 feet above the ground. For lattice or guyed towers, sheets of metal or wood or other barrier shall be fastened to the bottom tower section such that it cannot readily be climbed.

All ground-mounted electrical and control equipment shall be labeled or secured to prevent unauthorized access.

Evidence shall be submitted with a building permit application that the wind machine has been constructed in accordance with accepted industry standards and certified safe.

The potential ice throw or ice shedding from the proposed wind machine shall not cross the property lines of the site.

The only advertising sign allowed on the wind machine shall be a manufacturer's label, not exceeding one square foot in size, located on the generator housing.

Wind machines, unless subject to any applicable standards of the FAA, shall be a non-reflective, non-obtrusive color such as tan, sand, gray, black or similar colors. Galvanized steel or metal is acceptable for the support structures. Any painting or coating shall be kept in good repair for the life of the wind machine.

The wind machine shall be equipped with both manual and automatic controls to limit the rotational speed of the blade within the design limits of the rotor. An external, manual shut-off switch shall be included with the installation. The minimum distance between the ground and any protruding blades utilized on a private wind machine shall be 10 feet as measured at the lowest point of the arc of the blades.

7. The project will not result in material damage or prejudice to other property in the vicinity.

Additional conditions of approval have been provided to ensure that the proposed project will not result in material damage to other properties within the vicinity. Noticing was sent out to 30 adjacent property owners within 600 feet of the subject site. Staff has not heard any evidence or concerns that indicate that material damage or prejudice to other property in the vicinity will result from the proposed project. There have been concerns expressed related to the height of the proposed wind turbine and the noise it will potentially generate.

If a motion for denial is made, here is the appropriate finding for denial: If the Planning Commission wishes to deny the application based on the evidence presented, the following findings are recommended for denial pursuant to the Carson City Municipal Code (CCMC) Sections 18.02.080 (Special Use Permits). The finding states:

2. The project **will not be** detrimental to the use, peaceful enjoyment, economic value, or development of surrounding properties or the general neighborhood; and will cause no objectionable noise, vibrations, fumes, odors, dust, glare or physical activity.

The proposed wind turbine will be detrimental to the use, peaceful enjoyment, economic value and development of surrounding properties. The proposed height causes visual impacts to the adjacent parcels and does not meet the required noise or setback standards at property lines which could be detrimental to the peaceful enjoyment, economic value, or development of surrounding properties or the general neighborhood.

Respectfully submitted,

PUBLIC WORKS, PLANNING DIVISION

Jennifer Pruitt

Jennifer Pruitt, AICP, LEED AP
Principal Planner

Kathe Green

Kathe Green
Assistant Planner

Attachments:
Application (SUP-10-114)
Building Division comments
Engineering Division comments
Health Department comments
Fire Department comments
Parks and Recreations comments

Engineering Division
Planning Commission Report
File Number SUP 10-114

TO: Planning Commission

FROM Rory Hogen – Engineer Intern

DATE: December 23, 2010 **MEETING DATE:** January 26, 2011

SUBJECT TITLE:

Action to consider an application for a Special Use Permit for Joseph Goni and James Medeiros at 7300 Schulz Dr., apn 10-671-02 to place a wind turbine on the site, which is zoned SF6.

RECOMMENDATION:

The Engineering Division has no preference or objection to the special use request.

DISCUSSION:

The Engineering Division has reviewed the conditions of approval within our areas of purview relative to adopted standards and practices and to the provisions of CCMC 18.02.080, Conditional Uses. The issue of possible blocking of drainage due to the proximity of the concrete base to the home can be addressed on the submittals for a construction permit.

CCMC 18.02.080 (2a) - Adequate Plans
The information submitted by the applicant is adequate for this analysis.

CCMC 18.02.080 (5a) - Master Plan
The request is not in conflict with any Engineering Master Plans for streets or storm drainage.

CCMC 18.02.080 (5c) - Traffic/Pedestrians
The proposal will have little effect on traffic or pedestrian facilities.

CCMC 18.02.080 (5d) - Public Services
Existing facilities are not impacted.

CARSON CITY FIRE DEPARTMENT

"Service with Pride, Commitment, Compassion"

MEMORANDUM

TO: Community Development

FROM: Duane Lemons, Fire Inspector

DATE: January 14, 2011

SUBJECT: AGENDA ITEMS FOR JANUARY 26, 2011 PLANNING COMMISSION MEETING.

We reviewed the agenda items for the Planning Commission Meeting and have the following comments:

- SUP-10-114 Joseph Goni, James Medeiros The applicant must meet all codes and ordinances as they relate to this request.
- SUP-10-115 CB Maddox The applicant must meet all codes and ordinances as they relate to this request. Of additional note, applicant will need to refer to response to MPR 10-098, Sec 8, page 5 for further instructions.
- SUP-10-117 Carson City School District, Mark Korinek The applicant must meet all codes and ordinances as they relate to this request.
- SUP-08-046 Boys & Girls Club of Western Nevada We have no concern with the applicant's request.

DL/llb

777 S. Stewart Street, Carson City, Nevada 89701
Business Phone (775) 887-2210 • Fax (775) 887-2209 • www.carsonfire.org

Jennifer Pruitt - Planning Commission Applicants

From: Teresa Hayes
To: MPR Committee
Date: 12/21/2010 10:08 am
Subject: Planning Commission Applicants

SUP 10-114

Carson City Health and Human Services has no comments regarding the project as described in the packet received. The applicant must meet all applicable codes and ordinances as they apply to this request. *Et. Seq.*

SUP 10-115

Carson City Health and Human Services has no comments regarding the project as described in the packet received. The applicant must meet all applicable codes and ordinances as they apply to this request. *Et. Seq.*

SUP 10-117

Carson City Health and Human Services has no comments regarding the project as described in the packet received. The applicant must meet all applicable codes and ordinances as they apply to this request. *Et. Seq.*

SUP 08-046

Carson City Health and Human Services has no comments regarding the project as described in the packet received. The applicant must meet all applicable codes and ordinances as they apply to this request. *Et. Seq.*

Teresa Hayes, R.E.H.S.
Environmental Health Specialist II
Carson City Health and Human Services
900 E. Long St
Carson City, NV 89706
Phone: (775) 887-2190 ext 7227
Fax: (775) 883-4701
e-mail: thayes@carson.org

Go Green: Please do not print this e-mail unless you really need to!

File # (Ex: MPR #07-111)	*SUP 10-114*
Brief Description	*Goni Wind turbine*
Project Address or APN	*7300 Schulz Drive*
Bldg Div Plans Examiner	*Kevin Gattis*
Review Date	*January 10, 2011*
Total Spent on Review	

BUILDING DIVISION COMMENTS:

NOTE: These comments do not constitute a complete plan review, but are merely observations based on the information provided.

GENERAL PLAN SUBMITTAL COMMENTS:

1. This project requires an application for a Building Permit, issued through the Carson City Building Division. This will necessitate a complete review of the project to verify compliance with all adopted construction codes and municipal ordinances applicable to the scope of the project.

2. The plans submitted for review shall comply with the prescriptive requirements found in the Carson City Building Division handout titled: *Residential Submittal Requirements.* This handout may also be found online at: www.carson.org/building

3. Effective January 1, 2008, all new commercial submittals shall show compliance with the following codes, and adopted amendments:

   - 2007 Northern Nevada Amendments*
   - 2006 International Building Code
   - 2006 International Energy Conservation Code
   - 2006 International Existing Building Code
   - 2006 International Fire Code
   - 2006 Uniform Mechanical Code
   - 2006 Uniform Plumbing Code
   - 2005 National Electrical Code
   - 2003 ICC/ANSI A117.1 (For accessible design)

   *- Carson City has adopted the 2007 Northern Nevada Amendments, which are available online at both the Carson City Building Division website and the Northern Nevada Chapter of the International Code Council (NNICC) at www.nnicc.org. With the adoption of the amendments, the snow and wind loads have increased within Carson City.

COMMENTS APPLICABLE TO THE WIND TURBINES:

4. The plan submittal for the wind turbines shall comply with the prescriptive requirements outlined within the Carson City Building Division handout titled *PLAN SUBMITTAL REQUIREMENTS: Wind Electrical Systems.*

5. *2006 IBC Section 1803.1 requires excavations for any purpose shall not remove lateral support from any footing or foundation without first underpinning or protecting the footing or foundation against settlement or lateral translation. The proposed footing is located very close to the existing dwelling footing.*

6. *The electrical system shall be designed by a Nevada registered electrical engineer in order to show code compliance for tying in of the multiple electrical generating systems located on the subject property.*

CARSON CITY, NEVADA

CONSOLIDATED MUNICIPALITY AND STATE CAPITAL

MEMORANDUM

To: Lee Plemel, Planning Director

From: Roger Moellendorf, Parks and Recreation Director
Juan F. Guzman, Open Space Manager
Vern L. Krahn, Park Planner

Subject: Parks & Recreation Department's Comments for the Planning Commission meeting on January 26, 2011

Date: January 14, 2011

SUP-10-114 Height variance for a wind energy tower in a sfF6 district.
The Carson City Parks and Recreation Department does not have any comments regarding this item. We found that there are no conflicts in the areas of purview with the Parks and Recreation Department.

SUP-10-115 Asphalt plant and aggregate crushing facility including a 1.5 megawatt wind turbine at a height of 225 feet plus blade height.

The subject SUP for a aggregate and crushing facility is not in conflict with any of the areas of purview by the operations of the Parks and Recreation Department. Staff has concerns relating to the turbine's proposed height.

The Open Space Program has worked in cooperation with the Planning Department towards the implementation of the Carson City Federal Lands Bill. The proposed use is adjacent to lands that are to be transferred from the Bureau of Land Management to Carson City for the purpose of parks and public purposes. The zoning of the parcels for the proposed aggregate plant and crushing facility is General Industrial where this type of industrial use is appropriate. Staff believes that, due to the zoning of the property in question, this is the correct site for industrial operations of this type to take place.

The adjacent lands to be transferred to Carson City also contain uses that are of industrial nature including the Carson City waste disposal facility and a water tank. Among these industrial uses there are some recreation facilities such as a shooting range located towards the south end and a model aircraft landing strip and flying field. Staff will venture to state that the previously described uses have been compatible and further conflicts are not readily discernable as a consequence of approving the proposed special use permit.

In reference to the height of the wind turbine, it is found that the proposed height is in excess of the maximum height requirement of 45 feet for the General Industrial zoning district. Therefore, granting of this special use permit to exceed the height standard is a discretionary action by the Planning Commission. Staff finds that there is not City policy regarding the placement of wind turbines for commercial purposes, particularly in contrast of scenic regulations and in contrast to regulations, programs, and policy already adopted toward the protection of our scenic resources. Staff anticipates that the visual intrusion that may be caused by the height of this turbine and antenna may be somewhat mitigated if in fact the overall height does not exceed the height of the Pinion Mountains in the background. Staff believes that the crux of this matter is the discussion of the need to provide for our community renewable energy facilities as opposed to the preservation of scenic values. Again, even when the City has adopted multiple standards and regulations towards the preservation of its scenic beauty, this specific question has not been studied comprehensively. It is staff's opinion that impacts of the proposed tower height and turbine is not likely to have a significant impact on the scenic quality of the eastern hills surrounding the Eagle Valley. This opinion is rendered in light of the extensive mass and length of the Pinion Range in relation to the single proposed turbine.

SUP-10-117 The Carson City Parks and Recreation Department does not have any comments regarding this item. We found there are no conflicts with the Parks and Recreation Department or the Open Space Program.

SUP-08-046 The Carson City Parks and Recreation Department is the applicant and is requesting a time extension for the project's approved special use permit for the construction of a recreation center. This time extension is necessary for our department to find additional funding for the project.

Rea Thompson - special use permit File No. SUP-10-114

From: Perry Batten <pbatten74@hotmail.com>
To: <planning@carson.org>
Date: 1/10/2011 8:45 AM
Subject: special use permit File No. SUP-10-114

This E-mail is in respone to the special use permit requested at 7300 Schultz Dr.

As a home owner in the immediate area I request that a special use permit not be issued for this project. A 160' wind turbine structure in our neighborhood would be out of the question. Not only would it be a eye sore, but it could potentially reduce our already falling resale values in the area. Also there is a large migratory bird population that frequently flies overhead and a wind turbine would directly affect there flight paterns. Again, I say no to the proposed special use permit requested for 7300 Schultz Dr..

Sincerely,
Perry & Jenera Batten

Actually against turbine! Dudley 1/10/2011
& Lynda Leavitt

OFFICIAL NOTICE OF PUBLIC HEARING

You are hereby notified that the Carson City Planning Commission will conduct a public hearing on Wednesday, January 26, 2011, regarding the item noted below. The meeting will commence at 5:00 p.m. The meeting will be held in the Carson City Community Center, Sierra Room, 851 East William Street, Carson City, Nevada. For information on the approximate time these items will be heard by the Planning Commission or for staff reports, please contact the Planning Division after 9 am, Friday, January 21, 2011, at 887-2180.

SUBJECT: Special Use Permit **FILE NO. SUP-10-114***

SUP-10-114 Action to consider a Special Use Permit request from the Rainbow Conservation Corp (property owner: Joseph Goni) for a height variance for the installation of a wind energy tower at 160 feet, on property zoned Single Family 6000 (SF6), located at 7300 Schultz Dr., APN 010-671-02.

Summary: Carson City adopted standards related to Private Use Wind Energy Conversion Systems in 2009. Pursuant to the Carson City Municipal Code (CCMC) 18.05.080(5c), variations to the regulations and standards related to Private Use Wind Energy Conversion Systems may only be permitted by special use permit approval. This request will allow the placement of a wind turbine of 160 feet on the subject site for personal use accessory to the existing single family dwelling unit on site, which will exceed the height standard of 60 feet maximum and not satisfy the setback standard of 1.1 times the height from the project property lines.

The application materials are available for public review at the Planning Division, 108 E. Proctor St., Carson City, Nevada, 89701. If you have questions related to this application, you may contact Jennifer Pruitt, Principal Planner, at 775-283-7076 ([redacted].org). Staff reports are available approximately six days prior to the Planning Commission meeting or online at www.carson.org/planning/pc under Agendas with Supporting Materials.

As an owner of property in the vicinity, you are invited to submit comments relative to this matter to the Planning Commission, either in writing or at the Planning Commission meeting. Written comments should be sent to the Carson City Planning Division at the above-noted address, via fax at 775-887-2278, or via e-mail at planning@carson.org. Written comments received at least seven days prior to the Planning Commission meeting will be forwarded to the Commissioners for their review prior to the meeting; written comments received after that but by noon on the day of the meeting will be given to the Commissioners at the meeting.

Dudley & Lynda Leavitt
Dudley D & Jeffrey D
7501 Martha Circle
Carson City, NV 89701

Wind Turbine Zoning Issues Could Be the Next Big Thing

Wind turbine zoning presents a dilemma to any municipality seeking to promote green development and sustainability. With alternative energy a hot topic, and with the LEED® standards from the U.S. Green Building Council awarding points for alternative energy, the topic will pop up. First we'll discuss the issue of a single wind turbine, providing energy mostly to the property owner, although more than half the states allow "net metering" in which an individual may sell excess electricity generated to the power grid.

Most municipalities simply wouldn't know how to deal with such a request, so it's time to start thinking about how to revise your zoning ordinance to deal with an immediate or future possibility. Of course, many towns may not have any locations suitable for wind energy generation, so this will be a moot point for them.

If you already have a tower zoning, cell phone zoning, or antenna zoning provision, refer to those for ideas on how you want to regulate this new form of tall, slender object.

Usually it's helpful to divide wind turbines into small and large, based on their energy output. But even "small" may seem like a problem to planning commissioners who aren't ready for a 60-foot tall turning object in back yards.

Until the technology settles down, and people get used to the idea, we suggest that any wind energy generating device require a conditional use permit under the wind turbine zoning provisions. A conditional use permit usually requires public hearings before the planning commission and city council, and action by the latter. "Conditions" for construction and/or performance also may be imposed by the governing body.

Usually the ordinance will define a structure in such a manner that a single turbine would have to be reviewed under zoning, but height restrictions and limits on the number of accessory uses (examples are garages and sheds) would stop the proposal in its tracks in both locations.


Open Space

Thus far people seem pretty much united in the notion that we don't want a single-family residence in a subdivision erecting a tall wind turbine. However, be aware that there are small rooftop units that generate only a tiny amount of electricity. But a single house on forty acres, with no close neighbors, might be a different story.

Be aware that there are different types of wind turbines, and a Minnesota model ordinance in 2005 divided them into commercial and non-commercial scales. You may want to do the same. Just be aware that outputs, height, and thickness do vary.

So the question becomes how much land is enough to prevent a wind turbine from having a negative impact on the neighborhood? The National Academy of Sciences has recommended a 2600 foot setback, about half a mile, from the nearest home. Other recommendations and ordinances have allowed much less. You should have a professional engineer specify the "fall zone" for where the turbine could conceivably land if it were to topple. Certainly your setback from both property lines and buildings that may lie on the same property should exceed that fall zone.

We are early in the process of determining what is appropriate and whether there is any real reason for people to be concerned. Also the technology is advancing, so design changes in the products available might make a real difference in their performance characteristics.

Another issue is noise, an actual complaint when wind turbines have been installed somewhat near residential neighborhoods. However, this problem seems easily addressed. The wind turbine zoning amendment simply should refer to the acceptable decibel level (a measure of noise) in residential neighborhoods, providing one has been established either through zoning or in a separate ordinance. If not, the highest level of total noise on a regular basis you should tolerate at the outside wall of any house is probably 40 decibels, abbreviated dB. (The higher the decibel number, the louder the noise.)

Our recommendation is to provide through wind turbine zoning that the ambient (existing normal) noise level at the property line could not be increased by any more than 10 dB through addition of the turbine. If you face opposition, of course permitting no increase is a viable option.

Height is certainly an appropriate concern, and related to height is appearance and community design. While almost all residential zoning districts specify a height restriction, wind turbine zoning will need to be realistic about the products and technology available. Current wind turbines need to be at least 20 feet above the trees to be effective.

A minimum clearance from the ground to the lowest turbine also must be established. At least 12 feet is recommended. Other setbacks, such as from roads, rivers, streams, wetlands, conservation areas, or scenic or historic sites may need to be established.

The fact that the stem of the wind turbine designs now most prevalent is slender means that the mass of a single turbine will not appear to be great. The most common design also is white or near-white, with the effect of a graceful appearance to most people. Some will find them ugly because they are unfamiliar. In fact, however, the design is simple and pleasant enough near newer suburban neighborhoods.

The appearance debate seems much more viable when the proposed wind turbine zoning is adjacent to a vintage neighborhood or historic district. The wind industry will have to be resourceful to design a complement to a richly textured neighborhood.

Commercial wind farm zoning also presents the same issues--noise, appearance, height, and proximity to residences. I personally find a large wind farm in a rural or industrial area not at all offensive in appearance, but it will be a matter of lively local debate. We recommend that in a county or town with an agricultural zoning district, wind turbine zoning be allowed with a conditional use permit.

In industrial or commercial zoning districts, you certainly need to require the conditional use permit so that you can control individual site conditions. Generally, we like the potential of applying a wind farm zoning overlay in areas of your city that are appropriate. This can provide that some debate occurs before an actual case arises--always good policy in zoning matters.

A few other requirements apply. Require that feeder power lines from the turbines be buried underground, as those would be some high and ugly wires. Also require compliance with FAA regulations, which may include a small light.

You probably will need to permit any type of safety warning signs suggested by the manufacturer.

A couple of last things. You also will hear from bird lovers that wind turbine zoning would cause terrible collisions for our feathered friends. In fact, however, there are many other hazards for birds, but it would be wise to avoid known nesting and migration areas.

But also the word is around that wind turbines might interfere with cell phone reception, and we're mighty cranky when that happens. Investigate that closely; it seems to be approaching urban myth status.

The trade association for the wind industry is the American Wind Energy Association.

Return from Wind Turbine Zoning to Zoning

WFAA.com
DALLAS/ FORT WORTH | WFAA-TV

Neighbors claim wind turbine makes them ill

by By JANET ST. JAMES / WFAA-TV

wfaa.com

Posted on August 15, 2009 at 3:43 PM

Updated Friday, Oct 16 at 2:04 PM

WFAA-TV
Some neighbors say the wind turbine next door makes too much noise.
Video
Janet St. James reports
July 28, 2008
LINK:
LINK:
LINK:
LINK:
MORE:
MORE:

SAGINAW - T. Boone Pickens says they're the wave of the future. But a wind turbine meant to generate electricity for one Saginaw family has sparked a huge headache for their neighbors.

"It makes a terrible 'air raid' noise," said Debbie Behrens, talking about the high-pitched whine made by the turbine. "It's driving me crazy."

What's worse - Debbie and her son Lance both say that the high-pitched hum is now causing physical problems.

"You occasionally have the dizziness," Lance explained, "The ringing in the ears; I've

never experienced the ringing in the ears."

It turns out there is a documented health condition associated with the noise generated by some windmills called "Wind Turbine Syndrome."

Symptoms include headaches, dizziness, nausea and ringing in the ears, known as tinnitus.

Dr. Lee Wilson of the UT Dallas Callier Center says the noise from most turbines isn't loud enough to cause actual loss, but constant sound can cause other problems.

"Any kind of thing like that has the potential to affect those kinds of feelings," Dr. Wilson said. "And they're real. I mean you're really sick, nauseated, but it may be a result of some anxiety that's related to what you're hearing rather than the actual sound."

Because there aren't many windmills around, Dr. Wilson hasn't yet seen any cases.

And not every turbine makes that whine.

For example, the giant mills near Sweetwater make a quiet thump as they spin.

Doctors say some people are more sensitive to constant sound than others.

WFAA-TV
Debbie Behrens and her son Lance say they've suffered since a neighbor installed a wind turbine.

The people who installed the small, residential turbine in Saginaw aren't bothered at all.

But the Behrens believe without attention and - potentially - regulation, wind turbine noise could become a major problem in neighborhoods as the country switches to more eco-friendly energy sources.

Some science shows turbines should be at least a mile away from homes.

The turbine that stands 50 yards from the Behren's back door is loud enough to make them want to move.

"My life savings is in this house," said Debbie, "but, I would not live with that going here for the rest of my life, no."

E-mail

Add another comment

Carson City Planning Division
108 E. Proctor St.
Carson City, Nevada 89701
ATTN: JENNIFER PRUITT
Re: SUP-10-114

January 11, 2011

Dear Ms. Pruitt,

My family and I live directly downwind of Mr. Goni's property along with 2-3 other homes. I do not work and am at home all day with my disabled child. I live in this area because it is quiet and serene here.
I have very serious concerns regarding the height, noise and setback issues regarding the special use permit #SUP-10-114. As your office states, the typical residential use height is 60 foot max. I don't believe an additional 100 feet is fair to any of the neighbors when all the other personal use wind towers in the area have stayed within the max. restrictions. To our knowledge, Mr. Goni lives alone, so what constitutes a 160 ft. tower for one resident? If this is for personal use only, I believe Mr. Goni's tower should remain within the designated max. The wind tower is in addition to his recent solar power set-up, so between the *two* systems he should have plenty of power.
I have also enclosed a copy of a study from Lawrence University regarding wind turbines & noise. It is written in layman's terms and I believe is easily understood.
I hope this article is helpful in your decision making process.
Once again, I am not against solar or wind power, I am 100% for changes that help our planet survive, but I believe we can do this without destroying each others serenity.

Thank you,

Ann Essex- Bankston Legal Guardian of Melanie L. Essex
Melanie Essex
Ruben Bankston
7305 Schulz Dr.
Carson City, Nevada 89701
775-841-8998

Primer for

Addressing Wind Turbine Noise

Revised Oct. 2006

by Daniel J. Alberts

LAWRENCE
TECHNOLOGICAL
UNIVERSITY

Table of Contents

Introduction

Michigan is proceeding to develop renewable energy policies. The Energy Office of Michigan, in their 2004 Annual Report to the Michigan Public Service Commission on Michigan's Renewable Energy Program, recommended that the State of Michigan adopt the following policies:

- Set a goal of installing 800 MW of wind power by the year 2010.
- Adopt statewide policies to encourage the development of wind energy in Michigan.
- Adopt a Renewable Portfolio Standard (RPS) that requires 1.0% of all energy sold within the state of Michigan be generated from renewable sources (including wind) by December 2006.
- Increase the RPS requirement by 0.5 % each year to reach a total of 10% by 2015.

Although the State of Michigan may encourage renewable energy development, local governments within the state will be responsible for zoning and permitting wind turbines. To develop zone and permit wind turbines, local governments will need to examine a variety of issues, including the impact of wind turbine noise on land use compatibility.

To help wind energy advocates and Michigan's policy makers better understand this issue, Michigan's Energy Office asked Lawrence Technological University to research the noise issue and present their findings to Michigan's Wind Working Group. The formal research documents are available at Lawrence Technological University's web site:

http://www.ltu.edu/engineering/mechanical/delphi_wind.asp

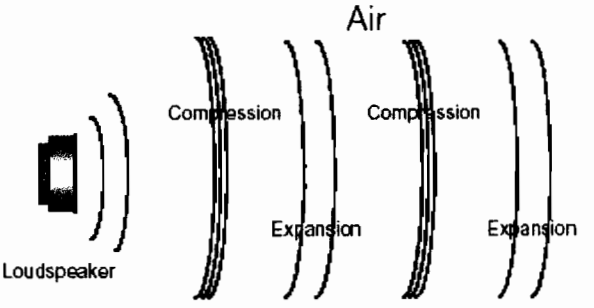
This paper consolidates the education material on noise concepts and assessment distributed through the two formal phases of the research with additional material on engineering standards for noise measurement. The author hopes this paper will help decision makers understand wind turbine noise well enough to develop beneficial permitting procedures and zoning ordinances, and permit wind energy development with minimal conflicts.

Noise Concepts and Definitions

The dictionary defines noise as unwanted sound. But to understand noise measurement and assessment, it is necessary to examine noise from an engineering perspective. This means defining several characteristics of sound, and redefining noise based on these definitions.

Sound is a defined as rapid fluctuations of air pressure which create a repeating cycle of compressed and expanding air.

Figure 1. Sound



Sound power is the energy converted into sound by the source. Sound power is not measured directly, it is calculated from measurements, and is used to estimate how far sound will travel and to predict the sound levels at various distances from the source. Several wind turbine manufacturers provide sound power with their turbine brochures. For example, Vestas' V80, 1.8 MW turbine emits between 98 and 109 dB(A) of sound power depending on configuration.

As sound energy travels through the air, it creates a sound wave that exerts pressure on receivers such as an ear drum or microphone. *Sound pressure* is typically measured in micropascals (μPa) and converted to a *sound pressure level* in decibels (dB) for reporting. The decibel scale is a logarithmic scale relative to the human threshold of hearing. Sound pressure level is used to determine loudness, noise exposure, and hazard assessment. (The next section covers sound pressure scales in more detail.) ANSI, the EPA, ISO, OSHA, and the WHO[1] all base their recommendations for maximum noise exposure on sound pressure levels.

As stated above, sound is a repeating cycle of compressed and expanding air. The *frequency* is the number of times per second, or Hertz (Hz), that this cycle repeats. An *octave* is a range where the lowest frequency is exactly half the highest frequency. A Concert A is 440 Hz, the next higher A is 880 Hz.

Sounds are often classified by the number of frequency components they contain. A *tone* is a sound that contains only one frequency. Musical notes are tones. Mechanical systems often emit noise that contains a noticeable tone. *Narrowband* sounds contain two or more frequency components, but the frequencies are very close to each other, within 1/3 of an octave. *Broadband* sounds contain multiple frequency components, and the frequencies span more than 1/3 of an octave. Cars, lawn equipment, jet engines and wind turbines all produce broadband noise.

---

[1] American National Standards Institute (ANSI), US Environmental Protection Agency (EPA), International Standards Institute (ISO), Occupational Safety and Health Administration (OSHA) and the World Health Organization (WHO)

Table 1 lists some important frequency ranges for studying the impact of wind turbine noise.

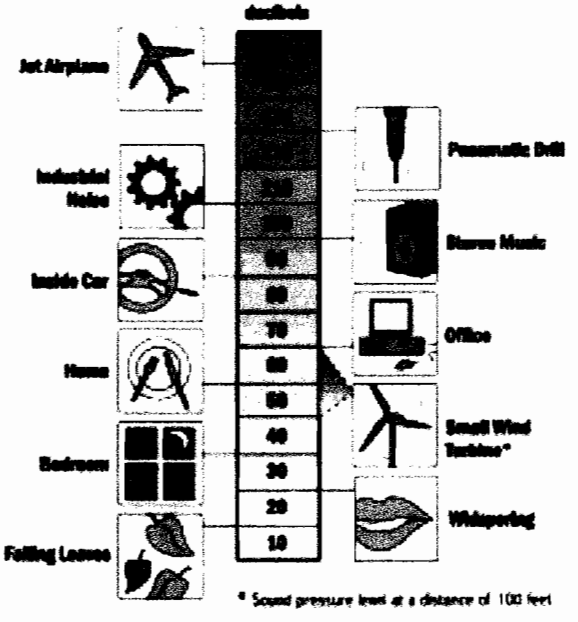
Table 1. Important Frequency Ranges

	Range
Normal Hearing	20 Hz – 20 kHz
Normal Speech	100 Hz – 3 kHz
Low Frequency	20 – 200 Hz
Infra Sound	< 16 Hz

Sound Pressure Level Scales

The human ear can detect and respond to sound pressures, from 20 μPa to over 200,000,000 μPa. (beyond 200,000,000 μPa the response becomes pain.) Engineers wanted a scale with a smaller range, so they mapped sound pressure on logarithmic scale which they defined as the decibel (dB). Zero decibels is the lowest pressure (20 μPa) that a person with normal hearing can detect. One hundred forty decibels is the pressure (20,000,000 μPa) that causes most people physical pain. Figure 2 shows how this scale relates to some common noise sources.

Figure 2. The Decibel Scale[2]



[2] Source: The American Wind Energy Association, http://www.awea.org/faq/noisefaq.html

Because decibels are a logarithmic scale, values do not add the same as they would for a linear scale. Doubling the sound power increases the sound pressure level by 3 dB. For example, two wind turbines each generating 110 dB of noise would produce a combined noise of 113 dB. However, doubling the sound pressure will increase the sound level by 6 dB.

A few additional things to remember about the decibel scale:

- Outside the laboratory most people cannot notice a volume change of less than 3 dB.
- A volume change of 3–5 dB is clearly noticeable.
- Most people subjectively perceive volume increase of 10 dB as twice as loud.

Peoples' perception of noise, however, do not always correspond with the dB scale. Sounds created with the same energy, but with different frequencies are not perceived to be equally loud. A lower frequency sound will seem quieter than a higher frequency sound of the same sound level. Noise control engineers wanted scales that reflected peoples' perception of noise. So they created 'weighting' scales.

In one sense, noise scales are like temperature scales. A thermometer measures the amount of heat in the air. The heat measurement is then compared to a reference scale such as Fahrenheit or Celsius. When we measure noise, we are actually measuring the amount of pressure that sound exerts on the receiver. We then compare that pressure to a decibel scale. However, the decibel scales are also adjusted by frequency. Engineers specify adjusted values by appending the scale name to the units, i.e., dB(A) or dB(C). Unadjusted values are reported as simply dB. Three of the scales, A, C, and G, have been identified as potentially relevant to addressing wind turbine noise.

The A scale is the most commonly used for community noise assessment and for specifying exposure limits. Designed to reflect the way people perceive sounds, the A scale divides the range of possible frequencies into octaves, and for each octave adjusts the decibel level so that a specified decibel level will seem to have the same loudness in each range. Table 2 shows how to adjust a sound pressure level for each frequency range to report a sound pressure level on the A, C, and G scales.

Table 2. Decibel Weighting Scales

Octave-center frequency (Hz)	Weighted response (dB)		
	A scale*	C scale*	G scale**
4			-16.0
8			-4.0
16			+7.7
31.5	-39.4	-3.0	-4.0
63	-26.2	-0.8	
125	-16.1	-0.2	
250	-8.6	0.	
500	-3.2	0.	
1,000	0.0	0.	
2,000	+1.2	-0.2	
4,000	-1.0	-0.7	

*From IEC 60651
**From ISO 7196

Many noise control texts state that the A scale is insufficient for determining the impact of noise or the level of annoyance when the frequency is below 100 Hz. Other texts state that the A scale is insufficient for any sound above 60 dB. These texts recommend the C scale which more closely resembles the actual sound pressure. However, the US Department of Labor based their noise exposure standards on the A scale. ANSI, the EPA, ISO, OSHA and WHO all provide their health impact data and their recommended noise exposure limits on the A scale; so it is likely the A scale will remain predominant.

As Table 2 shows, the difference between the A scale and the actual sound pressure varies significantly from one frequency range to another. So in order to ensure compliance with limits specified on the A scale, engineers specify non-adjusted limits for each range. Table 3 shows how Mundy Township in Michigan specified non-adjusted noise limits for each octave band to achieve the desired A scale limits.

Table 3. Octave Band Noise Limits

Frequency at center of octave band	31.5 Hz	63 Hz	125 Hz	250 Hz	500 Hz	1 kHz
Non-adjusted dB level	72 dB	71 dB	65 dB	57 dB	51 dB	45 dB
Equivalent dB(A)	32.6 dB(A)	44.8 dB(A)	49 dB(A)	48.4 dB(A)	47.8 dB(A)	45 dB(A)

The G scale is used only for infrasound, i.e., sounds below 20 Hz. A few studies show that wind turbines do generate infrasound. However, the practicality and the importance of using the G scale for measuring this noise is still being debated.

For additional information on noise measurement, visit:

http://www.phys.unsw.edu.au/~jw/dB.html
http://www.dataphysics.com/support/library/downloads/articles/DP-Aweight.pdf

Wind Turbine Noise

Wind turbines generate two types of noise: aerodynamic and mechanical. A turbine's sound power is the combined power of both. Aerodynamic noise is generated by the blades passing through the air. The power of aerodynamic noise is related to the ratio of the blade tip speed to wind speed. Table 4 shows how the sound power of two small wind turbines vary with wind speed.

Table 4. Sound Power of Small Wind Turbines[3]

Make and Model	Turbine Size	Wind Speed (meters/second)	Estimated Sound Power
Southwest Windpower	900 W	5 m/s	83.8 dB(A)
Whisper H400		10 m/s	91 dB(A)
Bergey Excel BW03	10 kW	5 m/s	87.2 dB(A)
		7 m/s	96.1 dB(A)
		10 m/s	105.4 dB(A)

Depending on the turbine model and the wind speed, the aerodynamic noise may seem like buzzing, whooshing, pulsing, and even sizzling. Turbines with their blades downwind of the tower are known to cause a thumping sound as each blade passes the tower. Most noise radiates perpendicular to the blades' rotation. However, since turbines rotate to face the wind, they may radiate noise in different directions each day. The noise from two or more turbines may combine to create an oscillating or thumping "wa-wa" effect.

Wind turbines generate broadband noise containing frequency components from 20 – 3,600 Hz. The frequency composition varies with wind speed, blade pitch, and blade speed. Some turbines produce noise with a higher percentage of low frequency components at low wind speeds than at high wind speeds.

Utility scale turbines must generate electricity that is compatible with grid transmission. To meet this requirement, turbines are programmed to keep the blades rotating at as constant a speed as possible. To compensate for minor wind speed changes, they adjust the pitch of the blades into the wind. These adjustments change the sound power levels and frequency components of the noise. Table 5 lists the sound power for some common utility scale turbines.

Table 5. Sound Power of Utility Scale Wind Turbines

Make and Model	Turbine Size	Sound Power
Vestas V80	1.8 MW	98 – 109 dB(A)
Enercon E70	2 MW	102 dB(A)
Enercon E112	4.5 MW	107 dB(A)

A turbine's sound power represents the sound energy at the center of the blades, which propagates outward at the height of the hub. While writing this paper, I visited the Bowling Green Wind Farm Project, in Bowling Green, OH. At the base of 1.8 MW turbine, we measured the noise level at 58–60 dB(A). However, the turbines stand in a corn field, and depending on our position relative to the turbines, it was very difficult to distinguish the sound of the turbine from the rustling of the corn stalks.

Mechanical noise is generated by the turbine's internal gears. Utility scale turbines are usually insulated to prevent mechanical noise from proliferating outside the nacelle or tower. Small turbines are more likely to produce noticeable mechanical noise because of insufficient insulation. Mechanical noise may contain discernable tones which makes it particularly noticeable and irritating.

The amount of annoyance that wind turbine noise is likely to cause can be related to other ambient noises. One study in Wisconsin[4] reported that turbine noise was more noticeable and annoying at the cut-in wind speed of 4 m/s (9 mph) than at higher wind speeds. At this speed, the wind was strong enough to turn the blades, but not strong enough to create its own noise. At higher speeds, the noise from the wind itself masked the turbine noise. This could be of significance to Michigan communities where the average wind speeds very from 0 to 7 m/s (0–16.7 mph).

Health Impacts of Noise Exposure

Excessive exposure to noise has been shown to cause a several health problems. The most common impacts include:

- Hearing loss (temporary and permanent)
- Sleep disturbance

[3] Source: P. Migliore, J. van Dam and A. Huskey. Acoustic Tests Of Small Wind Turbines http://www.bergey.com/Technical/AIAA%202004-1185.pdf

[4] http://www.ecw.org/ecw/productdetail.jsp?productId=508&numPerPage=100&sortA

Exposure to extremely high noise levels can also cause headaches, irritability, fatigue, constricted arteries, and a weakened immune system[5]. However, there is no evidence that wind turbines generate the level of noise needed to create these problems.

Induced Hearing Loss

Noise exposure can induce two types of hearing loss: threshold shifts, which refers to the lowest volume a person can detect, and frequency loss, which means an inability to hear specific frequencies.

A person with normal hearing can detect any sound above 0 dB. Exposure to loud noises can temporarily desensitize nerve endings so that the lowest volume a person could hear might increase to 6 or 10 dB. With this shift, the person's entire perception of noise changes so that what was previously perceived as a normal volume seems too quiet to understand. If exposure is brief and the noise is removed, most people's hearing will return to normal. Long-term exposure, however, can cause permanent damage.

Hearing loss is related to the total sound energy to which a person is exposed. This is a combination of the decibel level and the duration of exposure. The Environmental Protection Agency (EPA), The American National Standards Institute (ANSI), and the US Occupational Safety and Health Administration (OSHA) have issued separate recommendations for maximum noise exposure to prevent hearing loss. Table 6 summarizes ANSI's recommendations.

Figure 3 shows how ANSI's recommendations compare to those of the EPA and OSHA.

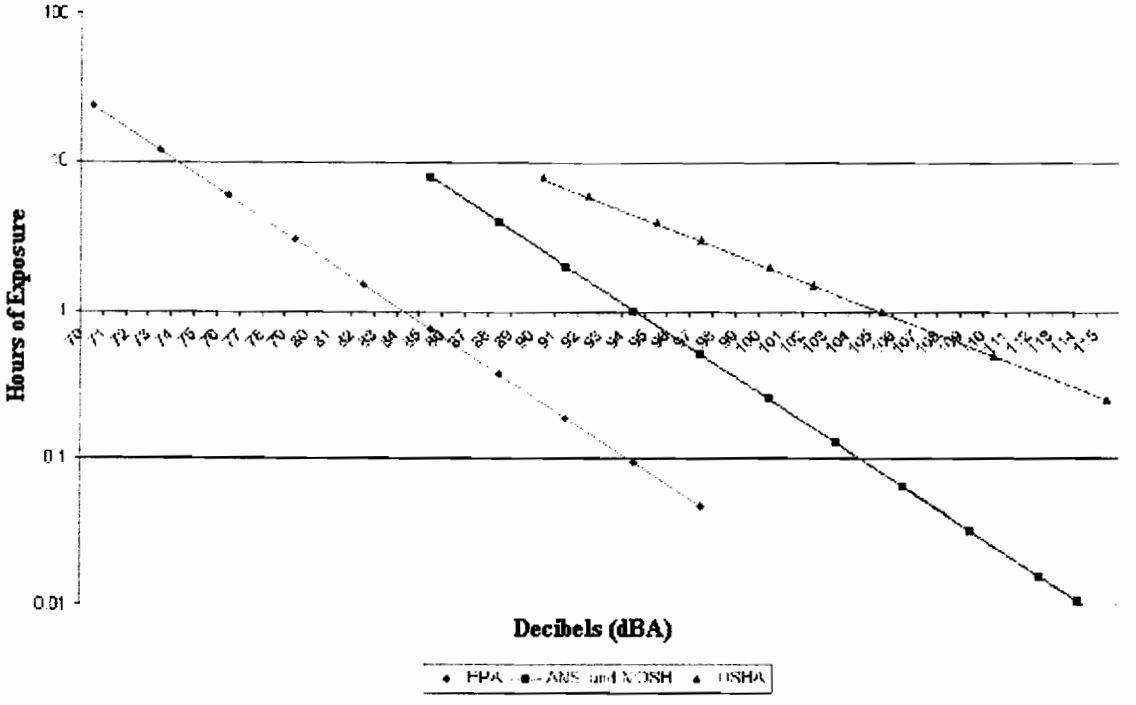
Table 6. ANSI Recommendations for Max Noise Exposure

Sound level dB(A)	Max exposure
90	8 hours
95	4 hours
100	2 hours
110	1/2 hour
115	1/4 hour

[5] Bragdon, Clifford. (19710Noise Pollution The Unquiet Crisis. (pg 69-71) University of Pennsylvania Press.

Stephens, Dafydd and Rood, Graham (1978) The Nonauditory Effects of Noise on Health (pg 285-312)in Handbook of Noise Assessment Edited by Daryl May Van Nostrand Reinhold Company New York

Figure 3. Comparison of Maximum Noise Exposure Standards[6]



Hearing loss can occur in specific frequencies. Elderly people tend to loose the ability to perceive higher frequencies before lower frequencies. Wind turbine noise, however, has not been linked to frequency loss.

Sleep Disturbance

The Institute of Environmental Medicine at Stockholm University prepared an extensive volume for the World Health Organization (WHO) on the impact of community noise on people's health. They report that noise exposure can affect sleep in several ways, including:

- increasing the time needed to fall asleep,
- altering the cycle of sleep stages, and
- decreasing the quality of REM sleep.

Over extended periods of time, any one of these problems could lead to more serious health issues.

[6]Source: http://www.nonoise.org/hearing/exposure/standardschart.htm

Sleep disturbances have been linked to three characteristics of noise exposure, including:

- the total noise exposure (including daytime exposure)
- the peak noise volume
- for intermittent noise, the number of volume peaks

The study reports that:

- Noise levels of 60 dB wakes 90% of people after they have fallen asleep.
- Noise levels of 55 dB affects REM cycles and increases time to fall asleep.
- Noise of 40-45 dB wakes 10% of people.

WHO recommends that ambient noise levels be below 35 dB for optimum sleeping conditions. These recommendations are significant because of a Dutch study[7] that showed noise from a 30 MW wind farm becomes more noticeable and annoying to nearby residents at night. This study noted that although the noise is always present, certain aspects of turbine noise, such as thumping and swishing, were not noticeable during the day, but became very noticeable at night. Residents as far as 1900 meters from the wind farm complained about the nighttime noise.

Intermittent peaks of 45 dB occurring more than 40 times per night, or peaks of 60 dB occurring more than 8 times per night will disturb most people's sleep. Intermittent starts and stops may be an issue for small, residential scale wind turbines (< 500 kW), and medium sized commercial turbines (500 kW – 1 MW) but are not likely to be an issue for utility scale turbines.

Many people (but not all) develop the ability to fall asleep regardless of the sound levels. Studies, however, show that this is only a partial adaptation. The presence of noise continues to negatively affect the sleep cycles and the quality of REM sleep.

Noise Assessment and Exposure Indicators

In many areas, noise levels change several times per day. So a noise that might seem loud at some times might be barely noticeable at other times. To account for these differences, many noise specifications use statistical limits. Table 7 lists some of the most commonly used indicators and their meanings.

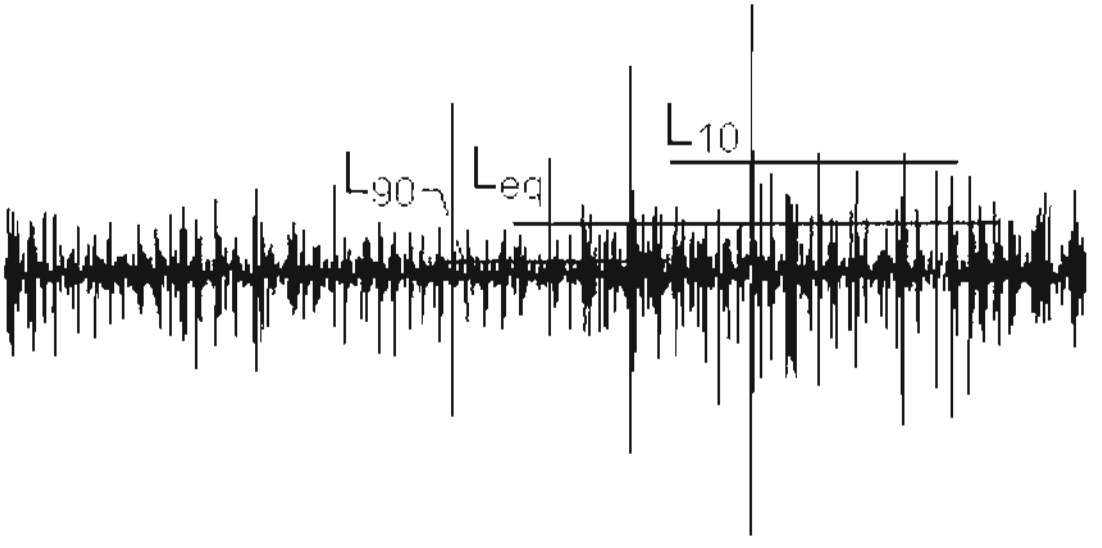
[7] G.P. van den Berg (2003) Effects of the wind profile at night on wind turbine sound. Journal of Sound and Vibration 277 (2004) 955–970

Table 7. Statistical Indicators

Indicator	Meaning
L_{max}	The maximum sound level measured.
L_{eq}	Equivalent continuous sound. An average sound energy for a given time
L_{10}	Sound level exceeded 10 percent of the time. Generally considered to be the sound level that will annoy most people.
L_{90}	Sound level exceeded 90 percent of the time. Generally considered to be a measure of ambient background noise.
L_{dn}	Day-night average sound level, or the average sound level for a 24-hour period

Figure 4 shows how sound levels vary over 1.5 minutes, and shows the relationship between L_{10}, Leq, and L_{90}.

Figure 4. Statistical Noise Indicators



With the exception of L_{max}, statistical indicators are not used to determine the effects of noise exposure on hearing or sleep. Community planners, however, often use these statistics to determine the existing noise levels and predict the impact or community responses of adding a new source of noise.

For example, the Oregon Noise Control Regulation[8] requires the operator of noise producing equipment to determine the L_{10} and L_{50} of a community prior to installing the equipment.

[8] http://www.energy.state.or.us/siting/noise.htm. (This web site also discusses some of the difficulty of measuring statistical noise levels for wind turbines.)

Operating the new equipment must not raise the statistical levels L_{10} or L_{50} by more than 10 dB in any one hour.

Kolano and Saha Engineers[9] especially recommend using statistical limits for regulating noise in hospital and school zones:

> For residential, community park, school, or hospital receiving zones the maximum wind turbine noise limit should be 10 dB greater than the preexisting statistical background sound level (L_{90}) of the community, or 3 dB less than the preexisting statistical high sound level of the community (L_{10}), whichever is lower. The preexisting L_{10} and L_{90} should be measured over a minimum of 3 continuous days that reasonably represents the community over the course of a year. For other zones, such as commercial, industrial and public rights of way the wind turbine noise limit should be 15 dB greater than the L_{90}, or equal to the L_{10}, whichever is less.

Sound Propagation and Attenuation

Propagation refers to how sound travels. Attenuation refers to how sound is reduced by various factors. Many factors contribute to how sound propagates and is attenuated, including air temperature, humidity, barriers, reflections, and ground surface materials. ISO 9613, "Predictive Modeling Standard," provides a standard method for predicting noise propagation and attenuation. This paper summarizes three of the most influential factors:

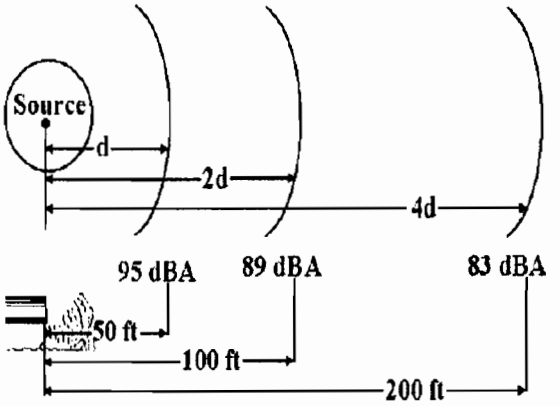
- distance
- wind direction
- building material absorption

Distance

As stated earlier, the decibel scale is logarithmic. Doubling the sound energy increases the sound pressure level by three decibels. But doubling the distance from a stationary source reduces the sound level by six decibels.

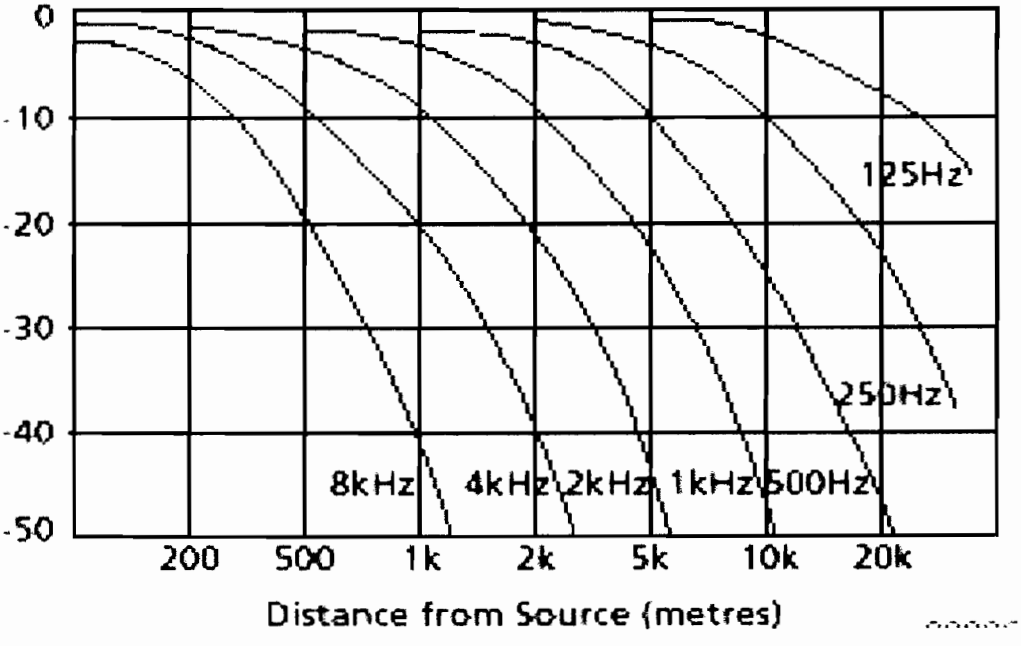
[9] Unpublished correspondence.

Figure 5. Attenuation by Distance[10]



Low frequencies travel further than high frequencies. An 8 kHz tonal sound will be attenuated (reduced in volume) about 40 dB per kilometer. By comparison, a 4 kHz tonal sound will be attenuated only about 20 dB per kilometer. For broadband noise, such as wind turbines produce, the low frequency components may travel further than the higher frequency components. Since low-frequency noise is particularly annoying to most people, it is important to specify limits for low frequency noise.

Figure 6. Frequency Attenuation[11]



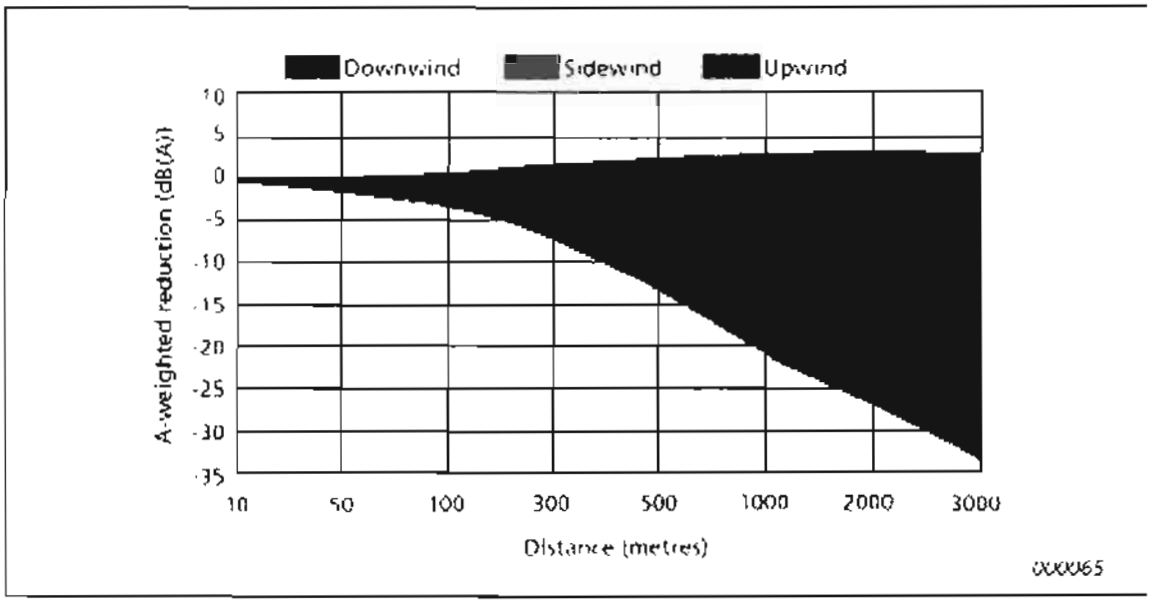
[10] Image source unknown.

[11] Source: Environmental Noise Booklet from Brüel & Kjær Sound & Vibration Measurement A/S. Retrieved from http://www.nonoise.org/library/envnoise/index.htm

Wind Direction

Wind direction also has an influence on sound propagation. Within 900 ft of a sound source, the wind direction does not seem to influence the sound. But after about 900 ft., the wind direction becomes a major factor in sound propagation. Downwind (meaning the wind is moving from the noise source towards the receiver) of the source, sound volume will increase for a time before decreasing. Upwind (the wind is moving from the receiver to the noise source), sound volumes decrease very quickly.

Figure 7. Wind Attenuation of Sound[12]



Building Materials

General home construction, with stud walls and windows in consideration, reduces noise differently for each frequency range. The EPA estimates that in cold climates, such as we have in Michigan, these types of homes attenuate 27 dB of noise. However, this estimate was based on traffic noise which consists of different frequency components than wind turbine noise.

Wind turbine noise, especially at lower wind and blade speeds, will contain more low frequency components than traffic noise. Light weight building home structures will not attenuate these frequencies components as well as higher frequency components. Table 8 lists the estimated attenuation for three octave bands in the low frequency range.

[12] Source: Environmental Noise Booklet from Brüel & Kjær Sound & Vibration Measurement A/S. Retrieved from http://www.nonoise.org/library/envnoise/index.htm

Table 8. Low Frequency Attenuation by Homes

Center of Octave Range	Estimated Attenuation
250 Hz	20 dB
125 Hz	10-15 dB
63 Hz	5-10 dB

Noise Ordinances

There are several methods to specifying noise limits:

- specifying a single all-encompassing maximum limit
- determining preexisting ambient noise levels and specifying that a new noise source may not increase the ambient noise by more than a particular amount
- setting a base limit, with adjustments for district types and time of day or night
- specifying maximum sound levels for each octave range

The American Wind Energy Association (AWEA) and the State of California recommend that noise from small turbines be limited to 60 dB(A) at the closest inhabited dwelling[13]. However, many people feel these simple limits are insufficient to protect people from noise's harmful effects, or even to address the annoyance level.

As mentioned before, the State of Oregon requires that turbine operators determine the preexisting L_{10} and L_{50} of a community. Operating the new equipment must not raise the statistical levels L_{10} or L_{50} by more than 10 dB in any one hour[14]. This method is adopted to address noise as a public nuisance, and takes into consideration the fact that each community will find different noise levels acceptable. However, many people consider it insufficient to account for low frequency noise or to protect people's sleep.

The International Standards Organization (ISO) recommends setting a base limit of 35– 40 dB(A) and adjusting the limit by district type and time of day. Table 9 lists the adjusted limits from a base of 35 dB(A).

[13] Permitting Small Wind Turbines: Learning from the California Experience http://www.energy.ca.gov/renewables/

[14] http://egov.oregon.gov/ENERGY/RENEW/Wind/docs/OAR340-035-0035.pdf

Table 9. ISO 1996-1971 Recommendations for Community Noise Limits

District Type	Daytime Limit	Evening Limit (7 -11 PM)	Night limit (11 PM – 7 AM)
Rural	35 dB(A)	30 dB(A)	25 dB(A)
Suburban	40 dB(A)	35 dB(A)	30 dB(A)
Urban residential	45 dB(A)	40 dB(A)	35 dB(A)
Urban Mixed	50 dB(A)	45 dB(A)	40 dB(A)

The most comprehensive method combines the district method with specific limits for frequency components in each octave range. The Charter Township of Mundy, MI's noise ordinance contains two tables; one specifying an overall limit, and one specifying octave band limits for each type of district. Table 10 shows an excerpt from Mundy's ordinance.

Table 10. Mundy Township Octave Band Noise Limits

		Frequency at center of octave band					Total Noise Limit
District Type		31.5 Hz	63 Hz	125 Hz	250 Hz	500 Hz	
Residential	Day	72 dB	71 dB	65 dB	57 dB	51 dB	55 dB(A)
	Night	67 dB	66 dB	60 dB	52 dB	46 dB	50 dB(A)
Agricultural	Day	82 dB	81 dB	75 dB	67 dB	61 dB	65 dB(A)
	Night	72 dB	71 dB	65 dB	57 dB	51 dB	55 dB(A)

Note: The standard practice among noise control engineers is to specify limits for octave band components as unadjusted dB, and limits for total noise exposure as dB(A).

Engineering Standards

Several organizations have issued recommendations and standards related to noise measurement, assessment and control. Table 11 lists some of the applicable engineering standards.

Table 11. Noise Control Engineering Standard

Standard	Title
ASTM E1014-84	Standard Guide for Measurement of Outdoor A-Weighted Sound Level
ISO 9613	Predictive Modeling Standard
IEC 61400-11	Wind turbine generator systems –Part 11: Acoustic noise measurement techniques
ISO 1996-1971	Recommendations for Community Noise Limits
ANSI S1.4-1983	Specifications for Sound Level Meters
ANSI S12.18-1994	Procedures for Outdoor Measurement of Sound Pressure Levels

Referencing these standards in noise control ordinances will help clarify many aspects of community noise control that might otherwise be left open to interpretation.

Example Ordinance Language

> Prior to installing the turbines, establish the existing ambient noise level according to ANSI S12.18-1994 with a sound meter that meets or exceeds ANSI S1.4-1983 specifications for a Type I sound meter.
>
> Use the sound propagation model of ISO 9613 to micro site the turbines within a wind farm so that the turbines will not emit noise above the limits specified in Table 9 and Table 10 beyond the property line of the wind farm.

Conclusions

Community noise assessment and control is a land compatibility issue which must be carefully addressed. A few years ago, the city of Sterling Hts., MI permitted an outdoor concert venue adjacent to a residential neighborhood. The noise became a nuisance, neighbors filed law suits, and the city spent more than $31 million trying to settle the conflict.

With good preparation, however, similar conflicts with wind energy development can be avoided. This paper provides a foundation which should help decision makers develop beneficial permitting procedures and zoning ordinances, and permit wind energy development with minimal conflicts.

About the Author

Daniel J. Alberts is a senior member of the Society for Technical Communication. He holds a BS in Engineering from the University of Michigan and a Master of Science in Technical and Professional Communication from Lawrence Technological University (LTU). Mr Alberts was a founding member of LTU's Alternative Energy Student Group and served as the group's Vice President for the 2004-05 school year.

Mr. Alberts can be reached through http://www.daniel-alberts.info or dja1701@nethere.com.

Acknowledgements

Thanks to members of the Michigan Wind Working Group and Darren Brown of Kalano and Saha Engineers for their research assistance. Special thanks to Dr. Fletcher, Director of LTU's Alternative Energy program, for introducing me to the issues and giving me the opportunity to conduct this research.

Carson City Planning Division
108 E. Proctor Street - Carson City NV 89701
Phone: (775) 887-2180 • E-mail: planning@carson.org

FOR OFFICE USE ONLY:

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DEC 16 2010
CARSON CITY
PLANNING DIVISION

CCMC 18.02

SPECIAL USE PERMIT

FILE # SUP - 10 - 114

FEE: $2,450.00 MAJOR
$2,200.00 MINOR (Residential zoning districts)
+ noticing fee and CD containing application digital data (all to be submitted once the application is deemed complete by staff)

SUBMITTAL PACKET
- ☑ 6 Completed Application Packets (1 Original + 5 Copies) including:
- ☑ Application Form
- ☑ Site Plan
- ☑ Building Elevation Drawings and Floor Plans
- ☐ Proposal Questionnaire With Both Questions and Answers Given
- ☑ Applicant's Acknowledgment Statement
- ☑ Documentation of Taxes Paid-to-Date (1 copy)
- ☐ Project Impact Reports (Engineering) (4 copies)

Application Reviewed and Received By: [signature]

Submittal Deadline: See attached PC application submittal schedule.
Note: Submittals must be of sufficient clarity and detail such that all departments are able to determine if they can support the request. Additional information may be required.

Joseph Goni
PROPERTY OWNER

7300 Schulz Dr, Carson City, NV 89701
MAILING ADDRESS, CITY, STATE, ZIP

775-267-9743 N/A
PHONE # FAX #

Name of Person to Whom All Correspondence Should Be Sent

James Medeiros, Rainbow Conservation Corp.
APPLICANT/AGENT

1803 No. Carson St, Ste A, Carson City, NV 89701
MAILING ADDRESS, CITY, STATE ZIP

775-841-9225 775-841-9225
PHONE # FAX #

Solarsuitcase@sbcglobal.net
E-MAIL ADDRESS

Project's Assessor Parcel Number(s):	Street Address	ZIP Code
010-671-02	7300 Schulz Dr, Carson City, NV	89701

Project's Master Plan Designation	Project's Current Zoning	Nearest Major Cross Street(s)
Medium Density	SF6	Racetrack + Rabe Way

Briefly describe your proposed project: (Use additional sheets or attachments if necessary). In addition to the brief description of your project and proposed use, provide additional page(s) to show a more detailed summary of your project and proposal. In accordance with Carson City Municipal Code (CCMC) Section: 18.04.190, or Development Standards, Division ____, Section ____, a request to allow as a conditional use is as follows:

Special use permit for height variance for installation of 120' tower to support Bergey 10Kw wind turbine for production of electricity.

PROPERTY OWNER'S AFFIDAVIT

I, Joseph R. Goni, being duly deposed, do hereby affirm that I am the record owner of the subject property, and that I have knowledge of, and I agree to, the filing of this application.

Joseph R. Goni — Signature
7300 Schulz dr C.C., Nev. 89701 — Address
12/15/10 — Date

Use additional page(s) if necessary for other names.

STATE OF NEVADA)
COUNTY)

On December 15, 2010, Joseph R Goni personally appeared before me, a notary public, personally known (or proved) to me to be the person whose name is subscribed to the foregoing document and who acknowledged to me that he/she executed the foregoing document.

Lena E Tripp
Notary Public

LENA E. TRIPP
NOTARY PUBLIC
STATE OF NEVADA
No.05-104526-12 My Appt. Exp. Mar. 28, 2014

NOTE: If your project is located within the historic district, airport area, or downtown area, it may need to be scheduled before the Historic Resources Commission, the Airport Authority, and/or the Redevelopment Authority Citizens Committee prior to being scheduled for review by the Planning Commission. Planning personnel can help you make the above determination.

January 15, 2011

TO: City Planning Staff and Planning Commissioners
FROM: Joseph R. Goni

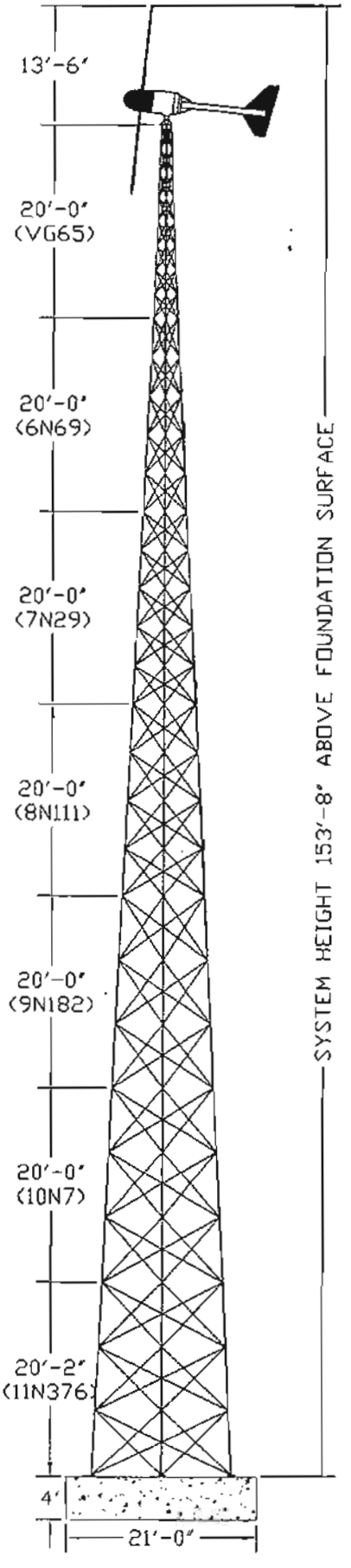
Howdy! First of all I would like to introduce myself: My name is Joseph R. Goni. I have lived in Carson all my life. I've lived at 7300 Schulz Dr. for 36 years. The way my body is designed-I breathe oxygen and I exhale carbon dioxide. I drive a 52 mile per gallon automobile that emits carbon monoxide. I have planted approximately 200 trees on my property. Hopefully my life style and philosophy will help to offset a certain percentage of harmful gases released in the atmosphere. I'm not under the illusion that I can change the whole world, nor would I want to. I'm only one person, but I would like to do my humble part.

My present utility bills do not represent my future utility bills. My Master Plan: Application: Special Use Permit for wind turbine to be used in conjunction with my photovoltaic arrays plays a very integral part, especially the wind turbine, in my Master Plan. By reclaiming my gray water (i.e., washing machine, dishwasher, shower and bathing water, as well as my wash basin), combined with the few thunderstorms that we have, will help with irrigation of those 200 trees. I have approximately 6,000 sq.ft. of roof surfaces to capture that rain water. The system uses gray water that consists of an 18,000 gal. fiberglass holding tank underground about 3 ft. deep and two 600 gal. underground tanks next to my remote accessory building to catch the rain water from those roof surfaces; they will be connected to the larger water storage tank. There is a 5-10hp electric motor driving the water pump. From the tank there is hooked an electric timer controlling 18 water zones thru 2,000 ft. of irrigation pipe. Presently I use Carson City potable water at peak times in summer, 10,000 to 15,000 gallons of water; during less peak times 5,000 to 10,000 gallons. This system should offset a percentage of that very precious natural resource that we Carson citizens enjoy. Hopefully this wind turbine in conjunction with the PV arrays will also offset the amount of electrical energy that is used by the electric motors. The future energy usage will also provide for the installation of a 250 amp welder and a 5hp two-stage air compressor in my 4 bay garage. The Master Plan will also put back electrical energy into NVEnergy's grid and help my neighborhood and my community. A byproduct of this proposal will result in jobs for **excavators, plumbers, electrical, engineers, rain gutter installer, City planning staff, and the Planning Commission.** ***In addition it will raise property values and increase the city tax coffers.*** The first step in the system is the wind turbine. I believe this is a good comprehensive plan. I can't change world events but I have the power to do my part by conserving and using renewable energy and, most certainly this Body, the Planning Commission, has the power to make this happen.

I hope you will approve this Special Use Permit application. We are breaking new ground, and I hope we keep this journey heading in the right direction into the future.

THANK YOU FOR YOUR TIME AND CONSIDERATION OF THIS MATTER!

Sincerely: Joseph R. Goni


13'-6"
20'-0"
(VG65)
20'-0"
(6N69)
20'-0"
(7N29)
20'-0"
(8N111)
20'-0"
(9N182)
20'-0"
(10N7)
20'-2"
(11N376)
4'
21'-0"
SYSTEM HEIGHT 153'-8" ABOVE FOUNDATION SURFACE

Conclusion: This project requires a 160' wind tower in order to stand above the nearby 105' hill and catch the wind coming off the top of the eastern slope of the Sierras. (Eastern slope winds have proven to be measurably consistent which aids tremendously in the production of wind power). Installing and utilizing this form of alternative energy helps the environment as well as providing physical proof that wind energy is a viable product that can be beneficial to the entire community.

ACKNOWLEDGMENT OF APPLICANT

I certify that the forgoing statements are true and correct to the best of my knowledge and belief. I agree to fully comply with all conditions as established by the Planning Commission. I am aware that this permit becomes null and void if the use is not initiated within one year of the date of the Planning Commission's approval; and I understand that this permit may be revoked for violation of any of the conditions of approval. I further understand that approval of this application does not exempt me from all City code requirements.

Joseph R. Gemi
Applicant

12/15/10
Date

Key Issues

Land Use

- This project is compatible the land use intended for a adjacent higher density neighborhood. There will no impact to this development
- Will not interfere with a Urban/rural interface

Circulation and Access

- There will not be any accessibility issues as a result of this Wind Turbine
- Will not interfere with the new traffic and proposed street corridor to Topsy Lane/US 395
- Does not impact the connection to Edmonds sports complex.
- Will not effect future NDOT studies

Infrastructure, Services, and Facilities

- There will not be any accessibility issues as a result of this Wind Turbine
- Will not interfere with the new traffic and proposed street corridor to Topsy Lane/US 395

Regional Coordination

- Project is located on 7300 Schulz Ave will not impact Douglass County It does not interfere with the boarder to effect any non motorized pathways to the county

Environmental and Cultural

- Project does not effect watershed nor does the culture around this project suffer a negative impact. The potential resources are protected.

Planning Division
Special Use Permit Package

Q: The subject site is located in the Schulz Ranch Specific Plan Area (SR-SPA). Please address the proposed project as it relates to the policies identified in the SPA document.

A: The special use permit requested relates to the Schulz Ranch Specific Plan Area and addresses minimal property easements. In the Schulz ranch plan with respect to the construction of a suburban sub-division, A minimal easement of 30' is observed as a standard see SPA-SR- 1.2. The plan also incorporates a demand for park/public access type areas. Although a percentage ratio of park per building area has not yet been established it is proposed to incorporate a Pedestrian and Bicycle Connection (SPA-SR-2.3) adjacent to the Goni property as a integral effort in accomplishing the needs of the City's adopted Bicycle Master Plan. SPA – SR-3.3 suggests that large buffer areas be utilized to accomplish transitions. It is therefore proposed that a walkway and possible obstacle course be implemented in future designs of the aforesaid Schulz Ranch Specific Plan Area. To enhance public enjoyment, a health beneficial training course and access area will enhance leisure and quality of life for all to enjoy. In the future construction of this suburban neighborhood a consistent 30' minimal easement plan may allow for future wind generators and renewable LEED certified housing for would be occupant homeowner/residents. Please see attached improvised plan addendum for impacted yet unprejudiced results as to adjacent corridor park and recreation possibilities. It is also possible that land use be incorporated and available to the option of documenting this historic racetrack as part of a certified par exercise course. The benefit of establishing newer LEED certification type "New Construction Housing" may prevail in future building. There could be a new and improved race track (obstacle course) with public access and unilateral enjoyment for the community, schools and local enthusiastic individuals to enjoy. The policies of the Schulz Ranch Specific Plan Area calling for a thirty foot (30') minimum easement may pave the way for using this land

successfully as a recreational path. In addition a call for park type area to be created is consistent with the master plan of Carson City. The area of suburban development around the proposed future subdivision may develop into a grid interactive community utilizing wind resources as well.

Q: Address all findings related to the Special Use Permit. The findings submitted do not address the proposed development specifically findings (a-h) as noted in CMCC 18.02.080(5)

A: According to Impact due to this special use permit being granted it is addressed as line item issues.

a. The Special use permit is consistent with the objectives of CMCC 18.02.080(5) in that property easements are encourages and additional wind generators may be a possibility for future land/home owners. The special use permit also encourages incorporating a park/trail access route utilized for the leisure and benefit of the public.

b. The erection of a WECS (Wind Energy Conversion System) will not be detrimental to establishing the development of the surrounding property. There will be less than 25 decibels of noise produced at the boundary of residences located a considerable 30' plus from known boundaries. It will enhance surrounding properties to encourage more WECS systems.

c. Any and all traffic effects due to this special use permit project will be benign.

d. There will be no additional burden on public services from this project. Wind energy towers will be protected in accordance with municipal standards removing all accessible climbing steps for twelve feet. It may be beneficial to light a potential park site utilizing a series of future community wind towers and allow remote access monitoring and weather data available for the US weather

service, and local emergency traffic to gain local measurement data

e. The succession of this project paves the way for future wind projects in this area. The goal to establish a suburban neighborhood is consistent with newly established LEED certification type housing. For future developments a new perspective can be adapted to incorporate renewables to a new and modern subdivision.

f. The tower of 160' in height meets all IDEC building codes and standards. The creation of this WECS (Wind Energy Conversion System) will not be any inconvenience or effect to the welfare of the public.

g. There will be no result in material damage or future property development values. This project encourages the development of a adjacent suburban community. Although the project of the Schulz Ranch Specific Plan Area is now owned by a bank A WECS will encourage future wind generation projects potentially attracting "green" building developers. Adapted policies from this commission favoring a wind eligible developmental community will demonstrate and signify Carson City as a leader in renewables.

h. The burden of presenting this information exists within the evidence here presented. To see the total effect of this wind energy system will present itself as a step into the future and a endorsement of N.R.S. 278.0208 That discourages unreasonable restriction from renewables intergrading into the community.

SPECIAL USE PERMIT APPLICATION QUESTIONNAIRE

1. How will the proposed development further and be in keeping with, and not contrary to, the goals of the Master Plan Elements?

The proposed project uses sustainable building materials and construction techniques to promote energy conservation while protecting existing features. The materials used in construction are durable and long lasting. Installation of a wind generator is economically and environmentally friendly, generating electricity for the primary residence which reduces the neighborhood's overall power consumption.

2. Will the effect of the proposed development be detrimental to the immediate vicinity? To the general neighborhood?

The subject property is bounded on the south by single family residences, zoned SF6; on the west, north, and east by undeveloped acreage zoned Single-Family SF6; on the northeast by a minimum security prison with surrounding acreage.

While there are currently no other wind generators installed in this neighborhood, the anticipated sound level at the property line should not exceed 25 dB in no-wind scenarios or 5 dB above ambient noise in wind.

SOURCE/ACTIVITY	INDICATIVE NOISE LEVEL dB (A)
Threshold of hearing	0
Quiet Library	30
Rural night-time background	20 - 40
Quiet bedroom	35
Car at 40 mph at 300'	55
Busy general office	60
Truck at 30 mph at 300'	65

It should be noted that, as wind increases, the ambient noise increases. When the wind speed reaches 15 mph to 30 mph, the noise created by trees alone often exceeds 60 db (A) which would tend to mask any noise output from the wind generator.

There are no anticipated problems, such as dust, odors, vibration, fumes, glare, or physical activity, associated with the generation of electricity by wind or the installation of a tower to support a wind generator. The entire project is outside of an enclosed structure. Installing the tower should cause minimal disturbance to the surrounding area.

Installation of a tower to support a wind generator should have minimal impact on the surrounding neighborhood as it does not intrude physically on any surrounding properties and is a positive move toward the utilization of alternative energy as currently endorsed by the federal government.

Due to the fact that the proposed project is fully contained within private residential property boundaries with no changes made to existing traffic patterns and flow, there is no anticipated impact on the existing traffic, pedestrian or vehicular, and no anticipated change to the existing time frame for emergency vehicle response when the project is fully operational.

Installation and use of a wind generator and tower is a major step in demonstrating Carson City to be proactive in promoting alternative energy services in accordance with US energy trends.

3. Has sufficient consideration been exercised by the applicant in adapting the project to existing improvements in the vicinity?

This is a minor development project that is strictly contained within the boundaries of the private residential property upon which it is located and will have no effect on the school district, water supply, water drainage, sewage disposal, roads, lighting, public landscaping, or require additional parking.

Conclusion: This project requires a 160' wind tower in order to stand above the nearby 105' hill and catch the wind coming off the top of the eastern slope of the Sierras. (Eastern slope winds have proven to be measurably consistent which aids tremendously in the production of wind power). Installing and utilizing this form of alternative energy helps the environment as well as providing physical proof that wind energy is a viable product that can be beneficial to the entire community.

ACKNOWLEDGMENT OF APPLICANT

I certify that the forgoing statements are true and correct to the best of my knowledge and belief. I agree to fully comply with all conditions as established by the Planning Commission. I am aware that this permit becomes null and void if the use is not initiated within one year of the date of the Planning Commission's approval; and I understand that this permit may be revoked for violation of any of the conditions of approval. I further understand that approval of this application does not exempt me from all City code requirements.

James Medeiros — 1/7/11

Applicant — Date

Master Plan Policy Checklist

Special Use Permit, Major Project Review & Administrative Permits

PURPOSE

The purpose of a development checklist is to provide a list of questions that address whether a development proposal is in conformance with the goals and objectives of the 2006 Carson City Master Plan that are related to non-residential and multi-family residential development This checklist is designed for developers, staff, and decision-makers and is intended to be used as a guide only.

Development Name: Goni Wind Generator Project

Reviewed By: James Medeiros - Jennifer Pruit

Date of Review: 1/7/11 (Final)

DEVELOPMENT CHECKLIST

The following five themes are those themes that appear in the Carson City Master Plan and which reflect the community's vision at a broad policy level. Each theme looks at how a proposed development can help achieve the goals of the Carson City Master Plan. A check mark indicates that the proposed development meets the applicable Master Plan policy. The Policy Number is indicated at the end of each policy statement summary. Refer to the Comprehensive Master Plan for complete policy language.

CHAPTER 3: A BALANCED LAND USE PATTERN

The Carson City Master Plan seeks to establish a balance of land uses within the community by providing employment opportunities, a diverse choice of housing, recreational opportunities, and retail services.

Is or does the proposed development:

- ☑ Meet the provisions of the Growth Management Ordinance (1.1d, Municipal Code 18.12)?
- ☑ Use sustainable building materials and construction techniques to promote water and energy conservation (1.1e, f)?
- ☑ Located in a priority infill development area (1.2a)?
- ☑ Provide pathway connections and easements consistent with the adopted Unified Pathways Master Plan and maintain access to adjacent public lands (1.4a)?
- ☑ Protect existing site features, as appropriate, including mature trees or other character-defining features (1.4c)?

- ☑ At adjacent county boundaries or adjacent to public lands, coordinated with the applicable agency with regards to compatibility, access and amenities (1.5a, b)?
- ☑ In identified Mixed-Use areas, promote mixed-use development patterns as appropriate for the surrounding context consistent with the land use descriptions of the applicable Mixed-Use designation, and meet the intent of the Mixed-Use Evaluation Criteria (2.1b, 2.2b, 2.3b, Land Use Districts, Appendix C)?
- ☑ Meet adopted standards (e.g. setbacks) for transitions between non-residential and residential zoning districts (2.1d)?
- ☑ Protect environmentally sensitive areas through proper setbacks, dedication, or other mechanisms (3.1b)?
- ☑ Sited outside the primary floodplain and away from geologic hazard areas or follows the required setbacks or other mitigation measures (3.3d, e)?
- ☑ Provide for levels of services (i.e. water, sewer, road improvements, sidewalks, etc.) consistent with the Land Use designation and adequate for the proposed development (Land Use table descriptions)?
- ☑ If located within an identified Specific Plan Area (SPA), meet the applicable policies of that SPA (Land Use Map, Chapter 8)?

CHAPTER 4: EQUITABLE DISTRIBUTION OF RECREATIONAL OPPORTUNITIES

The Carson City Master Plan seeks to continue providing a diverse range of park and recreational opportunities to include facilities and programming for all ages and varying interests to serve both existing and future neighborhoods.

Is or does the proposed development:

- ☑ Provide park facilities commensurate with the demand created and consistent with the City's adopted standards (4.1b)?
- ☑ Consistent with the Open Space Master Plan and Carson River Master Plan (4.3a)?

CHAPTER 5: ECONOMIC VITALITY

The Carson City Master Plan seeks to maintain its strong diversified economic base by promoting principles which focus on retaining and enhancing the strong employment base, include a broader range of retail services in targeted areas, and include the roles of technology, tourism, recreational amenities, and other economic strengths vital to a successful community.

Is or does the proposed development:

- ☑ Encourage a citywide housing mix consistent with the labor force and non-labor force populations (5.1j)
- ☑ Encourage the development of regional retail centers (5.2a)
- ☐ Encourage reuse or redevelopment of underused retail spaces (5.2b)?
- ☑ Support heritage tourism activities, particularly those associated with historic resources, cultural institutions and the State Capitol (5.4a)?
- ☐ Promote revitalization of the Downtown core (5.6a)? *

* If Public Works Wind Energy Conversion Becomes commer

- ☐ Incorporate additional housing in and around Downtown, including lofts, condominiums, duplexes, live-work units (5.6c)?

CHAPTER 6: LIVABLE NEIGHBORHOODS AND ACTIVITY CENTERS

The Carson City Master Plan seeks to promote safe, attractive and diverse neighborhoods, compact mixed-use activity centers, and a vibrant, pedestrian-friendly Downtown.

Is or does the proposed development:

- ☑ Use durable, long-lasting building materials (6.1a)?
- ☑ Promote variety and visual interest through the incorporation of varied building styles and colors, garage orientation and other features (6.1b)?
- ☑ Provide variety and visual interest through the incorporation of well-articulated building facades, clearly identified entrances and pedestrian connections, landscaping and other features consistent with the Development Standards (6.1c)?
- ☑ Provide appropriate height, density and setback transitions and connectivity to surrounding development to ensure compatibility with surrounding development for infill projects or adjacent to existing rural neighborhoods (6.2a, 9.3b 9.4a)?
- ☑ If located in an identified Mixed-Use Activity Center area, contain the appropriate mix, size and density of land uses consistent with the Mixed-Use district policies (7.1a, b)?
- ☐ If located Downtown,
  - o Integrate an appropriate mix and density of uses (8.1a, e)?
  - o Include buildings of the appropriate scale for the applicable Downtown Character Area (8.1b)?
  - o Incorporate appropriate public spaces, plazas and other amenities (8.1d)?
- ☐ Incorporate a mix of housing models and densities appropriate for the project location and size (9.1a)?

CHAPTER 7: A CONNECTED CITY

The Carson City Master Plan seeks promote a sense of community by linking its many neighborhoods, employment areas, activity centers, parks, recreational amenities and schools with an extensive system of interconnected roadways, multi-use pathways, bicycle facilities, and sidewalks.

Is or does the proposed development

- ☑ Promote transit-supportive development patterns (e.g. mixed-use, pedestrian-oriented, higher density) along major travel corridors to facilitate future transit (11.2b)?
- ☐ Maintain and enhance roadway connections and networks consistent with the Transportation Master Plan (11.2c)?
- ☑ Provide appropriate pathways through the development and to surrounding lands, including parks and public lands, consistent with the Unified Pathways Master Plan (12.1a, c)?

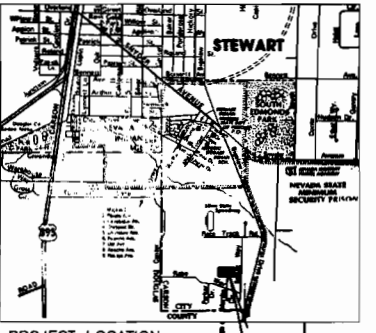
I. GENERAL NOTES

A. All construction on the above-noted project shall be in accordance with the minimum of the latest adopted edition of the International Building Code (IBC) and all local building ordinances, or as specifically noted on these plans and calculations, with the most stringent condition governing. It is the responsibility of the contractor/builder to be familiar with and comply with the requirements as stated in the IBC, and all local building ordinances. The certified blueprints are an integral part of these design calculations.

PROJECT: 160' TOWER WITH 10KW BERGEY WIND TURBINE
THE TURBINE AND TOWER TO MEET IBC CODE REQUIREMENTS FOR PUBLIC SAFETY.
GRID TIE SYSTEM PROVIDING ELECTRICITY
OCCUPANCY GROUP: U
TYPE OF CONSTRUCTION: V-B
FLOOD ZONE: C-MINIMAL FLOODING, NATURAL DRAINAGE

JOE GONI
7300 SCHULZ DRIVE
CARSON CITY, NEVADA 89701
APN 010-671-02

VICINITY MAP



34.09 ACRES
A.P.N. 10-671-07
SF6-SRSPA

2.48 ACRES
A.P.N. 10-671-02
SF6-SRSPA

0.15 ACRES
A.P.N. 10-671-14
COMMON AREA

0.31 ACRES
A.P.N. 10-671-15
SF6-SRSPA

0.45 ACRES
A.P.N. 10-671-03
SF6-SRSPA

0.23 ACRES
A.P.N. 10-671-01
PC

1.13 ACRES
A.P.N. 9-321-06
MH1A

1 ACRE
A.P.N. 9-323-04
MH1A

1.17 ACRES
A.P.N. 9-323-01
MH1A

S89° 17' 25.00"E 143.480
S88° 29' 51.00"E 99.790
N10° 41' 31.00"E 120.350
S21° 11' 01.00"E 124.410
S21° 11' 01.00"E 38.210
S81° 33' 28.00"E 257.540
S21° 11' 01.00"E 144.550
S1° 01' 09.00"W 99.470
S1° 01' 09.00"W 43.720
N9° 13' 47.00"W 164.530
N89° 20' 21.00"W 86.870
N0° 39' 39.00"E 50.000
N89° 20' 21.00"W 463.870
S89° 17' 25.00"E 200.760
100'
125.99'
64'
140.43'
60'
64.51'
32'
45'
54'
53.2'
100.56'
72.42'
112.68'

SOLAR PANEL GRID TIE SYSTEM ON WATSON TRACKER
3" CONDUIT
EXISTING 14'x67' RESIDENCE (1,002 SF)
EXISTING 32'x54' ACCESSORY FARM STRUCTURE (1,728 SF)
2 FLOORS 3,456 SF TOTAL
EXISTING GAS METER
PULL BOX
EXISTING GAS METER
EXISTING SS LEACH FIELD
ALT. LEACH FIELD
EXISTING DIRECT BURIAL POWER
GAS TAP
DRIVEWAY
40'X60'
EXISTING SHOP METER AND DISCONNECT FOR SHOP
NEW PANEL FOR SOLAR GRID-TIE SYSTEM TO BE AT EXISTING SHOP METER
EXISTING BARN APPROX. 2,400 SF
EXISTING SOLAR PANEL GRID-TIE SYSTEM WITH TRACKER ON 8" POLE. FOR HOUSE
ABANDONED WELL
EXISTING WATER METER
EXISTING 200A METER & OLD WELL HOUSE ABOUT 16'X16' 256 SQ.FT.
EXISTING 1.5" DOMESTIC WATER
EXISTING NATURAL GAS
EXISTING OH POWER POLE
MARTHA CIRCLE
EXISTING OH POWER POLE
SCHULZ DRIVE
DRIVEWAY

NORTH

PROFESSIONAL ENGINEER STATE OF NEVADA
JAMES JAY SWANN
CIVIL
No. 8289

PLOT PLAN
WITH INFORMATION PROVIDED BY OWNER
SCALE: 1/32" = 1'-0"

PLOT AND NOTES

CREATED
DRAWN BY: JJS
CHECKED BY: JJS
DATE: 10-26-2010
SCALE: 1/32" = 1'-0"
JOB NO: 2010-027

JAMES J SWANN, P.E.
P.O. 2078 PORTOLA
CALIF. 96122
530-832-1410

SPECIAL USE PERMIT
PROPOSED PLANS FOR :

JOE GONI
RESIDENCE NEW
160' TOWER
WITH 10KW
WIND TURBINE

JOE GONI 775-841-9225
7300 SCHULZ DRIVE
CARSON CITY, NEVADA 89701
APN 010-671-02
CONTACT PERSON
MEDEIROS, JAMES
RAINBOW CONSERVATION CORP.
1803 N. CARSON ST, NV
PHONE 775-247-1071
775-247-2507
E-MAIL
solarsuitcase@sbcglobal.net
39.170544/-119.672798

SHEET
1

The Solar Store

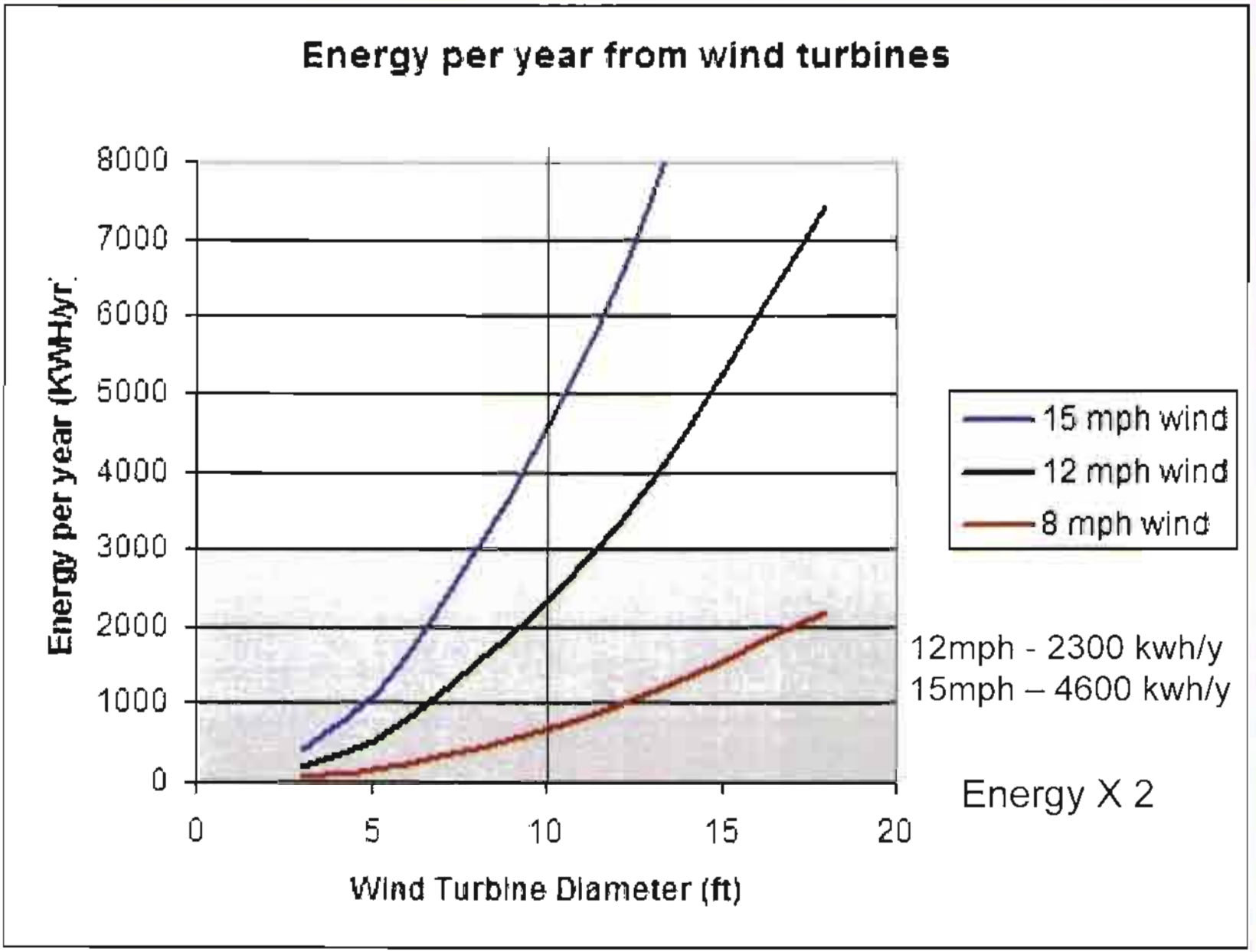
Special Use Permit Packet

An Itemized Consideration for Variances to Municipal Codes (18.05.080) and Reasonable Consideration for N.R.S. 278

The Solar Store

Table of Contents

The Solar Store



The Solar Store

I. Wind Energy Conversion Standards

Location

The Size of Parcel for 7300 Schulz Ranch is 2.48 acres. The horizontal axis wind turbine has not been placed above any drainage areas, property easements, or over any power-lines per 18.02(2a.) There will be one wind energy conversion system (WECS) generator on this parcel.

Setbacks for the WECS will exceed current restrictions as set forth in 18.05(2)Standards(c.) setbacks. A minimum of 1.1 times the total extended height to the property lines is a "unreasonable restriction" per N.R.S. 278. This application seeks a variance to address this shortfall. A tower height of 160' feet is needed to produce good wind results as data will show. The property although more than an acre can not accommodate a WECS

even if it were placed in the center of the parcel. It should be noted and shown that telephone pole's, power lines, and cell phone towers require no such easements and are potentially more hazardous than wind generators could ever be. Who in their right mind is going to be outside playing in a wind storm!

A Height Maximum of 60 feet is completely unreasonable Per N.R.S. 278. For this particular turbine, " The Bergey Excel" the manufacturer beginning tower size is 60'. Typical tower sizes are from 60' to 160'. In the instance of the smallest tower available and designed for the Bergey Excel the total system height is 60' + 11' for the blades.

FAA REQUIREMENTS

The Federal Aviation Administration outlines specific guidelines for runways longer than 3600'. In this case FAA requirements apply to structures less than 200' and within the glide slope of a 100 to 1 ratio. . So in the case of a WECS being 10,000 within the runway you have to be under 100' to satisfy this requirement 14CFR 77.13 (1) *. So in the case of 3.8 miles (20,000feet) the glide slope would be 200'. In the case of 7300 Schulz Dr the airport is 6.8 miles from the airport and the glide slope requirement does not apply. Lighting requirements are not addressed for structures less than 200'.

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Access Considerations

Access to this wind turbine will be limited. All restrictions to climbing step bolts will limit access from below 12 feet above the ground. All step bolts below 12 feet are to be removed and stored apart from the WECS so that they will not be readily accessible to the public. Labeling will be consistent with 18.05 (2)(f)ii. That will insure proper safety and means of disconnect and access.

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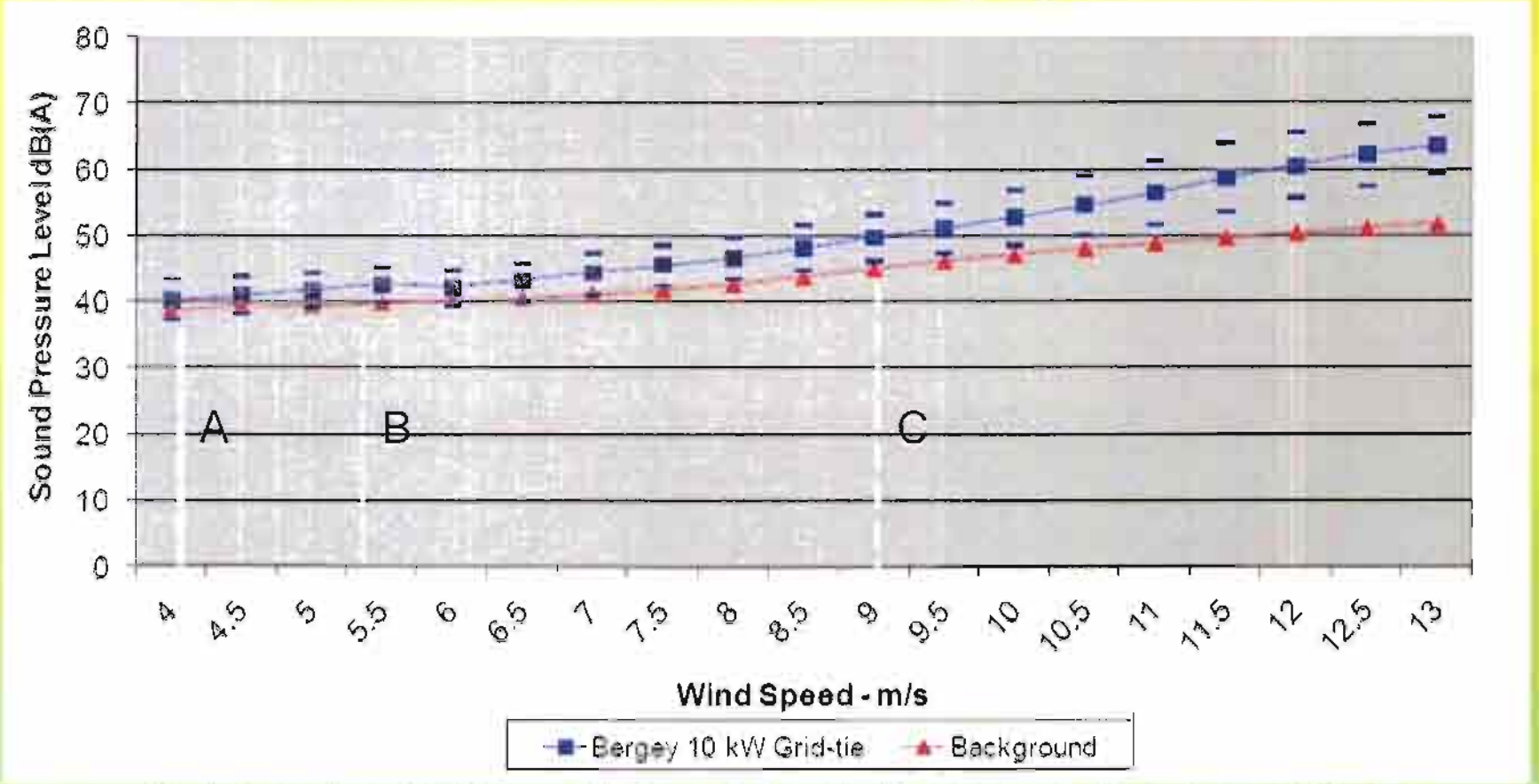
Noise Considerations

The Solar Store

Acoustic Characteristics -Bergey Excel-S 10kw



Independent test – USDA-ARS Lab Bushland ,Tx (June (2010)

A - at 4 m/s (8.9 mph) background noise equiv. to wind machine sound
B - 10 yr average wind at 50m height is 5.1m/s (11.4 mph)
C – Code requirement 50 dba at wind speed of 8.8 m/s (19.5 mph)

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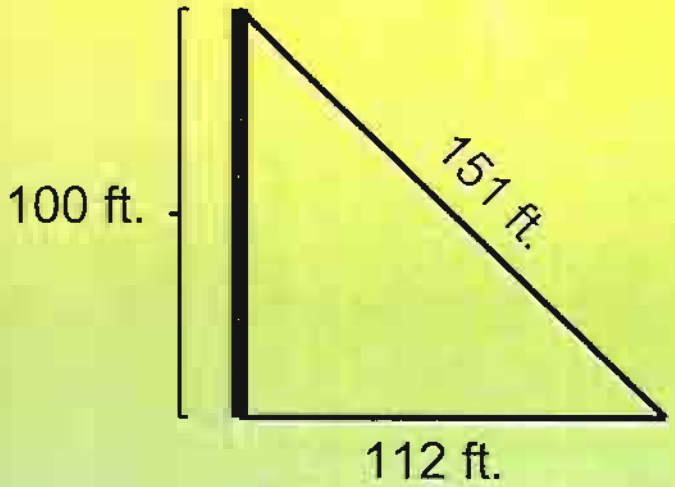
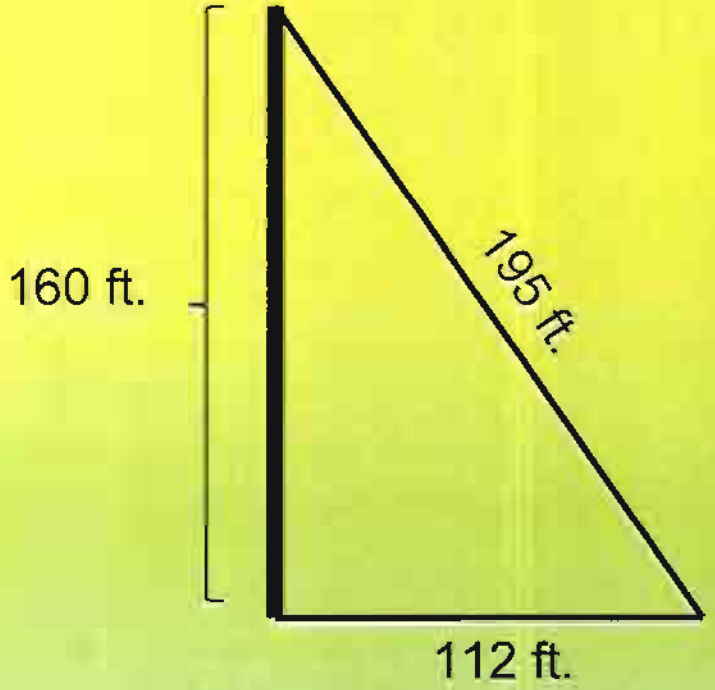
Noise Standards (section 18.05 2h i) - continued





Change in level do to change in distance
DB =20 Log (151/195) = -2.3 DB

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Noise Standards (section 18.05 2h i)

- Code requirements for a 50DB(A) level at the property line can be satisfied for wind speeds of less than 19.5 mph.

- The acoustic data presented is for a hub height of 100 ft , measured at a slant range of 151 feet. (approx 112 feet from tower base) The 160 ft tower will have a slant range of 195 feet at the same point.

- Because of the added height (and slant range), noise will be reduced an additional 2.3DB This amounts to meeting code with wind speeds less than 22 mph. This requirement can be met at least 95% of the time.

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Noise Standards (section 18.05 2h i) - continued

- Noise requirement for the abutting properties of one acre or less is 25 dBA. This will be impossible to meet at any property line. Three properties are in this class, two are unoccupied.

- A quiet library is 40dBA, while a quiet bedroom at night is 30dBA A whisper or background in a recording studio is 20dBA (see other attachments)

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Noise Standards (section 18.05 2h i) - continued

- The background noise created by an 8.9 mph wind is equivalent to 40 dB(A). This almost masks the sound of the wind machine. See previous charts (line A on the acoustics chart)

- This requirement should be stricken from municipal ordinance as it is an unreasonable restriction per N.R.S 278.02 . It is an unreasonable standard enacted to prohibit wind.

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FAA Recommendations

- There are not any regulations that state a special luminare or coloring is needed for this project. It will be less than 200 feet in height

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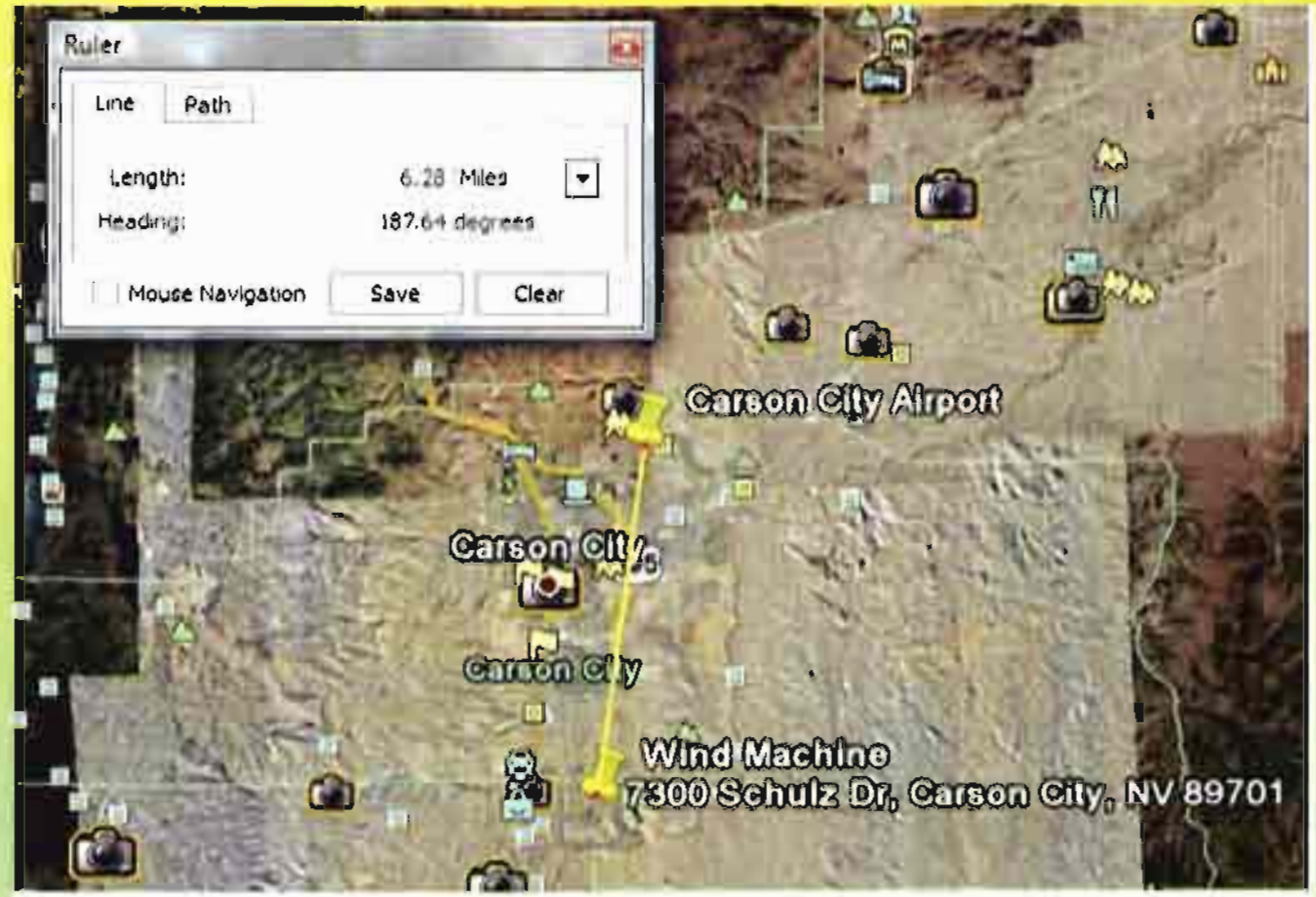
FAA Recommendations continued



Carson City Airport - has two 6100 ft runways - FAA 77.18 applicable under glide slope of 100 to 1 ,out to 20000 feet horizontal (3.8 miles)

-- 7300 Schultz not impacted - located 6.28 miles from airport

-- Tower height limited to 200 feet

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Site History

In 1979 At 7300 Schulz Drive Joe Goni moved on to the property. A 14' X 72' Mobile Home was placed on the property at that time. A Barn was erected later in 1997. In 2008 a 4 bay Garage was approved in conjunction with a special use permit .

The Solar Store

Project Overview: A 10 Kilowatt 10kw Bergey Excel

Bergey Wind Corporation was created in 1973 by Carl Bergey in the infamous area of Oklahoma known as "Tornado Alley". Originally an Aircraft designer Carl sought to design a wind generator that would have the ability to withstand any amount of wind. Unlike most other wind generators of today the Bergey Excel does not have a "destruct speed" In the case of the Bergey Excel the design was intended that one subsystem failure not lead to other events triggering a "cascading failure". With the Bergey Wind Generator there are minimal moving parts and the wind generator is designed to withstand all conditions ; even freewheeling in a total grid failure.

In this installation a 160' tower is intended recover energy created by the east slope affect known as the zephyr wind that comes into Eagle Valley. The Wind Generator itself has a swept wind area of 23 feet. From top to bottom the WECS will measure 171 feet. This Manufacture sells towers that range in size from 60 to 160 feet. To add for the additional radius of the blades an additional eleven feet is the sum to equal the total structures height.

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Project Overview: A 10 Kilowatt 10kw Bergey Excel

To insure proper installation with respect to foundation and bolt integrity it is often a building departments' request to have in a third party to inspect the anchor bolt fastening. To insure that a proper overall installation is done proper it is the policy of Bergey Wind Corporation that only, "Factory Trained and Qualified Dealers " purchase and install these turbines. Additional cut sheets and literature can be found in the appendices to this package or for even more information go to Bergey.com .

Specifications:

- Rated Power:
  - Burgey 10 KW 195 kwh/mo @ 12 mph
  - Burgey BWC approx. 2000 kwh/mo
- Turbine Size
  - Burgey 10,000 Watts
  - Burgey – 7.5 kw (dc) charging, 10kw to grid inverter
- 24v, 48v, 120v, 240v DC Output
- External GridTek inverter
- Costs $55K-$155K depending on configuration
- Tower Heights from 60ft to 160ft
- Rotor Diameter: 23 feet
- Design Life - 30yr; 5yr nominal maintenance
- 10 Year Warranty *

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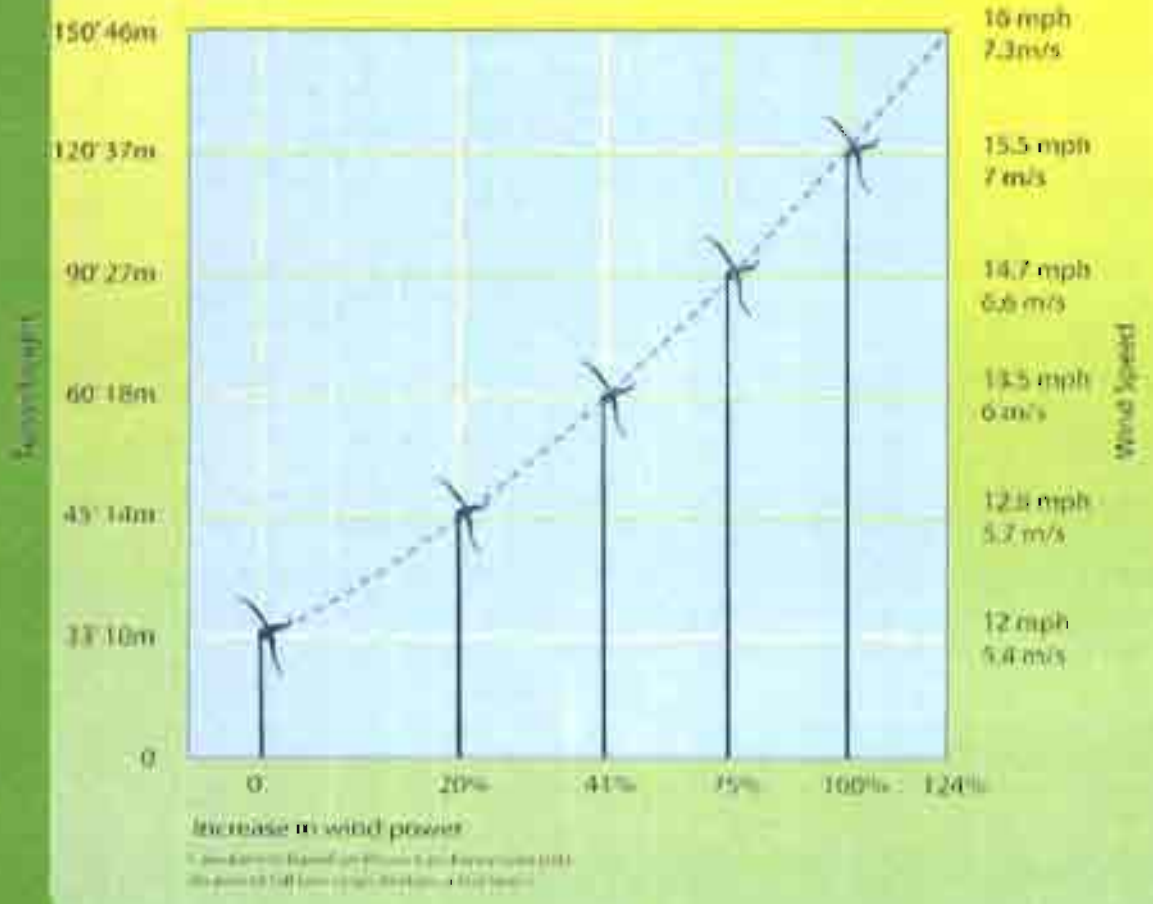
Tower Height Makes a Big Difference



$$V / V_o = (H / H_o)^{\alpha}$$

V	wind speed at new height
H	new height
H_o	original height
V_o	original velocity
α	(alpha) wind shear exponent

The Solar Store

Wind Speed changes with height

Height	Wind speed
90ft	13.7mph
60ft	13.5mph
30ft	12.3mph
15ft	11.2mph
0ft (surface)	10.0mph

If you find it is 10 mph on the ground, a turbine on a 60' tower will experience a 13.5 mph wind

Creates 2.5 times More Energy

The Solar Store

Height Considerations

- Maximize Energy Production
  - Highest practical and economical height
  - Site positioning to avoid ground turbulence
  - Site positioning / height to capture prevailing wind
  - Site positioning for a practical installation
- Satisfy All Safety (FAA) Requirements
- Meet All Building Code Requirements
- Perform Trade Offs as Needed

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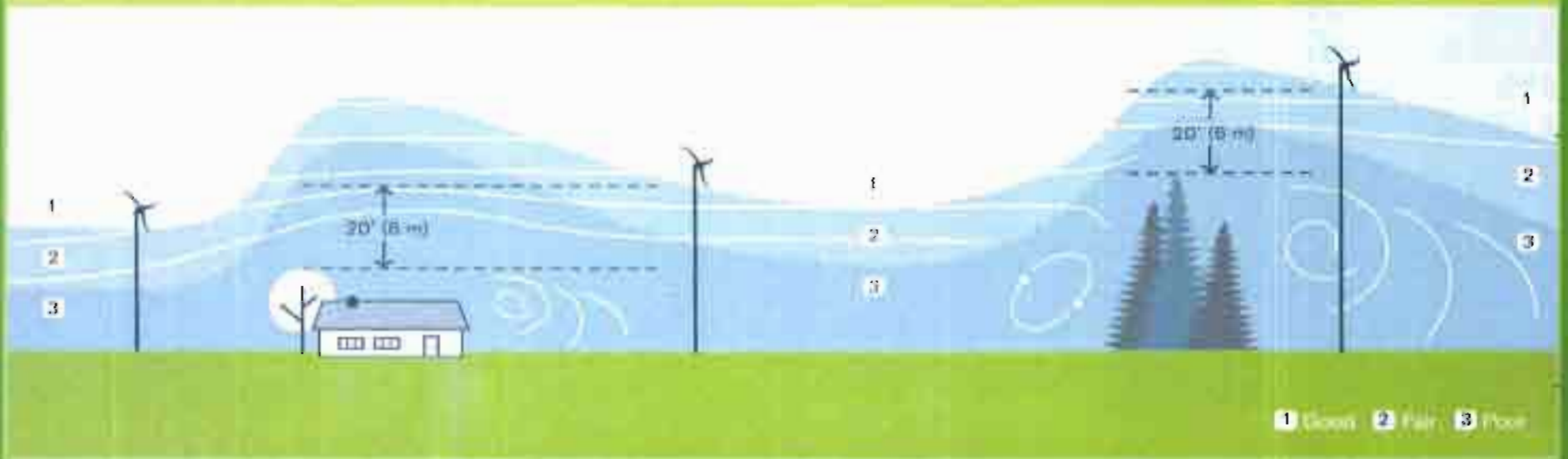
Turbine/Tower placement

- Open space with prevailing wind
- Turbulence
- Features—trees, buildings, landscape
- 30/120 rule



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Natural Features

Coast or Lakeside

Ridge top

Mesa

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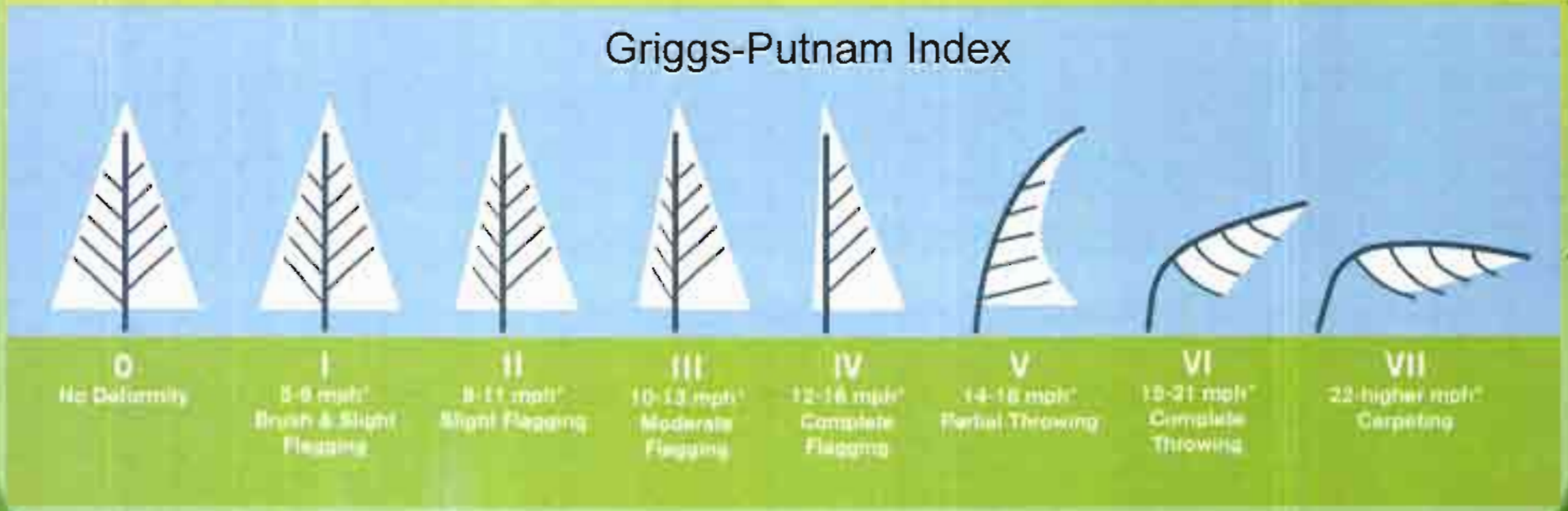
How Much Wind Do I Have ?

- On Site Anemometer
- Rainbowsolar.com – Link to NREL
- NV Energy
- NASA Surface Meteorological Data
- Analysis Software e.g. 3Tier
- Biological Indicators



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Schulz Ranch Specific Plan Area

It was found in SPA-SR-1.2 **Policies and Land Use** that

A variety of setbacks is encouraged

And

Larger buffer lots are required on the perimeter of the project

And

A minimum setback of 30' is established from adjoining properties

The Schulz Ranch Plan does not appear to be impacted by a towering wind generator on a adjacent property. It is also known that the SPA – SR – 1.2 Schulz Ranch Specific Plan Area has been put indefinitely on hold. Currently the land is owned by a bank and no longer in the ownership of a developer.

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Residential Wind Generators

- Small Wind Turbines 400 – 50,000 watts

←< 3KW→
Southwest
Wind

← 10KW →
Bergey
Wind Power

- The Average American Family Uses Between

10,000 – 15,000 Kilowatt Hours Per Year

- It is estimated that this WECS will Generate 14,000 KWH Annually

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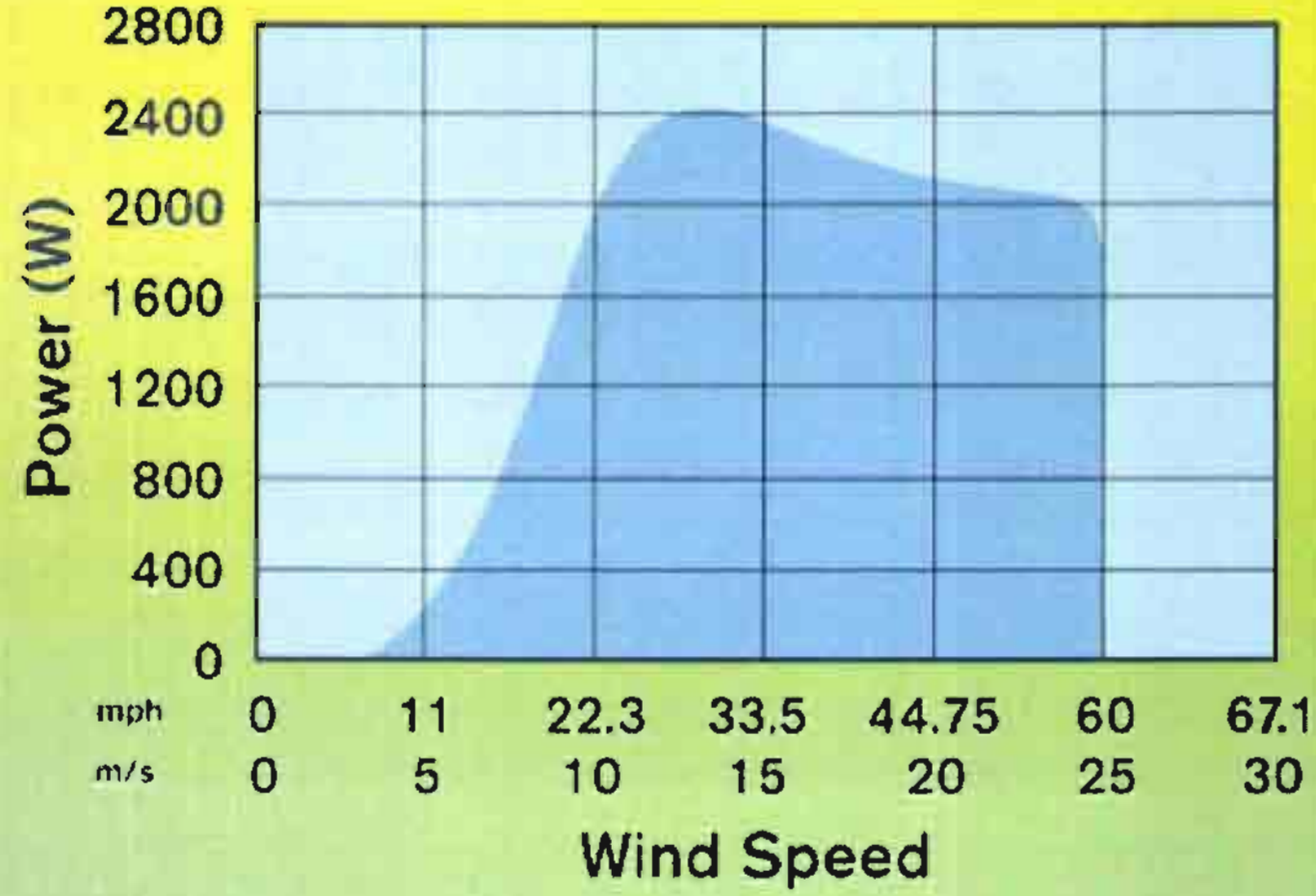
Power – Rate of Energy Production



Data measured and compiled by USDA ARS Research Lab, Bushland, TX

The Power Curve – Varies Among Turbines

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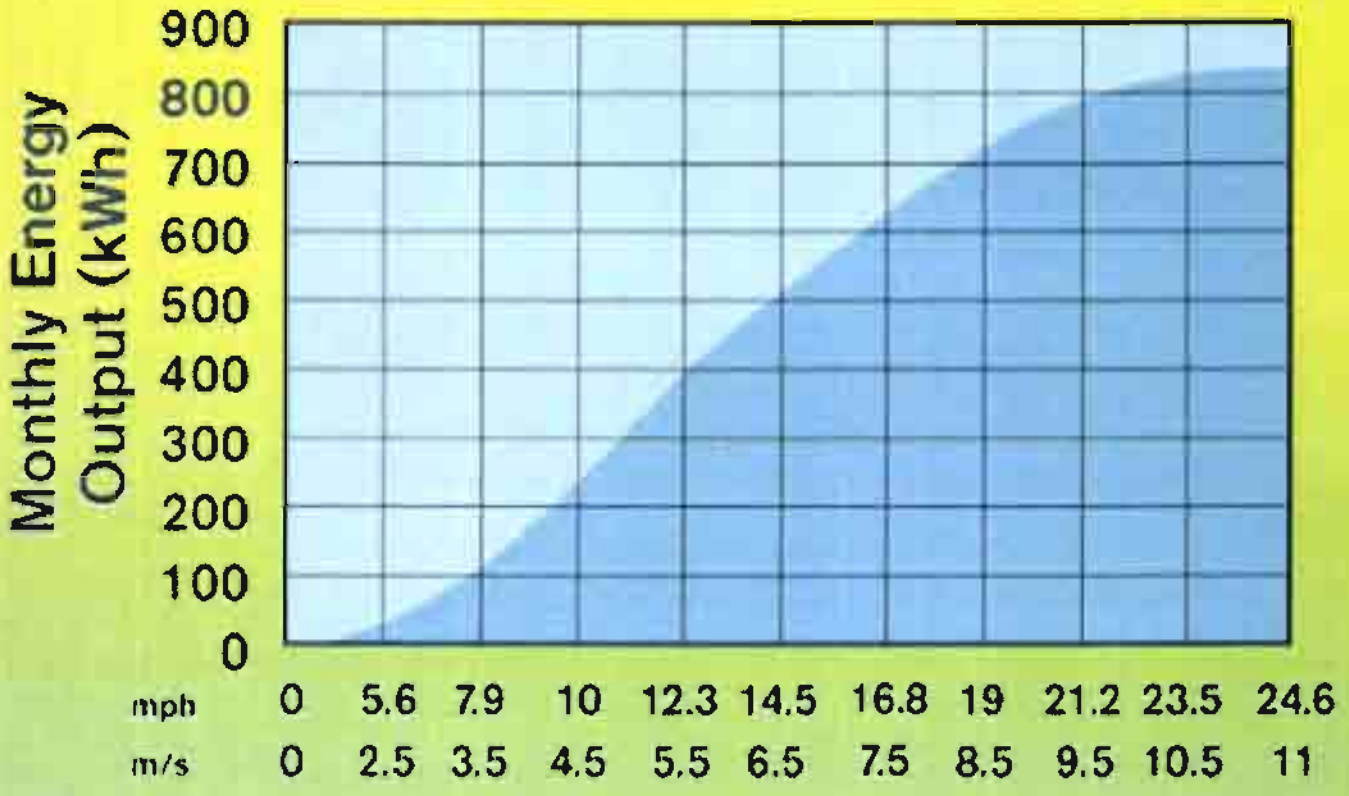
Energy – Is What We Buy



Power Over Time

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Laws, Ordinances and Homeowner Associations

- NRS. Ch.278.0208

  Restrictions for the use of system for obtaining solar or wind energy prohibited

  AB 236 now part of NRS

NRS Material

- PURPA ACT - 1978

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The Bergey Excel

The Solar Store

Simulated View from Racetrack & Schulz Looking West

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Simulated View From N. Sunridge – Looking North East

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Goni Wind Machine Project Summery Appendix A
Findings and Recommendations to County Commissioners

It is the purpose of this special use application to secure approval for the installation and operation of a Bergey 10 kw wind machine at 7300 Schulz Drive. In order to maximize energy production, it is proposed to mount the Berger Excel-S on a 160 feet (50m) free standing lattice tower. Great effort has been made to ensure minimal impact to the surrounding area, while maximizing the system performance.

This effort has included an independent wind study using the 3 Tier wind models, the Bergey performance projection software and assurance that the structure satisfies all title 14 Code of Federal part 77 regulations. (FAA 14CFR part 77) Wind turbine third party acoustic data from USDA-ARS labs is also presented. The selection of the 160 feet tower is required to capture prevailing winds over Sunridge while increasing performance from poor to fair, resulting in a 37% improvement in wind machine annual output compared to a 60 ft. hub height.

The Solar Store

To accommodate these efforts, variances from the ordinance standards for maximum height, setbacks and noise limits shall be requested. Special use permit requests variances for the following:

Private Use Wind Energy Conversion Systems:

Section 2. Standards

c. Setbacks

"A minimum of 1.1 times the total extended height from the project property lines adjacent to a residence"

Remove this requirement for this project.

Rationale : Even the shortest tower available for the Bergey Excell-S will not meet this requirement. Accept for one property, the adjacent properties are either undeveloped, bank owned or owned by the Goni family. See variance request for exceeding the 60 ft height limit.

Section 2. Standards

d. Height

"the maximum total extended height of Wind Energy Conversion Systems is 60 feet."

Remove this requirement for this requirement

The Solar Store

Rationale: Even the shortest tower available for the Bergey Excell-S will not meet this requirement. Manufacturers have learned through experience that there is little or no energy at lower heights. Several including Skystream, Bergey and others no longer make towers for the lower heights. A wind analysis using 3Tier and NASA surface meteorological data for this height (60 ft) at this location indicate poor or marginal energy production. Going to a height of 100 to 160 feet will give "fair" performance at this location. Wind energy is an exponential function of hub height and is also related to surrounding manmade and natural features. A height of 160 ft will better capture the prevailing winds from the southwest direction (over Indian Hills).

Section 2. Standards

h. Noise

i) "No wind machine or combinations of wind machines on a single parcel shall create noise that exceeds a maximum of 25 decibels (dBA) at any property line where the property on which the wind machine is located or the abutting property is one acre or less or a maximum of 50 decibels (dBA) at any other property line."

Remove this Requirement for this project.

The Solar Store

Rationale: The 25 decibel requirement is totally unreasonable or is in error. Perhaps it might mean 25 dBA above the ambient noise ? See the attached charts and independent sound level reports from the USDA and AWEA (American Wind Energy Association).
A whisper in a quiet library, a quiet rural area, a quiet bedroom at night all exceed this sound level by 5 dBA That is to say 25 dBA is less than half of even these quiet levels.
The 50dBA limit
As seen in the independent sound reports, the 50dBA requirement can be satisfied for wind speeds of less than 8.9 m/s or 19.5 mph for a tower of approximately 100 ft at a distance of about 100 ft from the property line. This is far above the wind average for this area. According to Section 2 h. of the code "levels may be exceeded during short term events such as severe wind storms"

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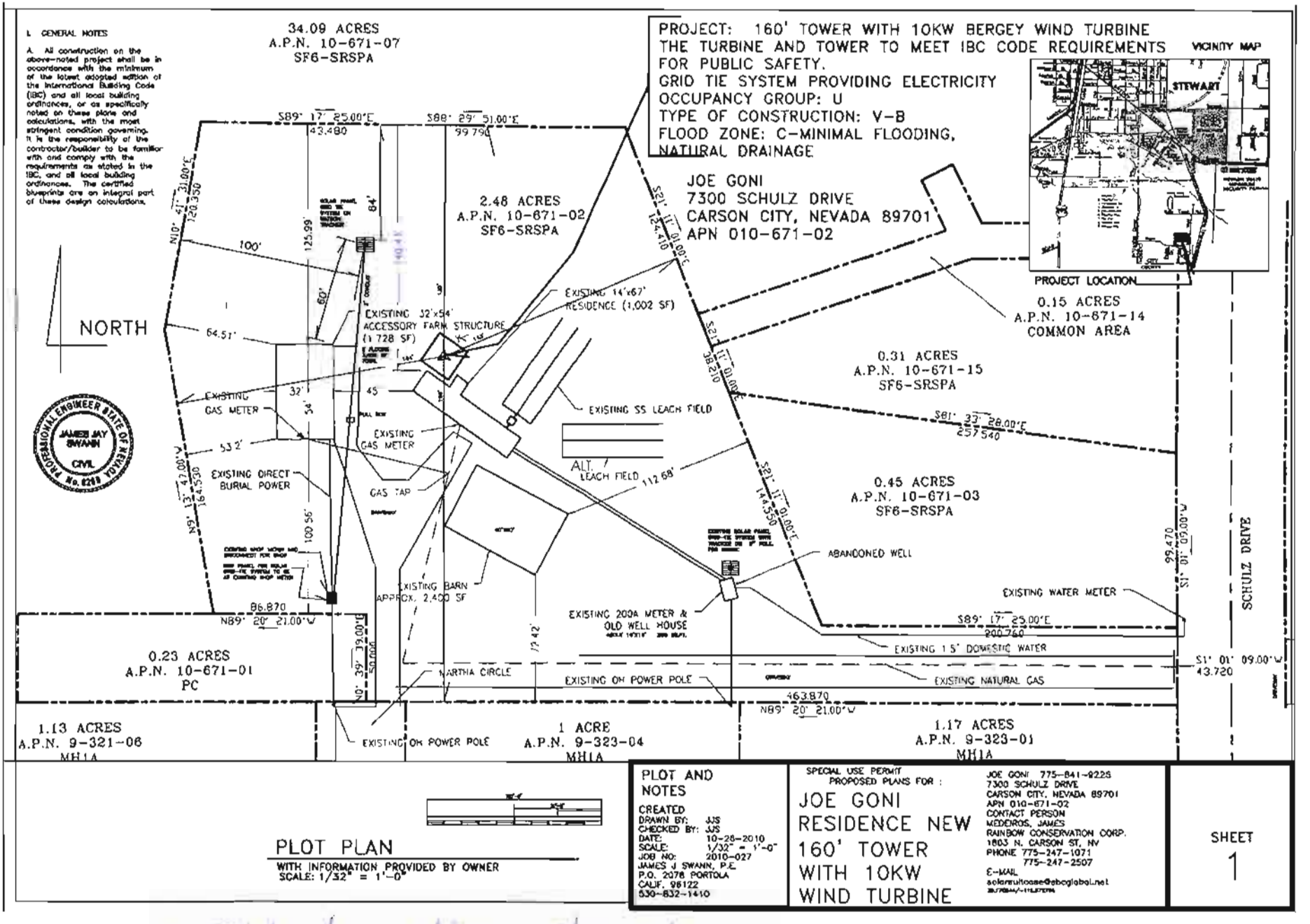
Because the slant distance between the wind machine and the property line increases with tower height, sound is further attenuated by the amount 20 log(d1/d2). Where d1 is the slant range at 100 ft height and d2 is the slant range at the 160 ft height. This is approximately 2.5 dBA less. The higher the tower the less the sound.

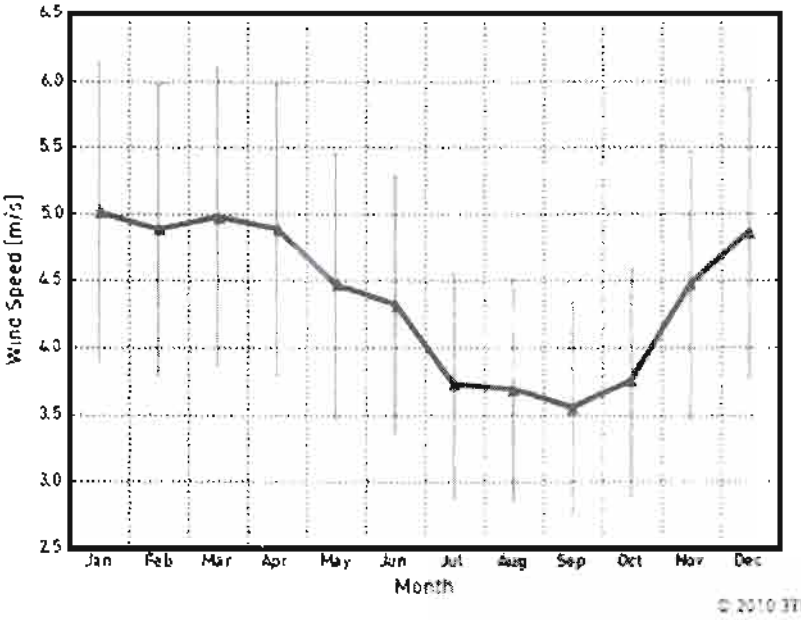
To support the sound reports, we have conducted independent sound measurements on an identical wind machine. The residential neighborhood had similar terrain and vegetation. Wind speeds have been measured using a calibrated anemometer.



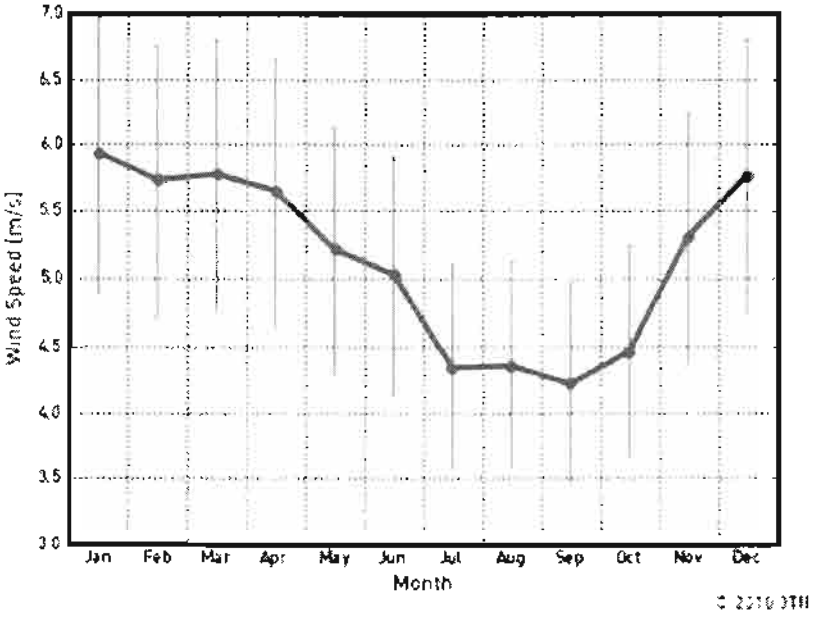
PLOT PLAN
WITH INFORMATION PROVIDED BY OWNER
SCALE: 1/32" = 1'-0"

* Old location turbine

- Hub Height: **20 meters**
- Latitude: **39.104°** Longitude: **-119.753°**
- Your highest wind month is: **January**
- Your lowest wind month is: **September**



- Hub Height: **50 meters**
- Latitude: **39.104°** Longitude: **-119.753°**
- Your highest wind month is: **January**
- Your lowest wind month is: **September**



ATMOSPHERIC SCIENCE DATA CENTER

NASA Surface meteorology and Solar Energy - Available Tables

Latitude 39.104 / Longitude -119.753 was chosen.

Geometry Information

Elevation: **1600** meters
averaged from the
USGS GTOPO30
digital elevation model

Northern boundary
40

Western boundary
-120

Center
Latitude **39.5**
Longitude **-119.5**

Eastern boundary
-119

Southern boundary
39

Show A Location Map

Meteorology (Wind):

Monthly Averaged Wind Speed At 50 m Above The Surface Of The Earth (m/s)

Lat 39.104 Lon -119.753	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual Average
10-year Average	5.59	5.59	5.38	5.12	5.34	5.35	5.15	4.91	5.27	5.30	5.65	5.72	5.36

Minimum And Maximum Difference From Monthly Averaged Wind Speed At 50 m (%)

Lat 39.104 Lon -119.753	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual Average
Minimum	-8	-10	-16	-12	-13	-8	-11	-9	-9	-16	-11	-12	-11
Maximum	9	17	15	11	8	6	12	10	7	10	8	12	10

It is recommended that users of these wind data review the SSE Methodology. The user may wish to correct for biases as well as local effects within the selected grid region.

All height measurements are from the soil, water, or ice/snow surface instead of "effective" surface, which is usually taken to be near the tops of vegetated canopies.

Parameter Definition *Units Conversion Chart*

SSE Homepage | Find A Different Location | Accuracy | Methodology | Parameters (Units & Definition)

ATMOSPHERIC SCIENCE DATA CENTER

NASA Surface meteorology and Solar Energy - Available Tables

Latitude 39.104 / Longitude -119.753 was chosen.

Geometry Information

Elevation: **1600** meters
averaged from the
USGS GTOPO30
digital elevation model

Northern boundary
40

Western boundary
-120

Center
Latitude **39.5**
Longitude **-119.5**

Eastern boundary
-119

Southern boundary
39

Show A Location Map

Meteorology (Wind):

Monthly Averaged Wind Speed At 10 m Above The Surface Of The Earth For Terrain Similar To Airports (m/s)

Lat 39.104 Lon -119.753	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual Average
10-year Average	4.42	4.42	4.25	4.04	4.22	4.23	4.07	3.88	4.16	4.19	4.46	4.51	4.23

It is recommended that users of these wind data review the SSE Methodology. The user may wish to correct for biases as well as local effects within the selected grid region.

All height measurements are from the soil, water, or ice/snow surface instead of "effective" surface, which is usually taken to be near the tops of vegetated canopies.

Parameter Definition *Units Conversion Chart*

Back to SSE Data Set Home Page

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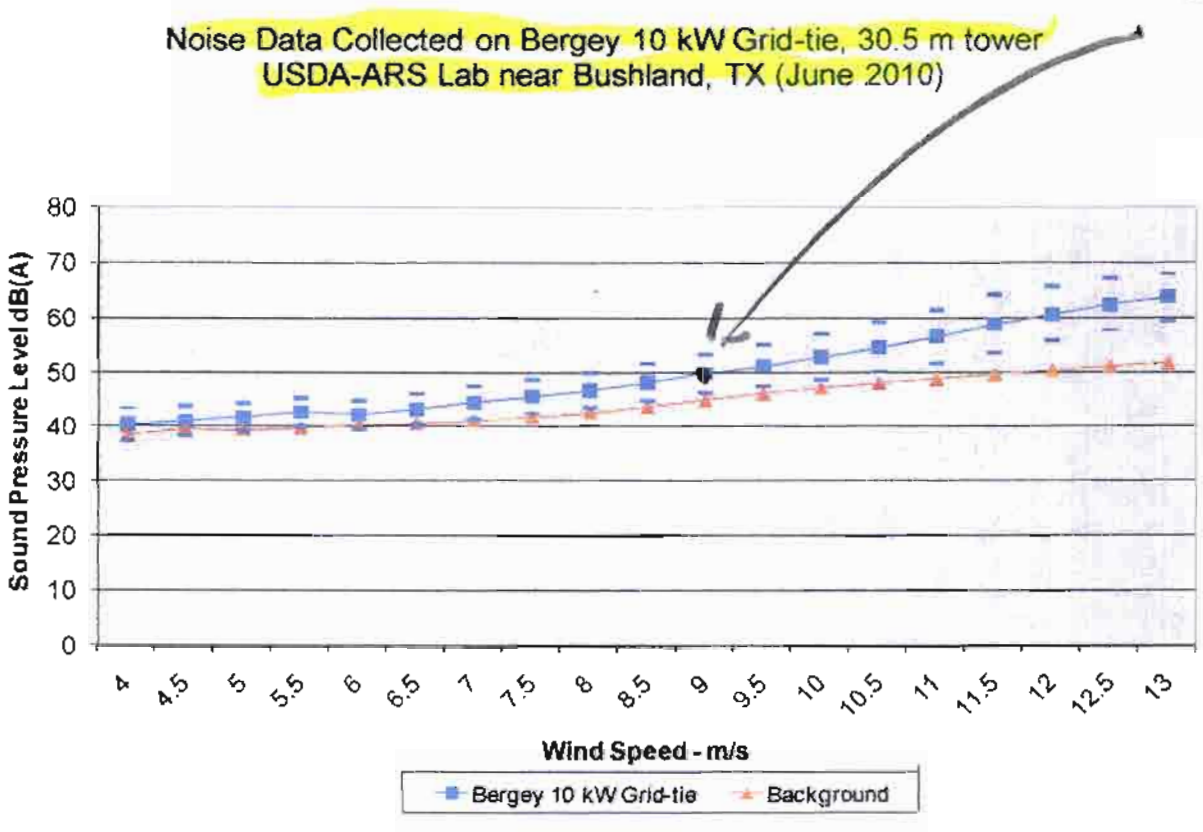
BERGEY WINDPOWER

July 14, 2010

Acoustic Characteristics of the Bergey Excel-S 10 kW Wind Turbine

The following noise level data were taken by the USDA Agricultural Research Service in Bushland, Texas. USDA-Bushland is a contractor to the U.S. Department of Energy and has been field testing small wind turbines since the 1970's. This acoustics testing was conducted in support of certification of the BWC Excel-S to AWEA 9.1-2009. Per the AWEA standard, the tests were conducted in accordance with IEC 61400-11, "Wind Turbine Generator Systems, Part 11 - Acoustic Noise Measurement Techniques".

The sampling microphone was a calibrated Larson Davis Model 824, which was placed 34.2m (112 ft) from the base of the 30m (100 ft) wind turbine tower. The slant distance was 46m (151 ft). Wind speed was taken at a height of 10 m (33 ft)



The data range provided is 4 m/s – 13 m/s because the calculation of the turbine component of the total sound pressure was calculated using background sound data at the same site from an earlier test on another brand of wind turbine and that test range was 4 – 13 m/s. Background sound levels must be taken with the wind turbine shutdown and that is more difficult to achieve on the Bergey Excel than the other brand previously tested. New background sound data over a wider range is currently being gathered. We do not believe there will be any significant differences in the results when this newer background data is available.

The calculation of the wind turbine contribution to total sound levels for follows the guidelines in IEC 61400-11.

For a typical 5 m/s (11.2 mph) average wind speed site the wind speed will be below 11 m/s (25 mph) over 95% of the time. In this range the Excel-S wind turbine will add just 1 – 6 dBA to the background. As a general rule it takes 3 dBA added before a person will perceive a separate noise source.

AWEA Rated Sound Level: 52.1 dBA

The Rated Sound Level is the sound level at 60 m (197 ft) that the wind turbine will not exceed 95% of the time in a 5 m/s (11 mph) average wind speed site. The previous version of the BWC Excel-S had an AWEA Rated Sound Level of 54.7 dBA. The new version is quieter because the more powerful neodymium alternator has reduced the rated rotor speed from 300 RPM to 240 RPM.

The Sound Power Level is the total noise right at the source – the top of the tower. For the BWC Excel-S turbine the Sound Power Level corresponding to the AWEA Rated Sound Level is 91.0 dBA. Sound diminishes with distance. The Sound Pressure Level is the sound a listener would hear at the distance given, in this case 60m (197 ft)

The binned sound pressure and sound power level data is provided on the following page.

2010 Excel-S Acoustics Test Data
Bushland, 46 m Slant Distance

Wind Bin (m/s)	Recorded Sound Pressure Level (dBA)	Std Dev	Backgrd Sound Pressure Level* (dBA)	Turbine Sound Pressure Level (dBA)	Turbine Sound Power Level (dBA)
1	37.08	0.35			
1.5	36.14	0.55			
2	36.70	1.68			
2.5	38.57	3.05			
3	39.18	3.03			
3.5	39.94	3.27			
4	40.39	3.04	38.7	40.39	78.5
4.5	41.06	2.75	39.55	41.06	79.2
5	41.76	2.47	39.48	41.76	79.9
5.5	42.71	2.66	39.84	42.71	80.9
6	43.51	2.66	40.31	42.21	80.4
6.5	44.56	2.81	40.67	43.26	81.4
7	45.75	3.01	41.2	44.45	82.6
7.5	46.87	3.10	41.87	45.57	83.7
8	48.08	3.24	42.65	46.78	84.9
8.5	49.55	3.41	43.72	48.25	86.4
9	51.04	3.60	44.91	49.83	88.0
9.5	52.40	3.78	46.14	51.23	89.4
10	53.92	4.17	47.17	52.89	91.0
10.5	55.53	4.53	48.13	54.66	92.8
11	57.31	4.92	48.91	56.63	94.8
11.5	59.35	5.22	49.73	58.85	97.0
12	61.07	4.88	50.48	60.67	98.8
12.5	62.69	4.71	51.17	62.37	100.5
13	64.02	4.24	51.85	63.75	101.9
13.5	65.44	3.79			
14	66.60	3.29			
14.5	67.39	3.12			
15	68.10	3.04			
15.5	68.92	3.40			
16	69.60	3.18			
16.5	70.02	2.63			
17	71.42	1.82			
17.5	71.79	1.71			
18	71.53	3.22			
18.5	72.14	2.30			
19	73.00	1.13			
19.5	70.10	4.93			
20	62.00	0.00			

* - From 2006 test on another turbine

Sound Levels at a Distance from the Turbine

Sound Power Level is defined as the sound level at a distance of 1 meter (3.3 ft) from the source, which we take as the center of the rotor or, in other words, hub height. As a person gets farther and farther away from the wind turbine, the intensity of the sound they will hear reduces as the square of the distance. The following table provides the AWEA Rated Sound Levels at different distances from the base of the turbine, assuming a 30m (100 ft) tower. These levels do not include a contribution from background noise levels.

Distance from Turbine (meters)	Distance (feet)	Slant Distance (m)	Sound Press. Level (dBA)
30	98.42	42.4	53.5
60	196.85	67.1	49.5
90	295.27	94.9	46.5
120	393.70	123.7	44.2
150	492.12	153.0	42.4
180	590.55	182.5	40.8
210	688.97	212.1	39.5
240	787.40	241.9	38.4
270	885.82	271.7	37.4
300	984.25	301.5	36.5
330	1,082.67	331.4	35.6
360	1,181.10	361.2	34.9
390	1,279.52	391.2	34.2

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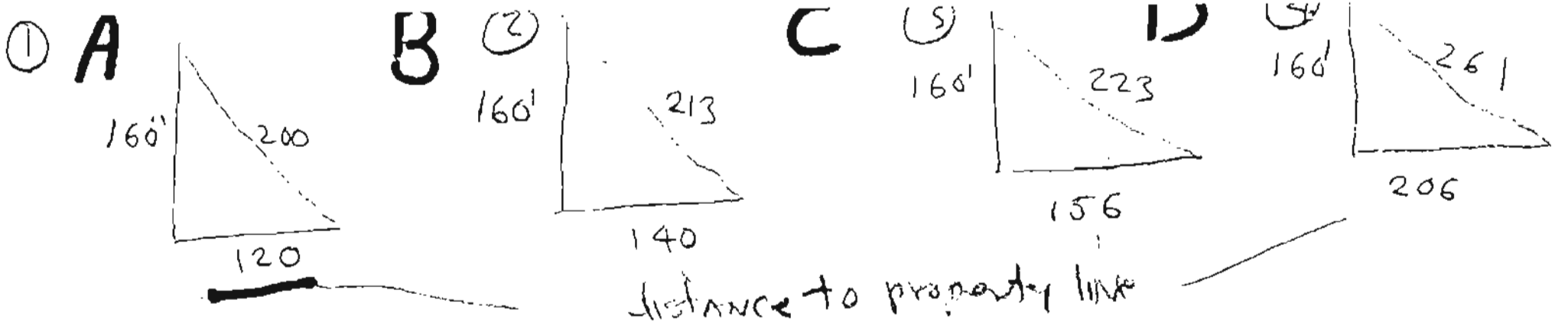
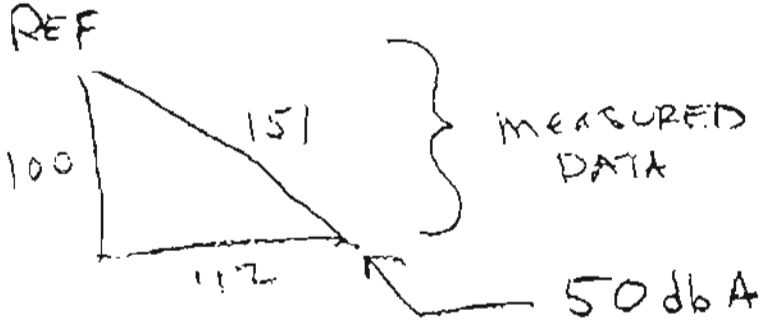




ALL Property LINES ARE UNDER the 50dba MAXIMUM

⇓

AT their boundries @ 19.5 mph

Reduction of DBA

Case

A ① $20 \log\left(\frac{151}{200}\right) = -2.44$ db

B ② $20 \log\left(\frac{151}{213}\right) = -3$ dbA

C ③ $20 \log\left(\frac{151}{223}\right) = -3.3$ dbA

D ④ $20 \log\left(\frac{151}{261}\right) = -4.75$ dbA

A 47.56 dbA

B 47 dbA

C 46.7 dbA

D 45.25 dbA

Attn: Planning

WindCad Turbine Performance Model

BWC EXCEL-S, Grid - Intertie

Tierneo-SH3055-23-BWC

Prepared For:	Joe Goni
Site Location:	7300 Schulz Drive
Data Source:	AWEA Standard
Date:	12/24/2010

10 kW

Inputs:

Ave. Wind (m/s) =	5.1
Weibull K =	1.59
Site Altitude (m) =	1,500
Wind Shear Exp. =	0.200
Anem. Height (m) =	50
Tower Height (m) =	50
Turbulence Factor =	0.0%

Results:

Hub Average Wind Speed (m/s) =	5.10
Air Density Factor =	-14%
Average Output Power (kW) =	1.63
Daily Energy Output (kWh) =	39.1
Annual Energy Output (kWh) =	**14,285**
Monthly Energy Output =	1,190
Percent Operating Time =	63.3%

Weibull Performance Calculations

Wind Speed Bin (m/s)	Power (kW)	Wind Probability (f)	Net kW @ V
1	0.00	9.31%	0.000
2	0.00	12.36%	0.000
3	0.12	13.25%	0.016
4	0.37	12.76%	0.047
5	0.76	11.45%	0.087
6	1.30	9.72%	0.127
7	2.03	7.90%	0.160
8	2.96	6.17%	0.183
9	4.14	4.66%	0.193
10	5.54	3.41%	0.189
11	7.08	2.43%	0.172
12	8.64	1.68%	0.145
13	9.80	1.14%	0.111
14	10.14	0.75%	0.076
15	10.40	0.48%	0.050
16	10.47	0.30%	0.032
17	10.48	0.19%	0.020
18	10.43	0.11%	0.012
19	10.28	0.07%	0.007
20	9.86	0.04%	0.004
2008, BWC	Totals:	98.19%	1.631

Weibull Calculations:
Wind speed probability is calculated as a Weibull curve defined by the average wind speed and a shape factor, K. To facilitate piece-wise integration, the wind speed range is broken down into "bins" of 1 m/s in width (Column 1). For each wind speed bin, instantaneous wind turbine power (W, Column 2)) is multiplied by the Weibull wind speed probability (f, Column 3). This cross product (Net W, Column 4) is the contribution to average turbine power output contributed by wind speeds in that bin. The sum of these contributions is the average power output of the turbine on a continuous, 24 hour, basis.
Best results are achieved using annual or monthly average wind speeds. Use of daily or hourly average speeds is not recommended.

Instructions:

Inputs: Use annual or monthly **Average Wind** speeds. If **Weibull K** is not known, use K = 2 for inland sites, use 3 for coastal sites, and use 4 for island sites and trade wind regimes. **Site Altitude** is meters above sea level. **Wind Shear Exponent** is best assumed as 0.18. For rough terrain or high turbulence use 0.22. For very smooth terrain or open water use 0.11. **Anemometer Height** is for the data used for the **Average Wind** speed. If unknown, use 10 meters. **Tower Height** is the nominal height of the tower, eg.: 24 meters. **Turbulence Factor** is a derating for turbulence, site variability, and other performance influencing factors -- typical turbulence has already been incorporated into the model. Use 0.00 (0%) for level sites with limited obstructions. Use -0.10 (negative 10%) for flat, clear sites on open water. Use 0.05 to 0.15 (5% to 15%) for rolling hills or mountainous terrain.

Results: **Hub Average Wind Speed** is corrected for wind shear and used to calculate the Weibull wind speed probability. **Air Density Factor** is the reduction from sea level performance. **Average Power Output** is the average continuous equivalent output of the turbine. **Daily Energy Output** is the average energy produced per day. Annual and **Monthly Energy Outputs** are calculated using the Daily value. **Percent Operating Time** is the time the turbine should be producing some power.

Limitations: This model uses a mathmatical idealization of the wind speed probability. The validity of this assumption is reduced as the time period under consideration (ie, the wind speed averaging period) is reduced. This model is best used with annual or monthly average wind speeds. Use of this model with daily or hourly average wind speed data is not recommended because the wind will not follow a Weibull distribution over short periods. The data used in creating the power curve was generated at the BWC test site in Norman, OK. Consult Bergey Windpower Co. for special needs. ***Your performance may vary.***

Noise Sources and Their Effects

Noise Source	Decibel Level	comment
Jet take-off (at 25 meters)	150	Eardrum rupture
Aircraft carrier deck	140	
Military jet aircraft take-off from aircraft carrier with afterburner at 50 ft (130 dB).	130	
Thunderclap, chain saw. Oxygen torch (121 dB).	120	Painful. 32 times as loud as 70 dB.
Steel mill, auto horn at 1 meter. Turbo-fan aircraft at takeoff power at 200 ft (118 dB). Riveting machine (110 dB); live rock music (108 - 114 dB).	110	Average human pain threshold. 16 times as loud as 70 dB.
Jet take-off (at 305 meters), use of outboard motor, power lawn mower, motorcycle, farm tractor, jackhammer, garbage truck. Boeing 707 or DC-8 aircraft at one nautical mile (6080 ft) before landing (106 dB); jet flyover at 1000 feet (103 dB); Bell J-2A helicopter at 100 ft (100 dB).	100	8 times as loud as 70 dB. Serious damage possible in 8 hr exposure
Boeing 737 or DC-9 aircraft at one nautical mile (6080 ft) before landing (97 dB); power mower (96 dB); motorcycle at 25 ft (90 dB). Newspaper press (97 dB).	90	4 times as loud as 70 dB. Likely damage 8 hr exp
Garbage disposal, dishwasher, average factory, freight train (at 15 meters). Car wash at 20 ft (89 dB); propeller plane flyover at 1000 ft (88 dB); diesel truck 40 mph at 50 ft (84 dB); diesel train at 45 mph at 100 ft (83 dB). Food blender (88 dB); milling machine (85 dB); garbage disposal (80 dB).	80	2 times as loud as 70 dB. Possible damage in 8 h exposure.
Passenger car at 65 mph at 25 ft (77 dB); freeway at 50 ft from pavement edge 10 a.m. (76 dB). Living room music (76 dB); radio or TV-audio, vacuum cleaner (70 dB).	70	Arbitrary base of comparison. Upper 70s are annoyingly loud to some people.
Conversation in restaurant, office, background music, Air conditioning unit at 100 ft	60	Half as loud as 70 dB. Fairly quiet
Quiet suburb, conversation at home. Large electrical transformers at 100 ft	50	One-fourth as loud as 70 dB.

Library, bird calls (44 dB); lowest limit of urban ambient sound	40	One-eighth as loud as 70 dB.
Quiet rural area	30	One-sixteenth as loud as 70 dB. Very Quiet
Whisper, rustling leaves	20	
Breathing	10	Barely audible

[modified from **http://www.wenet.net/~hpb/dblevels.html**] on 2/2000. SOURCES: Temple University Department of Civil/Environmental Engineering (www.temple.edu/departments/CETP/environ10.html), and *Federal Agency Review of Selected Airport Noise Analysis Issues*, Federal Interagency Committee on Noise (August 1992). Source of the information is attributed to *Outdoor Noise and the Metropolitan Environment*, M.C. Branch et al., Department of City Planning, City of Los Angeles, 1970.

Tontechnik-Rechner - sengpielaudio

Deutsche Version

• Decibel Table – Loudness Comparison Chart •

Table of Sound Levels (dB Scale) and the corresponding Units of Sound Pressure and Sound Intensity (Examples)

To get a feeling for decibels, look at the table below which gives values for the sound pressure levels of common sounds in our environment. Also shown are the corresponding sound pressures and sound intensities.
From these you can see that the decibel scale gives numbers in a much more manageable range. Sound pressure levels are measured without weighting filters. The values are averaged and can differ about ±10 dB. With sound pressure is always meant the effective value (RMS) of the sound pressure, without extra announcement. The amplitude of the sound pressure means the peak value. The ear is a sound pressure receptor, or a sound pressure sensor, i.e. the ear-drums are moved by the sound pressure, a sound field quantity. It is not an energy receiver. When listening, forget the sound intensity as energy quantity. The perceived sound consists of periodic pressure fluctuations around a stationary mean (equal atmospheric pressure).

This is the change of sound pressure, which is measured in pascal (Pa) ≡ 1 N/m^2 ≡ 1 J/m^3 ≡ 1 $kg/(m \cdot s^2)$. Usually p is the RMS value

Table of sound levels L (loudness) and corresponding sound pressure and sound intensity

Sound Sources Examples with distance	Sound Pressure Level L_p dBSPL	Sound Pressure p N/m^2 = Pa	Sound Intensity I W/m^2
Jet aircraft, 50 m away	140	200	100
Threshold of pain	130	63.2	10
Threshold of discomfort	120	20	1
Chainsaw, 1 m distance	110	6.3	0.1
Disco, 1 m from speaker	100	2	0.01
Diesel truck, 10 m away	90	0.63	0.001
Kerbside of busy road, 5 m	80	0.2	0.0001
Vacuum cleaner, distance 1 m	70	0.063	0.00001
Conversational speech, 1 m	60	0.02	0.000001
Average home	50	0.0063	0.0000001
Quiet library	40	0.002	0.00000001
Quiet bedroom at night	30	0.00063	0.000000001
Background in TV studio	20	0.0002	0.0000000001
Rustling leaves in the distance	10	0.000063	0.00000000001
Threshold of hearing	0	0.00002	0.000000000001

The sound level depends on the distance between the sound source and the place of measurement, possibly one ear of a listener.
The sound pressure level L_p in dB without the given distance r to the sound source is really meaningless. Unfortunately this error (unknown distance) is quite often.

Noise is a sound that disturbs or harms.

Assumption: The maximum sound pressure is 194 dBSPL. That cannot be exceeded because the average air pressure of 101325 Pa.
L = 20 · log (101325 / 0,00002) = **194 dB**. This theoretical idea is not correct, because a chaotic noise can also be asymmetrical.
There is no upper noise limit. A typical false statement: "No noise levels can exceed 194 dB ever". Is the end at 194 dB? In addition to this perception threshold is discussed more often a physical limit to 194 dB. Sound is nothing more than a minor disturbance of air pressure and 194 dB is theoretically the same as the disturbance itself. But even louder noise is possible.

Ultrasound between 20 kHz and 1.5 GHz does not belong to our human hearing. Infrasound below about 16 Hz is insensitive to the human ear.

The total sound power is emitted by the sound source. Sound power levels are connected to the sound source and are independent of distance. Sound pressure levels vary substantially with distance from the source.

Sound pressure p in pascals (newtons per square meter) is not the same physical quantity as intensity J or I in watts per square meter. ... and the sound power (acoustic power) does not decrease with distance r from the sound source - neither with $1/r$ nor as $1/r^2$.

Sound Field Quantities ☺	Sound Energy Quantities
Sound pressure, sound or particle velocity, particle displacement or particle amplitude, (voltage, current, electric resistance).	Sound intensity, sound energy density, sound energy, acoustic power. (electrical power).
Inverse Distance Law 1/r	**Inverse Square Law 1/r^2**

The reference sound pressure level for 0 dBSPL is the sound pressure p_0 = 20 µPa = 20 × 10^{-6} Pa = 2 × 10^{-5} Pa = 0.00002 Pa or N/m². That is the threshold of hearing. (The reference sound intensity is I_0 = 10^{-12} W/m^2.)
Pa = Pascal.

There is no "dBA" value given as threshold of human hearing.
These values are not given as dBA, but as dBSPL, that means **without any weighting filter.**

$$L_p = 20\ \log_{10}\left(\frac{p}{p_0}\right)\ \text{in dB} = L_I = 10\ \log_{10}\left(\frac{I}{I_0}\right)\ \text{in dB}$$

Differentiate between sound pressure p as a "sound **field** quantity" and sound intensity I as a "sound **energy** quantity". $I = p^2$ for progressive plane waves. When it comes to our ears and the hearing, it is recommended that the inappropriate expression of the sound energy parameters, such as sound power (acoustic power) and sound intensity to leave aside. So we are just listening to the sound pressure as sound field quantity, or the sound pressure level SPL.

The sound pressure level decreases in the free field with 6 dB per distance doubling. **That is the 1/*r* law.**

Often it is argued the **sound pressure** would decrease after the $1/r^2$ law (inverse square law). **That's wrong.**
The sound pressure in a free field is inversely proportional to the distance from the microphone to the source. ***p* ~ 1/*r*.**

How does the sound decrease with increasing distance?
Damping of sound level with distance

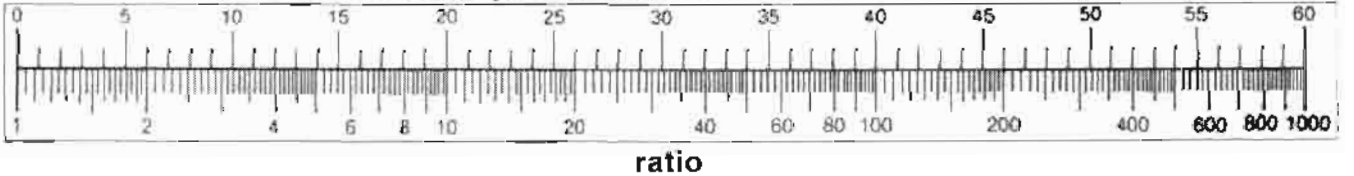
Relation of sound intensity, sound pressure and **distance law**:

$$I \sim p^2 \sim \frac{1}{r^2}$$

From this follows $p \sim \frac{1}{r}$

Note: The often used term "**intensity** of sound pressure" is not correct. Use "magnitude", "strength", "amplitude", or "level" instead.
"Sound intensity" is sound power per unit area, while "pressure" is a measure of force per unit area. Intensity (sound energy quantity) is not equivalent to pressure (sound field quantity).

dB scale for field quantities, like volts and sound pressures



ratio

The sound pressure is the force F in newtons N of a sound on a surface area A in m^2 perpendicular to the direction of the sound.
The SI-unit for the sound pressure p is N/m^2 = Pa. $p \sim 1/r$.

Note - Comparing dBSPL and dBA:
There is no conversion formula for measured dBA values to sound pressure level dBSPL or vice versa. That is only possible measuring one single frequency.

There is no "dBA" curve given as threshold of human hearing.

The weighted sound level is neither a physiological nor a physical parameter.

Words to bright minds: Always wonder what a manufacturer is hiding when they use A-weighting. *)

*) **http://www.google.com/search?q=Always+wonder+what+a+manufacturer+Rane&filter=0**

Readings of a pure 1 kHz tone should be identical, whether weighted or not.

How loud is dangerous?
Typical dbA levels

190 dBA	Heavy weapons, 10 m behind the weapon (maximum level)
180 dBA	Toy pistol fired close to ear (maximum level)
170 dBA	Slap on the ear, fire cracker explodes on shoulder, small arms at a distance of 50 cm (maximum level)
160 dBA	Hammer stroke on brass tubing or steel plate at 1 m distance, airbag deployment very close at a distance of 30 cm (maximum level)
150 dBA	Hammer stroke in a smithy at 5 m distance (maximum level)
130 dBA	Loud hand clapping at 1 m distance (maximum level)
120 dBA	Whistle at 1 m distance, test run of a jet at 15 m distance
	Threshold of pain, above this fast-acting hearing damage in short action is possible
115 dBA	Take-off sound of planes at 10 m distance
110 dBA	Siren at 10 m distance, frequent sound level in discotheques and close to loudspeakers at rock concerts, violin close to the ear of an orchestra musicians (maximum level)
105 dBA	Chain saw at 1 m distance, banging car door at 1 m distance (maximum level), racing car at 40 m distance, possible level with music head phones
100 dBA	Frequent level with music via head phones, jack hammer at 10 m distance
95 dBA	Loud crying, hand circular saw at 1 m distance
90 dBA	Angle grinder outside at 1 m distance
	Over a duration of 40 hours a week hearing damage is possible
85 dBA	2-stroke chain-saw at 10 m distance, loud WC flush at 1 m distance
80 dBA	Very loud traffic noise of passing lorries at 7.5 m distance, high traffic on an expressway at 25 m distance
75 dBA	Passing car at 7.5 m distance, un-silenced wood shredder at 10 m distance
70 dBA	Level close to a main road by day, quiet hair dryer at 1 m distance to ear
65 dBA	**Bad risk of heart circulation disease at constant impact is possible**
60 dBA	Noisy lawn mower at 10 m distance
55 dBA	Low volume of radio or TV at 1 m distance, noisy vacuum cleaner at 10 m distance
50 dBA	Refrigerator at 1 m distance, bird twitter outside at 15 m distance
45 dBA	Noise of normal living, talking, or radio in the background
40 dBA	**Distraction when learning or concentration is possible**
35 dBA	Very quiet room fan at low speed at 1 m distance
25 dBA	Sound of breathing at 1 m distance
0 dBA	Auditory threshold

From a dB-A measurement no accurate description of the expected noise volume is possible.

Table of the Threshold of pain

What is the threshold of pain?

You can find the following rounded values in various audio articles:

Sound pressure level L_p	Sound pressure p
140 dBSPL	200 Pa
137.5 dBSPL	150 Pa
134 dBSPL	**100 Pa**
120 dBSPL	20 Pa

The Psychoacoustic Loudness

Notice: Psycho acousticians tell us, that a 10 dB increase of level give the impression of the doubling the loudness (volume).
Your loudspeakers need 10 times more power.
If you have 6 violins as source, then you have to tenfold the violins; you need 60 violins to double the psycho-acoustic loudness (volume).

Half loudness ≡ level:	–10 dB	Double loudness ≡ level:	+10 dB
Half sound pressure ≡ level:	–6 dB	Double sound pressure ≡ level:	+6 dB
Half power ≡ level:	–3 dB	Double power: ≡ level	+3 dB
fourfold power ≡ level:	+6 dB	Tenfold power ≡ level:	+10 dB
Double distance ≡ level:	–6 dB	Double sources (Double power)=	+3 dB

Sound Level Comparison Chart and the Factors

Table of sound level dependence and the change of the respective factor to subjective volume (loudness), objective sound pressure (voltage), and sound intensity (acoustic power)

How many decibels (dB) change is double, half, or four times as loud?

How many dB to appear twice as loud (twofold)? Here are all the different factors. Factor means "how many times" or "how much" ... Doubling of loudness.

Level Change	Volume Loudness	Voltage Sound pressure	Acoustic Power Sound Intensity
+40 dB	16	100	10000
+30 dB	8	31.6	1000
+20 dB	4	10	100
+10 dB	2.0 = double	3.16 = √10	**10**
+6 dB	1.52 fold	2.0 = double	4.0
+3 dB	1.23 fold	1.414 fold = √2	2.0 = double
- - - - ±0 dB - - - -	- - - - 1.0 - - - - - - -	- - - - 1.0 - - - - - - -	- - - - - 1.0 - - - - -
−3 dB	0.816 fold	0.707 fold	0.5 = half
−6 dB	0.660 fold	0.5 = half	0.25
−10 dB	0.5 = half	0.316	0.1
−20 dB	0.25	0.100	0.01
−30 dB	0.125	0.0316	0.001
−40 dB	0.0625	0.0100	0.0001
Log. quantity	**Psycho quantity**	**Field quantity**	**Energy quantity**
dB change	**Loudness multipl.**	**Amplitude multiplier**	**Power multiplier**

The psycho-acoustic volume or loudness is a subjective sensation size.

Is a 10 dB or 6 dB sound level change for a doubling or halving of the loudness (volume) correct?
About the connection between sound level and loudness, there are various theories. Far spread is still the theory of psycho-acoustic pioneer Stanley Smith Stevens, indicating that the doubling or halving the sensation of loudness corresponds to a level difference of 10 dB. Recent research by Richard M. Warren, on the other hand leads to a level difference of only 6 dB. *) This means that a double sound pressure corresponds to a double loudness. The psychologist John G. Neuhoff found out that for the rising level our
hearing is more sensitive than for the declining level. For the same sound level difference the change of loudness from quiet to loud is stronger than from loud to quiet.
It is suggested that the sone scale of loudness reflects the influence of known experimental biases and hence does not represent a fundamental relation between stimulus and sensation.
***) Richard M. Warren, "Elimination of Biases in Loudness Judgments for Tones"**

It follows that the determination of the volume (loudness) which is double as loud should not be dogmatically defined. More realistic is the claim:

> **A doubling of the sensed volume (loudness) is equivalent to a level change approximately between 6 dB and 10 dB.**

Subjectively perceived loudness (volume), objectively measured sound pressure (voltage), and theoretically calculated sound intensity (acoustic power)

Psychoacoustic: Relationship between phon and sone

Conversion of sound units (levels)
Calculations of Sound Values and their Levels
Conversion of voltage V to dBm, dBu, and dBV

> The total sound power is emitted from the sound source. The sound power level and the sound power is connected firmly with the sound source and is really independent of the distance. On the other hand, the SPL varies significantly with the distance from the sound source.

Question: What is the standard distance to measure sound pressure level away from equipment?
There is no standard distance. It depends on the size of the sound source and the sound pressure level.

> **Sound pressure p in pascals is not the same physical quantity as intensity I in watts per square meter.**
> **... and the sound power (acoustic power) does not decrease with distance r from the sound source - neither with $1 / r$ nor as $1 / r^2$.**

Often the **sound pressure** as a **sound field quantity** is mixed incorrectly

with the **sound intensity** as a **sound energy quantity**. But $I \approx p^2$.

Note: The radiated sound power (sound intensity) is the cause - and **the sound pressure is the effect**.
The effect is of particular interest to the sound engineer
The effect of temperature and sound pressure.

Acousticians and sound protectors (noise fighters) need the sound intensity (acoustic intensity). As a sound designer you don't need that. Look out more for the sound pressure that makes an effect to your ears and to the microphones.

Sound pressure and Sound power – Effect and Cause

Ratio magnitudes and levels

The decibel is defined as a 20 times logarithm of a ratio of linear quantities to each other and as a 10-fold logarithm of a ratio of quadratic quantities to each other.
Ratios of electric or acoustic quantities, such as electric voltage and the sound pressure is referred to as factors, such as reflection factor.
Ratios of square quantities to one another, such as power and energy are called grades, such as efficiency.
Logarithmically ratios of electric or acoustic quantities of the same unit, we express as measures such as transfer factor, or level, such as sound pressure level.
Levels are measured in decibels - dB in short.

If the output voltage level is 0 dB, that is 100%, the level of −3 dB is equivalent to 70.7% and the level of −6 dB is equivalent to 50% of the initial output voltage.
This applies to all field quantities; e.g. sound pressure.

If the output power level is 0 dB, that is 100%, the level of −3 dB is equivalent to 50% and −6 dB is equivalent to 25% of the initial output power.
This applies to all energy quantities; e.g. sound intensity.

Try to understand this.

Conversion of sound pressure to sound power and vice versa

The sound pressure changes depending on the environment and the distance from the sound source. In contrast, the sound power of a sound source is location-independent.

Formulas for conversion:

Acoustical power (sound power) $P_{ac} = I \cdot A$ in watts

Sound intensity $I = p_{eff}^2 / Z_0$ in W/m^2 = P_{ak} / A in W/m^2

Perfused area $A = 4 \cdot \pi \cdot r^2$ in m^2

Distance measurement point from the sound source r in meters (has only meaning with sound pressure, not with sound power)

Acoustic impedance of air Z_0 = 413 N·s/m^3 at 20 °C

Sound pressure p_{eff} in Pa = N/m^2

In point-like sound sources spherical areas A shall be inserted.

Depending on the arrangement following sections are taken into account:

Solid sphere - sound source anywhere in the room, Q = 1

Hemisphere - sound source on the ground, Q = 2

Quarter Sphere - sound source on the wall, Q = 4

Eighth sphere - sound source in the corner, Q = 8

Q = direction factor and area $A = (4 \cdot \pi \cdot r^2) / Q$

back Search Engine home

DECIBEL (dB)

Acoustics / Noise

A unit of a logarithmic scale of power or intensity called the *power level* or *intensity level*. The decibel is defined as one tenth of a *bel* where one bel represents a difference in level between two intensities I_1, I_0 where one is ten times greater than the other. Thus, the intensity level is the comparison of one intensity to another and may be expressed:

$$\text{Intensity level} = 10 \log_{10} (I_1 / I_0) \text{ (dB)}$$

For instance, the difference between intensities of 10^{-8} watts/m^2 and 10^{-4} watts/m^2, an actual difference of 10,000 units, can be expressed as a difference of 4 bels or 40 decibels.

Because of the very large range of SOUND INTENSITY which the ear can accommodate, from the loudest (1 watt/m^2) to the quietest (10^{-12} watts/m^2), it is convenient to express these values as a function of powers of 10. This entire range of intensities can be expressed on a scale of 120 dB. (The physicist Alexander Wood once compared this range from loudest to quietest to the energy received from a 50 watt bulb situated in London, ranging from close by to that received by someone in New York.) See: DYNAMIC RANGE.

The result of this logarithmic basis for the scale is that increasing a sound intensity by a factor of 10 raises its level by 10 dB; increasing it by a factor of 100 raises its level by 20 dB; by 1,000, 30 dB and so on. When two sound sources of equal intensity or power are measured together, their combined intensity level is 3 dB higher than the level of either separately. Thus, two 70 dB cars together measure 73 dB under ideal conditions. However, note that when the AMPLITUDE of a single sound is doubled, its level rises 6 dB.

 Sound Example: Ramp descending at 6 dB per event, followed by a ramp descending at 3 dB.

0 dB is defined as the THRESHOLD OF HEARING, and it is with reference to this internationally agreed upon quantity that decibel measurements are made. In some situations, such as tape recording, a given intensity level is assigned 0 dB, and other levels are measured in negative decibels in comparison to it.

See: AUDIOGRAM, LEVEL RECORDER, VU METER, ZERO LEVEL VU. See also: HEARING LEVEL, LOUDNESS LEVEL, SOUND LEVEL, SOUND POWER LEVEL, SOUND PRESSURE LEVEL.

Decibels may be qualified as dBA, dBB, dBC, indicating the weighting network of the SOUND LEVEL METER with which the measurement was made. The term became accepted in the 1920s and since then noise measurement has generally come to rely on the decibel scale and others derived from it.

See: NOISE, NOISE LEVEL, NOISE RATING, NOISE & NUMBER INDEX, PERCEIVED NOISE LEVEL, TRAFFIC NOISE INDEX. Compare: EQUIVALENT ENERGY LEVEL.

These newer systems have brought environmental factors and frequency content to bear on the measurement of LOUDNESS. The PHON scale attempts to account for the subjective response of the ear to loudness, which is not possible with the decibel measurement of intensity. See also: EQUAL LOUDNESS CONTOURS.

See INVERSE-SQUARE LAW for variation of decibel measurement with distance, and SOUND PRESSURE LEVEL for scale according to which decibel measurements may be combined. Appendix D gives a conversion chart of voltage and power ratios to decibels.

Threshold of hearing	0 dB	Motorcycle (30 feet)	88 dB
Rustling leaves	20 dB	Foodblender (3 feet)	90 dB
Quiet whisper (3 feet)	30 dB	Subway (inside)	94 dB
Quiet home	40 dB	Diesel truck (30 feet)	100 dB
Quiet street	50 dB	Power mower (3 feet)	107 dB
Normal conversation	60 dB	Pneumatic riveter (3 feet)	115 dB
Inside car	70 dB	Chainsaw (3 feet)	117 dB
Loud singing (3 feet)	75 dB	Amplified Rock and Roll (6 feet)	120 dB
Automobile (25 feet)	80 dB	Jet plane (100 feet)	130 dB

Typical average decibel levels (dBA) of some common sounds.

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INVERSE-SQUARE LAW

Acoustics / Noise

The law by which the mean-square SOUND PRESSURE LEVEL varies inversely as the square of the distance from the source. The general rule of thumb is that, under ideal conditions (no reflecting surfaces or other background sound or interference), a sound level drops 6 dB for every doubling of the distance from the source. If the two distances in question are d_1 and d_2, then the decibel difference DD is:

$$DD = 10 \log (d_1/d_2)^2 = 20 \log (d_1/d_2)$$

The table below can be used to find the correction for distance such as in the case of distances quoted in noise measurement specifications, assuming ideal conditions. Take the given distance on the left-hand column and find the correction in the vertical column under the distance for which the correction is desired. Add the correction to the given level to find the corrected level.

For a discussion of environmental effects, see SOUND PROPAGATION. Note that this table applies only to point sources and FREE FIELD conditions. See: SIMPLE SOUND SOURCE.

Corrected Distance (ft)

Given Distance (ft)	3	5	10	15	20	25	30	40	50	60	70	80	90	100
3	0	- 4.4	-10.5	-14.0	-16.5	-18.0	-20.0	-22.5	-24.4	-26.0	-27.4	-28.5	-29.5	-30.5
5	4.4	0	- 6.0	- 9.5	-12.0	-14.0	-15.6	-18.1	-20.0	-21.6	-22.9	-24.1	-25.1	-26.0
10	10.5	6.0	0	- 3.5	- 6.0	- 8.0	- 9.5	-12.0	-14.0	-15.6	-16.9	-18.1	-19.1	-20.0
15	14.0	9.5	3.5	0	- 2.5	- 4.4	- 6.0	- 8.5	-10.5	-12.0	-13.4	-14.5	-15.6	-16.5
20	16.5	12.0	6.0	2.5	0	- 1.9	- 3.5	- 6.0	- 8.0	- 9.5	-10.9	-12.0	-13.1	-14.0
25	18.0	14.0	8.0	4.4	1.9	0	- 1.6	- 4.1	- 6.0	- 7.6	- 8.9	-10.1	-11.1	-12.0
30	20.0	15.6	9.5	6.0	3.5	1.6	0	- 2.5	- 4.4	- 6.0	- 7.4	- 8.5	- 9.5	-10.5
40	22.5	18.1	12.0	8.5	6.0	4.1	2.5	0	- 1.9	- 3.5	- 4.9	- 6.0	- 7.0	- 8.0
50	24.4	20.0	14.0	10.5	8.0	6.0	4.4	1.9	0	- 1.6	- 2.9	- 4.1	- 5.1	- 6.0
60	26.0	21.6	15.6	12.0	9.5	7.6	6.0	3.5	1.6	0	- 1.3	- 2.5	- 3.5	- 4.4
70	27.4	22.9	16.9	13.4	10.9	8.9	7.4	4.9	2.9	1.3	0	- 1.2	- 2.2	- 3.1
80	28.5	24.1	18.1	14.5	12.0	10.1	8.5	6.0	4.1	2.5	1.2	0	- 1.0	- 1.9
90	29.5	25.1	19.1	15.6	13.1	11.1	9.5	7.0	5.1	3.5	2.2	1.0	0	- 0.9
100	30.5	26.0	20.0	16.5	14.0	12.0	10.5	8.0	6.0	4.4	3.1	1.9	0.9	0

Decibel corrections for variations in distance from source. An example:

a sound source of 60 dB is measured at 50 feet; if the measurement were at 15 feet, the level would be 60 + 10.5 = 70.5 dB under ideal conditions.

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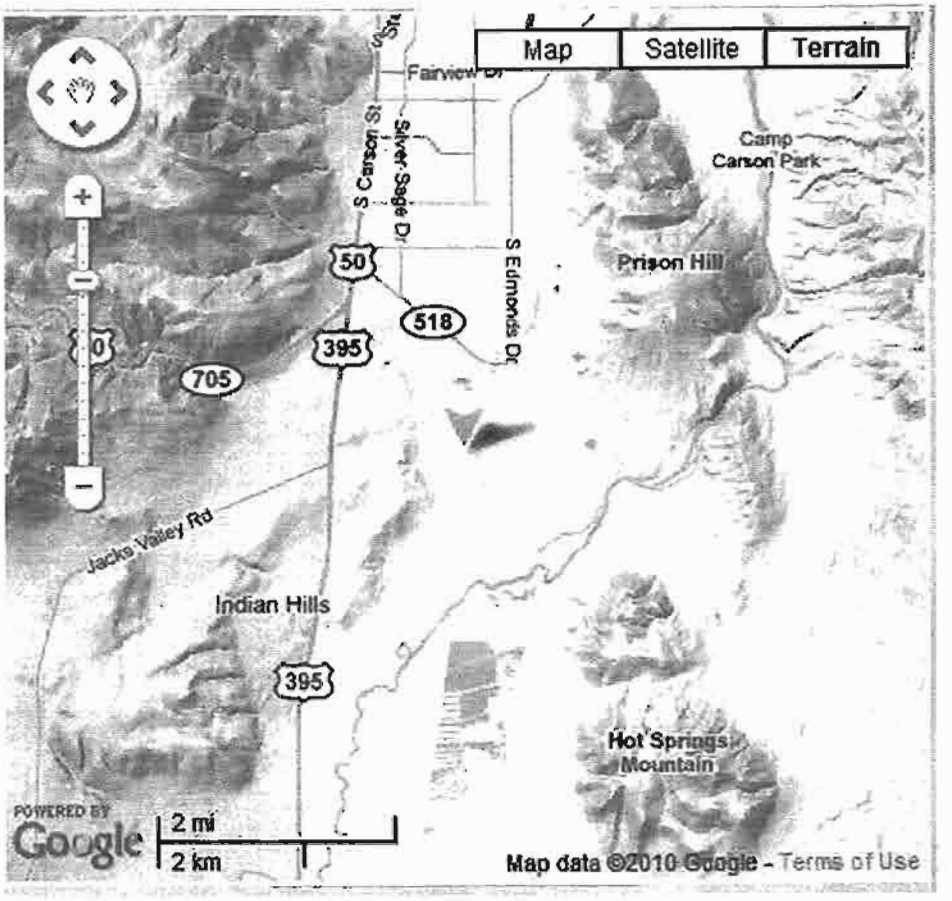
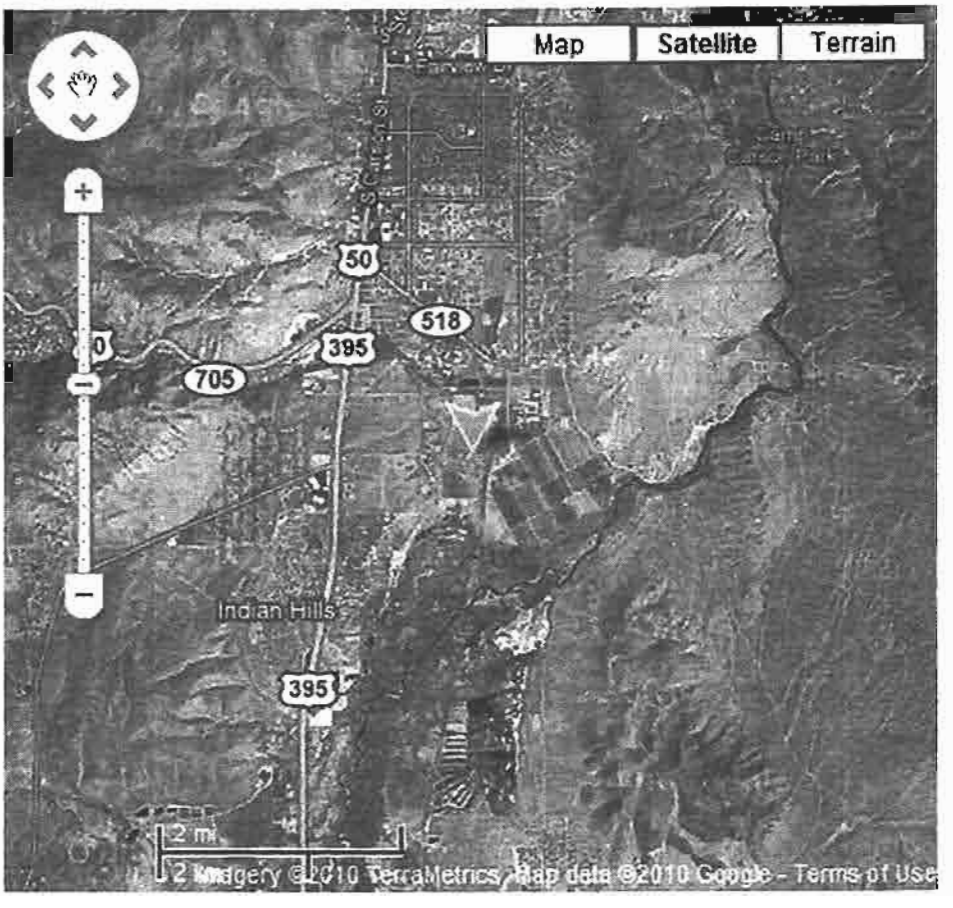
home

3 Tier Showing Location of Analsys

7300 Schulz Drive



SAT



WindCad Turbine Performance Model

BWC EXCEL-S, Grid - Intertie

Tier/neo-SH3055-23-BWC

Prepared For: **Joe Gonl**
Site Location: **7300 Schulz Drive**
Data Source: **AWEA Standard**
Date: **12/24/2010**

10 kW

Inputs:

Ave. Wind (m/s) =	4.4
Weibull K =	1.53
Site Altitude (m) =	1,500
Wind Shear Exp. =	0.200
Anem. Height (m) =	20
Tower Height (m) =	20
Turbulence Factor =	0.0%

Results:

Hub Average Wind Speed (m/s) =	4.40
Air Density Factor =	-14%
Average Output Power (kW) =	1.19
Daily Energy Output (kWh) =	28.5
Annual Energy Output (kWh) =	10,406
Monthly Energy Output =	867
Percent Operating Time =	55.4%

Weibull Performance Calculations

Wind Speed Bin (m/s)	Power (kW)	Wind Probability (f)	Net kW @ V
1	0.00	12.17%	0.000
2	0.00	14.91%	0.000
3	0.12	14.91%	0.018
4	0.37	13.42%	0.050
5	0.76	11.26%	0.085
6	1.30	8.94%	0.116
7	2.03	6.78%	0.137
8	2.96	4.95%	0.146
9	4.14	3.49%	0.144
10	5.54	2.38%	0.132
11	7.08	1.58%	0.112
12	8.64	1.02%	0.088
13	9.80	0.64%	0.063
14	10.14	0.39%	0.040
15	10.40	0.24%	0.025
16	10.47	0.14%	0.015
17	10.48	0.08%	0.008
18	10.43	0.04%	0.005
19	10.28	0.02%	0.003
20	9.86	0.01%	0.001
2008, BWC	Totals:	97.37%	1.188

Weibull Calculations:
Wind speed probability is calculated as a Weibull curve defined by the average wind speed and a shape factor, K. To facilitate piece-wise integration, the wind speed range is broken down into "bins" of 1 m/s in width (Column 1). For each wind speed bin, instantaneous wind turbine power (W, Column 2)) is multiplied by the Weibull wind speed probability (f, Column 3). This cross product (Net W, Column 4) is the contribution to average turbine power output contributed by wind speeds in that bin. The sum of these contributions is the average power output of the turbine on a continuous, 24 hour, basis.
Best results are achieved using annual or monthly average wind speeds. Use of daily or hourly average speeds is not recommended.

Instructions:

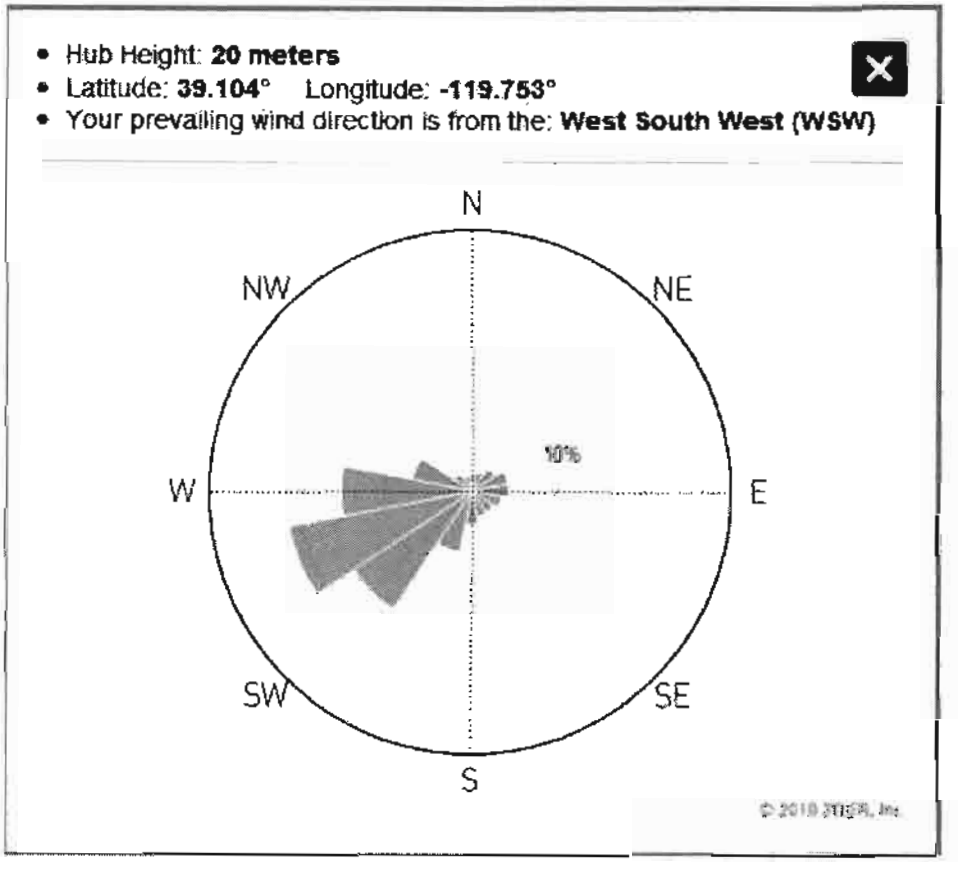
Inputs: Use annual or monthly **Average Wind** speeds. If **Weibull K** is not known, use K = 2 for inland sites, use 3 for coastal sites, and use 4 for island sites and trade wind regimes. **Site Altitude** is meters above sea level. **Wind Shear Exponent** is best assumed as 0.18. For rough terrain or high turbulence use 0.22. For very smooth terrain or open water use 0.11. **Anemometer Height** is for the data used for the **Average Wind** speed. If unknown, use 10 meters. **Tower Height** is the nominal height of the tower, eg.: 24 meters. **Turbulence Factor** is a derating for turbulence, site variability, and other performance influencing factors – typical turbulence has already been incorporated into the model. Use 0.00 (0%) for level sites with limited obstructions. Use -0.10 (negative 10%) for flat, clear sites on open water. Use 0.05 to 0.15 (5% to 15%) for rolling hills or mountainous terrain.

Results: **Hub Average Wind Speed** is corrected for wind sheer and used to calculate the Weibull wind speed probability. **Air Density Factor** is the reduction from sea level performance. **Average Power Output** is the average continuous equivalent output of the turbine. **Daily Energy Output** is the average energy produced per day. **Annual** and **Monthly Energy Outputs** are calculated using the Daily value. **Percent Operating Time** is the time the turbine should be producing some power.

Limitations: This model uses a mathmatical idealization of the wind speed probability. The validity of this assumption is reduced as the time period under consideration (ie, the wind speed averaging period) is reduced. This model is best used with annual or monthly average wind speeds. Use of this model with daily or hourly average wind speed data is not recommended because the wind will not follow a Weibull distribution over short periods. The data used in creating the power curve was generated at the BWC test site in Norman, OK. Consult Bergey Windpower Co. for special needs. ***Your performance may vary.***

3 Tier Data

wind rose
direction of winds



late info H-3

Rea Thompson - special use permit request

RECEIVED
JAN 19 2011
CARSON CITY
PLANNING DIVISION

From: George Frazier <george391@webtv.net>
To: <planning@carson.org>
Date: 1/19/2011 11:05 AM
Subject: special use permit request

reference special use permit request permit application SUP-10-114* my concerns as a vicinity property owner is the visual effects, 160 feet is very tall and how much noise will it make. I understand that they make a "whooshing" noise. George Frazier

Late Info H-3

Rea Thompson - SUP-10-114

From: Danny Akers <dannyoakers@gmail.com>
To: <planning@carson.org>
Date: 1/19/2011 4:33 PM
Subject: SUP-10-114

We are opposed to this height variance for a wind energy tower

- It would interfere with our views of the Sierras.
- Should it get blown over (highly likely in this area), it poses the danger of damage to neighboring properties and the possibility of blocking a street.

Keep it at the 60 foot height.
Danny O. Akers
Linda Gerfen

Late Info H-3

PUBLIC HEARING JAN-26-2011 5:PM
AGENDA file # SUP-10-114#

I CAN NOT BE THERE FOR THE MEETING.
BUT I AM IN FULL FAVOR OF LETTING
RAIN BOW CONSERVATION CORP / JOSEPH CONI
BUILD THERE WIND ENERGY TOWER
AT 7300 SCHULZ DR.

BEING WE LIVE AT 7177 SCHULZ DR
I FEEL THE HIEGHT IS NOT A PROBLEM
WITH OUR AREA

I WOULD ALSO LIKE RAIN BOW CON CORP
TO CONTACT US ON DOING ONE FOR US
ALSO.

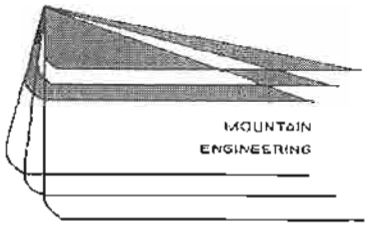
GOOD LUCK JOE ON BEING THE
FIRST IN OUR AREA TO GO WIND POWER

YOURS TRULY
WRANGLER RICH WONTO

RECEIVED
JAN 18 2011
CARSON CITY
PLANNING DIVISION

R & D RANCH
Rich Diana
Trail Rides & Horse Training
A.T.V. Rental's
Birthday Parties
7177 Schulz Drive
Carson City, NV 89702
Telephone
(775) 691-7723
Wonterski

Late Info H-3



January 24, 2011

To Whom It May Concern: Re: Review of Existing Sound Levels
7300 Schulz Drive, Carson City, NV

On January 22, 2011, I reviewed the background sound between 4:30 p.m. and 5:30 p.m. at the Goni residence located at 7300 Schulz Drive.

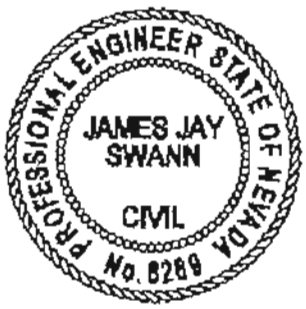
Schulz Drive has intermittent traffic with cars and small trucks producing 80 to 90 dba for up to a minute and small groups of cars extending the time. Beyond Schulz Drive and the prison are open fields. In the fields they ride dirt bikes, producing 100 db for several minutes at a time even with the sun about to set.

The average sound for the area was 60 dba consistent on all property lines. This sound was a mix of distant cars, trucks, and other motor equipment. Human voices along with opening and closing doors could be distinctly heard along with a slight breeze.

The decibel reading did not drop below 40 dba which is consistent with the slight breeze whispering through the trees, brush, and houses around the area. This breeze was too slow to run a wind generator. Any sound produced by a wind generator in this wind would likely match the telephone and power pole noises.

This was the quiet time of day on the weekend. The normal weekday sound levels would typically be higher with commuter traffic and typical neighborhood activities along with predictable afternoon breezes. There appears to be no average day where the existing sound level would fall below 25 dba.

Sincerely,



James J. Swann, P.E.

P.O Box 2078, Portola, CA 96122 (775) 831-9595 cell

Late Info H-3

RECEIVED
JAN 26 2011
CARSON CITY
PLANNING DIVISION

From: <DudleyDL@aol.com>
To: <JPruitt@carson.org>
Date: 1/26/2011 11:50 AM
Subject: SUP-10-114

Dear J Pruitt planning commission,
As this is also the route for the migration of the geese in Carson City it could be devastating to their lives or to move into the aircraft routes in Carson.
Thanks for consideration of the wildlife.
D and L Leavitt

1-25-11

Bert Wade Residence

Regards to Public Hearing
Tried to call - 775-283-7076.
No answer.

We are opposed to the -
wind energy system.

Too close to our residence -
noise and a fire hazard
a difference in taxes & Utilities etc
Thank you.

Sincerely
Bert Wade Res.

RECEIVED
JAN 27 2011
CARSON CITY
PLANNING DIVISION

BERT WADE
1307 Rabe Way
Carson City, NV 89701

FROM Bergey Website

Late Info H-3
Public comment
June 2007

BERGEY WINDPOWER

Noise Test Data for the 10 kW Bergey Excel Wind Turbine

The following noise level data was taken by NREL at the US-DOE National Wind Technology Center in Boulder, Colorado. The tests were conducted in accordance with IEC 61400-11, "Wind Turbine Generator Systems, Part 11 - Acoustic Noise Measurement Techniques". The sampling microphone was 40m (131 ft) from the base of the 37m (120 ft) wind turbine tower. The full research paper is available at http://www.bergey.com/Technical/AIAA%202004-1185.pdf

The data shows that the Excel wind turbine is less than 5 dBA above background noise, unless the inverter is off-line (e.g., power outage). Please note that wind speeds above 14 meters/second (31 miles per hour) are rare.

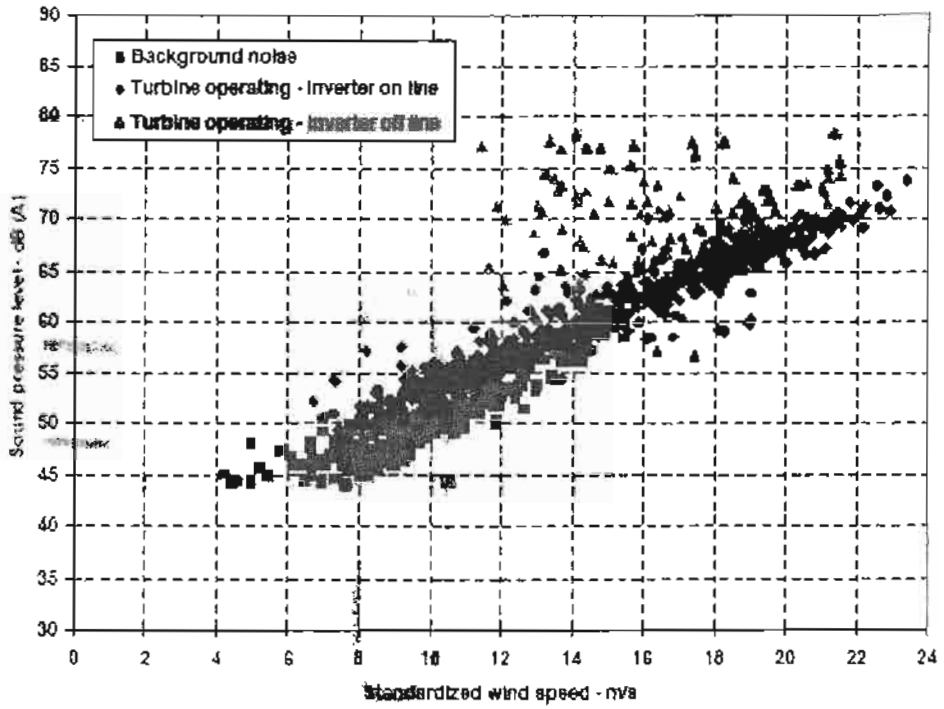


Figure 2. 10-second average sound pressure level for Bergey Excel-S with SH3052 airfoils

The American Wind Energy Association is finalizing approval of a new certification standard for small wind turbines. One parameter will be the Rated Sound Level. The Rated Sound Level is the sound level at 60 m (200 ft) that the wind turbine will not exceed 95% of the time in a 5 m/s (11 mph) average wind speed site. NREL has calculated the ratings for several small wind turbines they have tested. The results are presented below.

at 200 ft

at tower

	Wind Turbine Operating Alone		Wind Turbine Plus Background
Turbine Tested	**Sound Power Level (dBA)**	**Sound Pressure Level (dBA) at 60 m**	Sound Pressure Level (dBA) at 60 m
Bergey XL.1	78.7	38.1	50.3
Air X	85.2	44.6	51.1
Air 403	86.7	46.1	51.5
Whisper H40	91.0	50.4	53.2
Excel SH3052	93.4	52.8	54.7
NorthWind 100	97.0	56.4	57.3
AOC 15/50	102.3	61.7	62.0
~~Excel BW00~~	~~105.4~~	~~64.8~~	~~65.0~~
	10m/s wind speed - 50 dBA background		

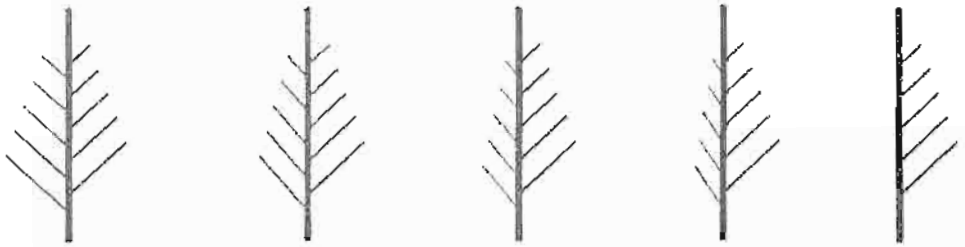
The Sound Power Level is the total noise right at the source – the top of the tower. Sound diminishes with distance. The Sound Pressure Level is the sound a listener would hear at the distance given, in this case 60m (200 ft). Note that the Excel is only adding 4.7 dBA above the background sound of 50 dBA. 50 dBA of background sound is the wind noise in a 10 m/s (22.3 mph) wind.

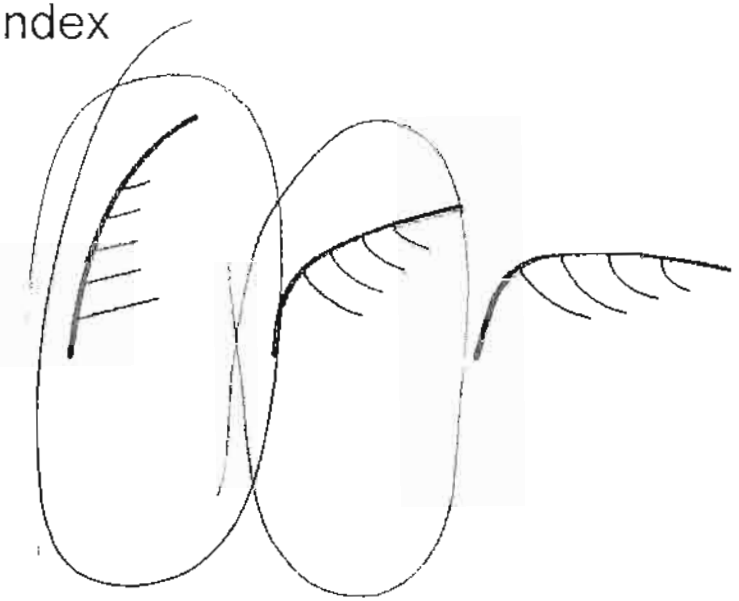
The Solar Store

How Much Wind Do I Have ?

- On Site Anemometer
- Rainbowsolar.com – Link to NREL
- NV Energy
- NASA Surface Meteorological Data
- Analysis Software e.g. 3Tier
- Biological Indicators

Griggs-Putnam Index

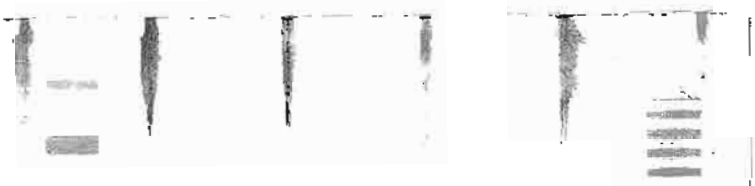




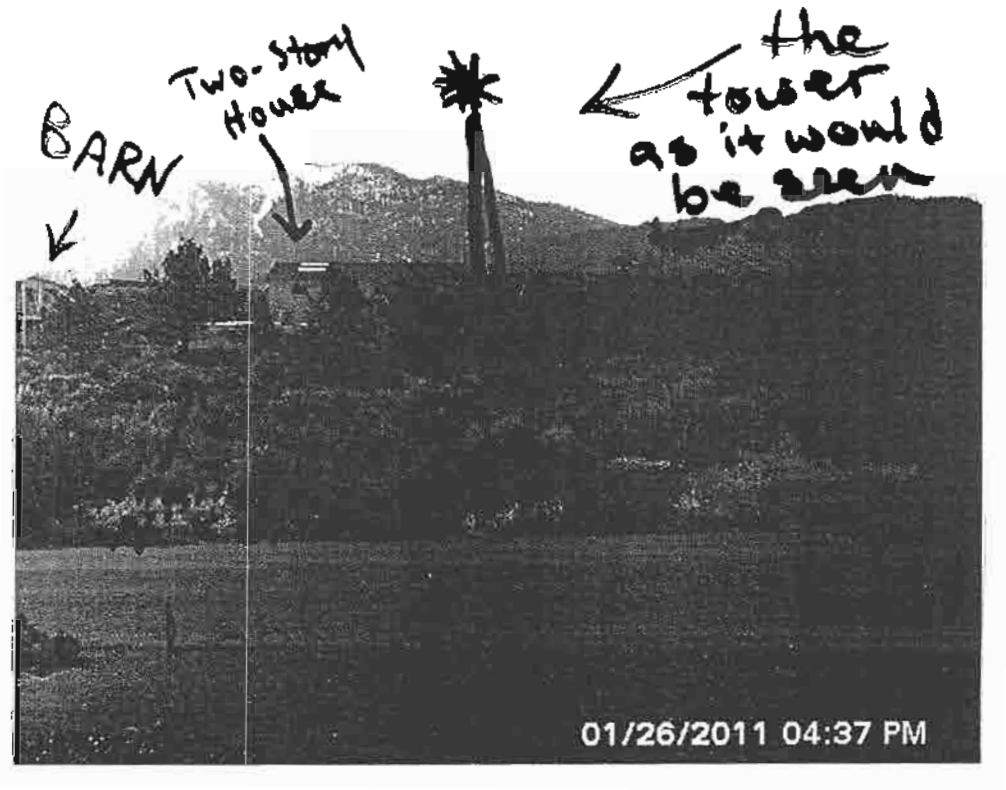

01/26/2011 12:59 PM


01/25/2011 11:54 AM

Peach Tree at
7305 Schulz Dr.
Planted 1996



Peach Tree
at 7305 Schulz Dr.
Planted 1996


BARN
Two-Story House
the tower as it would be seen
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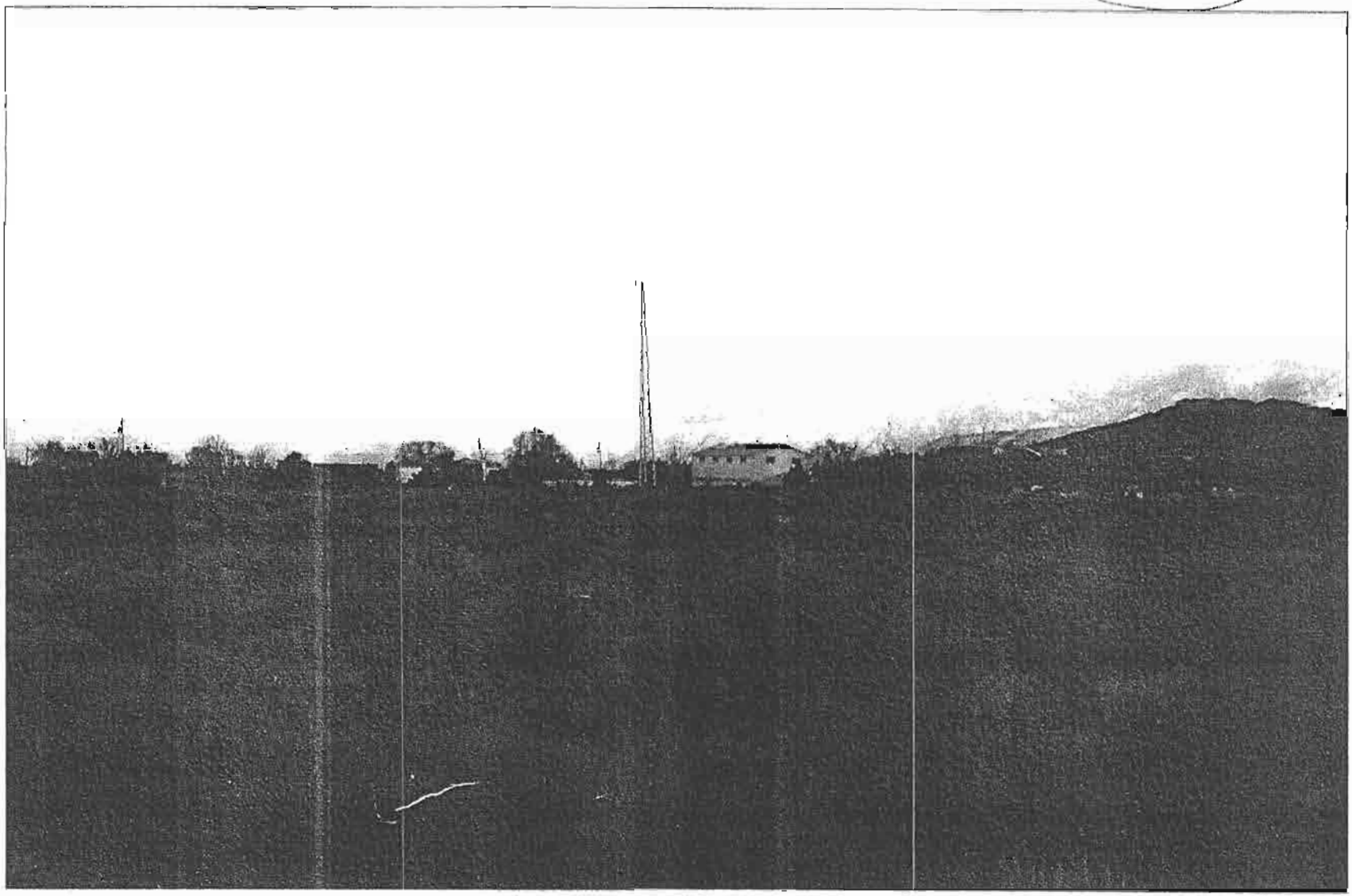
The Solar Store

Southwest

Simulated View from Racetrack & Schulz Looking West



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Preprint

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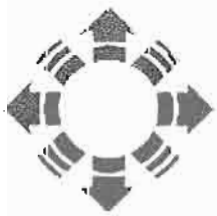

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ACOUSTIC TESTS OF SMALL WIND TURBINES*§

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ABSTRACT

Eight small wind turbines ranging from 400 watts to 100 kW in rated power were tested for acoustic emissions at the U.S. Department of Energy's National Renewable Energy Laboratory. Rigorous test procedures based on international standards were followed for measurements and data analyses. Results are presented in the form of sound pressure level versus wind speed, where the sound was recorded downwind of the turbine at a distance equal to the hub height plus half the rotor diameter. When there was sufficient separation between wind turbine noise and background noise, the apparent sound power level was calculated. In several cases, this was not possible. The implications of this problem are discussed briefly. Some of the configurations tested were specifically developed to reduce the noise level of their predecessors. Test data for these machines demonstrate marked progress toward quieter turbines.

INTRODUCTION

Until recently, wind turbine manufacturers and operators were challenged by the tasks of keeping machines operating reliably and improving energy capture. Although dramatic improvements have been made in both areas, there have been occasions when acoustic emissions proved so vexing they overshadowed performance and reliability issues. For example, some wind turbines suffer an unfavorable reputation for noise problems associated with high tip speeds, furling, or blade flutter. The U.S. Department of Energy (DOE) and its National Renewable Energy Laboratory (NREL) are engaged in several turbine research and demonstration projects focused on reducing the cost of energy at low wind speed sites. Recent analyses have shown that this effort, if successful, will lead to the installation of wind turbines in large numbers. In this circumstance, it is essential that the turbines available for deployment are quiet. This suggests there should be an effort by NREL to measure the acoustic signature of existing turbines and work diligently to reduce (below the state of the art) the signatures of new turbines being developed. Coincidentally, with recent energy shortages and the ensuing statewide deployment incentives, there is resurgent interest in small wind turbines for distributed generation. Because of the potential for installation near residences, noise may be even more important for small turbines than for large turbines installed in wind power plants.

Because small wind turbines are sold in large numbers and located close to people, there is a need for reliable noise data. If it was available, homeowners and local authorities could use the information to develop expectations regarding noise production before the turbines are actually installed. Furthermore, based on field test observations and the influence of the parameters investigated, improvements to the turbines might be made with relative ease and low cost.

As part of its aeroacoustic research program, NREL performed acoustic tests [1] on eight small wind turbines with power ratings from 400 W to 100 kW. The goals of these tests were to develop a database of acoustic signatures to compare new and existing turbines and to establish targets for low-noise rotors. Test results will be documented and disseminated in the form of NREL reports, technical papers, seminars, and colloquia. This is part of broader effort to support the U.S. wind industry in applying rational acoustic-design principles to the development and deployment of advanced wind turbines.

Tests were conducted on two Bergey *Excel* and one *XL.1* turbines, one Southwest Windpower *Whisper H40* and two *AIR* turbines, an Atlantic Orient Corporation *AOC 15/50*, and a Northern Power Systems *North Wind 100*. In some cases, more than one configuration was tested to demonstrate noise reduction techniques. Measurements were made according to procedures described in the International Electrotechnical Commission (IEC) standard for acoustic noise measurement techniques [2] with minor modifications that were necessary for small turbines. In addition to the acoustic signals, wind speed and direction, turbine power and rotor speed were measured. In this paper, results are

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presented as sound pressure level and apparent sound power level for several wind speeds of interest. In the NREL report [1], noise spectra of sound pressure level versus imission[1] frequency are also provided.

MEASUREMENTS AND DATA ANALYSES

Acoustic tests were conducted at the National Wind Technology Center (NWTC) near Boulder, Colorado. The site is located in somewhat complex terrain at an approximate elevation of 1850 m above sea level. The soil is covered with grassy vegetation and measurements indicate that the roughness length is approximately 0.05 m. A gravel mine and concrete plant to the west are the main sources of background noise, although passing automobiles and airplanes also contribute. The prevailing wind direction is 292° relative to true north.

Data were collected and analyzed according to the IEC standard [2] and NREL's quality assurance system [3] where possible. A reference microphone was located downwind of the turbine at a distance equal to the hub height plus half the rotor diameter. The microphone was placed on a circular plywood ground board that is one meter in diameter and 13 mm thick. The ground board was placed on a flat surface with no cavities beneath and the edges of the board were covered with dirt. Three additional microphones and ground boards were placed around some turbines for special tests. For this study, only data from the reference microphone were considered.

Wind speeds of 6–10 m/s were measured, although measurements were taken outside this range for some turbines. Data were obtained for both the operating and parked conditions to allow correction for background noise. In circumstances of intrusive background noise, such as airplanes, automobiles or animals, the test data were discarded.

In addition to the acoustic pressures, wind speed and direction were measured. Both were essential to the subsequent analysis, and particular importance is assigned to having the reference microphone downwind of the turbine. For some tests, rotor speed and power were also measured with the expectation that these data might provide insight regarding noise-generating mechanisms.

[1] In the study of acoustics, the term "imission" refers to the noise level perceived by an observer at a receptor location. This is in contradistinction to the term "emission" which means "something sent forth by emitting" and refers to the strength of the acoustic source.

Acoustic data were recorded on an 8-channel digital audiotape (DAT). All other data were recorded on a digital data logger. The analog microphone signals were recorded (digitally) on the DAT and then played back as analog inputs to a signal analyzer. Depending on the desired averaging period, either 1-minute or 10-second average sound pressure[2] levels were calculated. Although the IEC standard prescribes 1-minute averages, 10-second averages seem to reflect the system dynamics better for small turbines. The sound pressure levels were synchronized with the averages of the other data channels, and the average wind speed was determined for each data point then normalized to standardized conditions.

The wind speed standardization equation takes the wind speed measured at any height and roughness length and normalizes it to a "standardized" height of 10 m and a roughness length of 0.05 m. The formula used for this transformation is given in Equation (1).

$$V_s = V_z \cdot [\ln(10/0.05)\ln(H/z_0) \div \ln(H/0.05)\ln(z/z_0)] \quad (1)$$

where,

V_s	is the standardized wind speed (m/s)
V_z	is the wind speed (m/s) measured at height z
H	is the rotor center height (m)
z_0	is the roughness length of the test site (m)
z	is the wind speed measurement height (m)

Noise measurements for the operating wind turbine (wind turbine plus background noise) are correlated with background-only noise measurements at standardized wind speeds. The noise measurements are then corrected for background noise using Equation (2).

$$L_s = 10 \cdot \log\left[10^{(L_{s+n}/10)} - 10^{(L_n/10)}\right] \quad (2)$$

where,

[2] Sound is characterized by small pressure fluctuations overlaying atmospheric pressure, but the human ear does not respond linearly to the amplitude of sound pressure [4]. Doubling the amplitude produces the sensation of louder noise, but it seems far less than twice as loud. For this reason the scale used to characterize sound pressure amplitudes is logarithmic, which is an approximation of the actual response of the human ear. The definition of sound pressure level L_p is

$L_p = 10 \cdot \log\left[\bar{p}^2 - p^2_{ref}\right]$ expressed in decibels, dB.

where $\bar{p}$ is the root mean square sound pressure and p_{ref} has a value of $2 \cdot 10^{-5}$ Pa corresponding to the weakest audible sound – the threshold of human hearing – at a frequency of 1000 Hz.

L_s is the equivalent sound pressure level (dB) of the wind turbine operating alone

L_{s+n} is the equivalent sound pressure level (dB) of wind turbine plus background noise

L_n is the equivalent sound pressure level (dB) of the background noise

The background-corrected sound pressure level of the wind turbine is translated into sound power[3] level using Equation (3). The 6 dB constant accounts for the approximate doubling of sound pressure that occurs for microphone measurements on a ground board [2]

$$L_{WA} = L_{Aeq\,c} - 6 + 10 \cdot \log [4\pi R_1^2/S_0] \qquad (3)$$

where,

L_{WA} is the background-corrected A-weighted[4] apparent sound power level of the turbine, dB(A)

$L_{Aeq\,c}$ is the background-corrected A-weighted sound pressure level determined from analysis of multiple data pairs as described below, dB(A)

R_1 is the slant distance, in meters, between the microphone and the rotor center

S_0 is the reference area, $S_0 = 1\ m^2$

In practice, Equation (2) is not applied to individual data points. Instead, a large amount of data is accumulated and calculations are based on trends or averages. A linear regression is used to fit a straight line through the measured sound pressure level data for the operating wind turbine between the standardized wind speeds of 6 and 10 m/s. The process is repeated for background noise measurements. Then, the background-corrected sound pressure level is determined for a particular wind speed by subtracting the two results using Equation (2). However, according to the IEC Standard [2], if the difference in sound pressure level between the operating wind turbine and the background noise is less than 6 dB, the data may not be used for determination of the sound power level at that wind speed. If the difference is at least 6 dB, the sound power level for the turbine is calculated from Equation (3).

A second method for calculating sound power level was used in some cases. All of the acoustic data for the operating turbine and for the background noise were sorted and energy averaged in 1-m/s wind speed bins centered on integer values. A sound pressure level for the operating turbine was calculated for each wind speed if there were more than three data points in the bin. This process was repeated for background measurements. For each wind speed bin, the operating turbine noise was corrected for background noise using Equation (2). If the difference between the two was at least 6 dB, the sound power level for the wind turbine operating alone was calculated using Equation (3). This method was used for the comparisons in Table 1.

In addition to evaluating the sound power level as described above, it is useful to examine the spectra of sound pressure level versus frequency. NREL uses one of two approaches, depending upon the availability of data. Either two 1-minute spectra or twelve 10-second spectra having wind speeds closest to the reporting wind speed were energy averaged to obtain one spectrum. These narrow band spectra, so called because small incremental frequency bands were used, were reported [1] for wind speeds of 6, 8, and 10 m/s.

In some cases, the narrow band spectra were analyzed for the presences of pure tones. That information is not reported here but may be found in the individual test reports [5, 6, 7, 8]. The spectra were visually checked for the presence of possible tones. Similar spectra were developed for background noise around the same wind speeds to make sure that the peaks did not originate from the background noise. If there were no obvious tones indicated and nothing was heard during the tests, no further analysis was performed. If tones were observed, the Measnet [9] procedure was used to determine tonality. In this procedure, the critical band is identified and the tone and masking noise levels are calculated. The tonality value is the difference between the tone level and the masking noise level.

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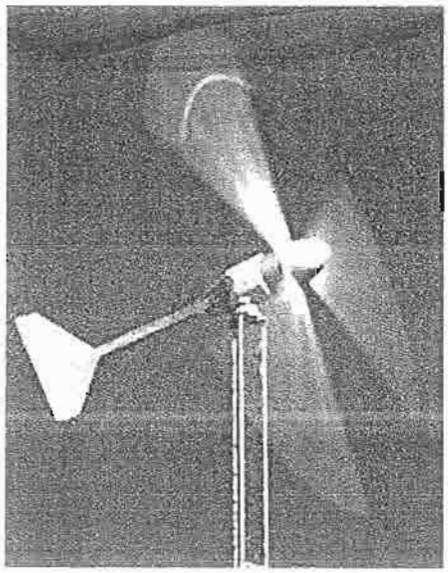
[3] Whereas sound pressure level is a property of the observer location [4], the total strength of a source of sound is characterized by the sound power emitted by the source. In general, the sound power P transmitted through a surface S is the integral of the sound intensity I (energy transmitted per unit time and unit area) over the surface. If the surface S encloses the source of the sound, then P is the total sound power emitted by the source. The definition of sound power level is

$L_w = 10 \cdot \log | P - P_{ref} |$ expressed in decibels dB.

where $P_{ref} = 10^{-12}$ watts is the standard reference sound power. The eardrum can detect incoming sound power as weak as one picowatt, and exposure to incoming sound power of more than one watt will result in some hearing loss.

[4] The ear is not equally sensitive to tones of different frequencies. Maximum response occurs between 3000 and 4000 Hz, where the hearing threshold is somewhat less than 0 dB. A 100 Hz tone, however, must have an intensity of 40 dB to be heard [4]. Therefore, weighted sound levels have been introduced where lower frequencies are de-emphasized in a manner similar to human hearing. A-weighting is most commonly used and is well suited for sound levels that are not too high

BERGEY EXCEL-S TURBINES



Bergey Windpower Company of Norman, Oklahoma, (www.bergey.com) manufactures the ***Excel-S*** (shown above), which is a three-blade upwind turbine that Bergey rates at 10 kW at a wind speed of 13 m/s. It is connected to a Bergey Gridtek inverter that provides power to the NWTC electrical grid. The ***Excel*** uses a permanent magnet alternator to produce three-phase variable frequency output at a nominal 240-volts. The three-phase output is rectified to DC power and then converted to single-phase 240-volt 60 Hz AC power in the inverter. The turbine blades are constructed of pultruded fiberglass. In high wind speeds—greater than about 16 m/s—the turbine will furl out of the wind to protect it from over-speeding.

The rotor diameter of the machine tested at the NWTC was 7 m and its hub height was 36.5 m. The slant distance of the microphone, an important parameter in Equation (3), was 54.5 m. To better reflect the dynamics of the turbine, 10-second averages were used instead of 1-minute averages. Wind speed was measured at hub height and standardized using Equation (1).

The Bergey ***Excel*** operates both loaded and unloaded, a condition defined by whether or not it is connected to the load. The load in this case was the utility grid. Because the operating condition has a strong influence on the noise characteristics, measurements were taken under both conditions.

Figure 1 shows the measured sound pressure levels for an earlier version of the ***Excel*** with BW03 airfoils. The graph also shows sound pressure levels measured when the inverter was offline (turbine was unloaded) for all or part of the 10-second averaging period. In this situation, the noise level increases approximately 4 dB(A) to 5 dB(A) compared to the turbine loaded. The apparent sound power level at 8 m/s, a common comparison point for wind turbines, was found to be 98.4 dB(A).

The ***Excel*** was also tested with a second blade set that had a reduced rotor diameter of 6.17 m, an opposite direction of rotation, and a Selig-Hanley SH3052 airfoil. The slant distance from the turbine to the microphone was the same as for the previous BW03 tests. Figure 2 shows a dramatic reduction in measured noise for this configuration. For example, in the range of 8 – 14 m/s the sound pressure level of the operating turbine was reduced by approximately 10 – 15 dB(A).

Although the turbine noise could not be separated from the background noise for the SH3052 blades (Figure 2), the sound pressure level can be compared directly to the BW03 blades (Figure 1), because the slant distance was identical in both tests, and the background noise levels were virtually the same. In high wind conditions, both configurations became noisy when the inverter was offline and the unloaded rotor increased speed. Thus, it is desirable to prevent the inverter from going offline under normal operating conditions, a feature that was not characteristic of the turbine tested at the NWTC.

SOUTHWEST WINDPOWER AIR TURBINES

Southwest Windpower, Inc., of Flagstaff, Arizona, (www.windenergy.com) produces the ***AIR 403*** (shown above), a three-blade upwind turbine with a manufacturer's rated power of 400 watts at 12.5 m/s. The DC output of the turbine was connected to a DC bus that was also connected to a battery bank and an Enermaxer. This device maintained the DC bus voltage at a constant 13.2 volts to prevent the turbine from shutting

down when the batteries were fully charged. The *AIR 403* is a free yaw turbine that employs aero-elastic stall, also known as flutter, for over-speed protection.

The machine tested at the NWTC had a rotor diameter of 1.14 m and a hub height of 13.3 m. The anemometer was mounted on a boom from the same tower. The microphone at the reference position was located at a slant distance of 19.1 m.

Figure 3 shows the measured sound pressure level for the *AIR 403*. Three patterns are distinguishable. At higher wind speeds, the turbine flutters as a means of over-speed control. Green triangle markers indicate the 10-second time periods during which the blades experienced flutter. Small horizontal bars on the markers indicate continuous flutter. The 10-second time periods during which the blades did not flutter are indicated with blue diamond markers. It appears that flutter increases the noise of the turbine approximately 10 – 12 dB(A). The apparent sound power level at 8 m/s, when the blades do not flutter, was found to be 81.2 dB(A).

We were not able to collect background noise data at higher wind speeds nor calculate the sound power level when the blades flutter. However, we estimated a background noise level of 65 dB(A) by extrapolating the available data to 20 m/s. By binning data between 18 and 20 m/s, we estimated a sound power level of 112.5 dB(A) for the blades in flutter, which is quite loud.

To mitigate the impact of this blade flutter, Southwest Windpower developed a new version of the turbine called *Air X*. The *Air X* controller causes the blades to stall if the rotor speed or DC voltage exceed set limits. A marine version of this turbine was tested at the NWTC. The distinctions from the standard version are corrosion protection and sealed electronics.

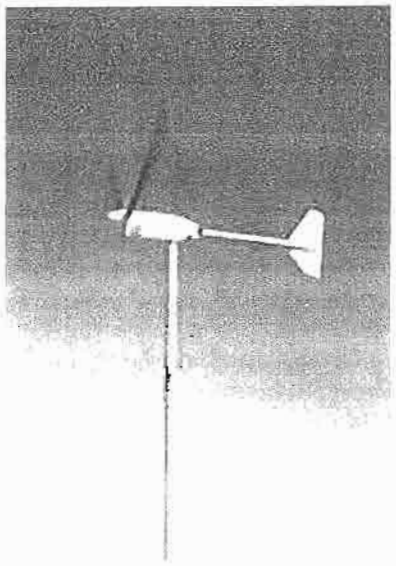
The measured sound pressure level of the *AIR X* is shown in Figure 4. During normal operation, when the blades are not fluttering, two groups of data can be distinguished. One group, which is representative of power production mode, is plotted above the background noise level. A second group overlays the background noise level, shown in this plot with open symbols. This lower noise level—sometimes as much as 10 dB(A) lower—occurs when the turbine is operating in stall mode or automatic shutdown mode. This is caused by the turbine controller attempting to limit the rotor speed. In turbulent winds, which are typical of the NWTC test site, rotor speed control is not precise. Therefore, the 10-second averages do not always reflect the same rotor speed.

If a curve fit or a bin analysis is performed using the entire set of normal operation data, the resulting sound pressures will be mix of normal operation, stall mode, and parked data. This procedure would underestimate the noise level an observer would experience during the normal power production mode.

Figure 4 exhibits a curious trend between 6 and 10 m/s, where the sound pressure level is unexpectedly low. Repeated reviews of the test data failed to provide an explanation for this behavior, although it is likely to be a result of the controller limiting rotor speeds.

In comparing Figures 3 and 4, it is evident that the control strategy implemented on the *AIR X* was successful in reducing the occurrence of flutter-induced noise.

BERGEY XL.1 TURBINE



The Bergey *XL.1* (shown above) is a three-blade upwind turbine with a manufacturer's rated power of 1 kW at a wind speed of 11 m/s. A permanent magnet generator produces three-phase variable frequency output that is rectified to 24 volts DC. The turbine uses sideways furling for over-speed protection. It has a rotor diameter of 2.5 m and a hub height of 9 m. The microphone at the reference position was located at a slant distance of 13.8 m.

Figure 5 shows the measured sound pressure level for the *XL.1*. The measured values are quite low and the apparent sound power level at 8 m/s cannot be reported because the turbine noise level could not be separated from the background noise.

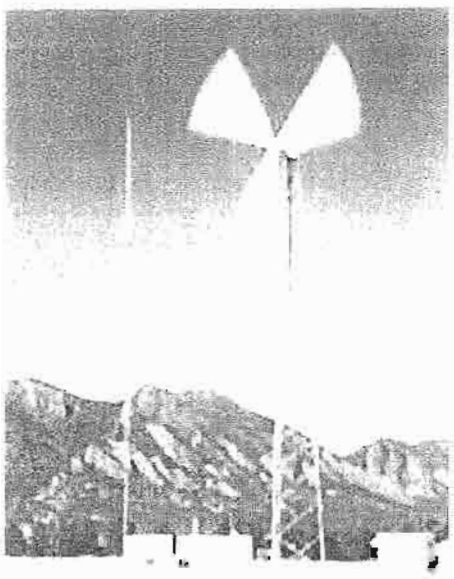
SOUTHWEST WINDPOWER
WHISPER H40

The ***Whisper H40*** (pictured above) is a three-blade upwind turbine with a rated power of 900 watts at a wind speed of 12.5 m/s. As tested, the turbine had its 24-volt DC output grid connected via a Trace SW4024 inverter. Power and over-speed control are by a patented "angle governor" that combines horizontal and vertical furling.

The Whisper's rotor diameter was 2.1 m and hub height was 9.1 m. The microphone at the reference position was located at a slant distance of 13.6 m. Test data were averaged over 10-second periods instead of 1-minute periods to better characterize the noise at higher wind speeds when the turbine employs over-speed control. Wind speed measurements, which were obtained from a hub-height anemometer located on a compass heading of 292° from the turbine, were standardized to the reference height of 10 m.

Figure 6 shows the measured sound pressure level for the ***Whisper H40***. There was sufficient separation between the turbine and background noise to determine the apparent sound power level at 8 m/s. It was found to be 84.9 dB(A).

ATLANTIC ORIENT CORPORATION
AOC 15/50 TURBINE

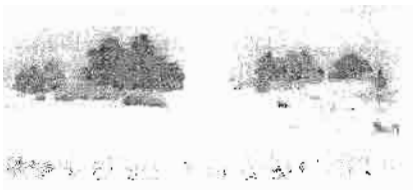


The Atlantic Orient Corporation, of Norwich, Vermont, and Charlottetown, Prince Edward Island, Canada, (www.aocwind.net) manufactures the ***AOC 15/50*** wind turbine (pictured above). It is a three-blade, downwind, free yaw machine with a rated power of 50 kW at 12 m/s. Its fixed-pitch, constant speed, stall-regulated, 15-m diameter rotor employs 7.2-m wood-epoxy blades manufactured by Aerpac/Merrifield Roberts. The rotor is mounted on the gearbox low-speed shaft, and the three-phase induction generator is connected to the gearbox high-speed shaft. The tower is a 24.4-m high, freestanding, three-leg lattice steel structure that provides a hub height of 25 m.

The turbine employs three independent brake systems. Electro-magnetically controlled tip plates are installed on the blade tips to provide aerodynamic braking. A capacitor/resistor network provides dynamic braking, and a mechanical brake is used for parking the rotor.

Figure 7 shows the measured 1-minute average sound pressure levels as a function standardized wind speed. The slant distance of the microphone was 41.2 meters. The apparent sound power level at 8m/s was found to be 101.1 dB(A) [6].

NORTHERN POWER SYSTEMS NORTH WIND 100 TURBINE



Northern Power Systems of Waitsfield, Vermont, (www.northernpower.com) manufactures the ***North Wind 100*** (shown above), a three-blade upwind turbine with a rated power of 100 kW at 13 m/s. Its fixed pitch, variable speed, stall controlled, 19.1-m diameter rotor employs modified ERS 0100 blades manufactured by TPI Composites. The test turbine was mounted on a 23.4-m tubular steel tower that provides a hub height of 25.0 m. The grid-connected turbine uses a direct-drive (no gearbox) salient pole synchronous generator and is specially designed to operate in very cold climates.

Figure 8 shows the measured 1-minute average sound pressure level for the ***North Wind 100***. The slant distance of the microphone was 42.0 meter. There was no difficulty obtaining the 6 dB separation between turbine and background noise [8], and the apparent sound power level at 8 m/s was found to be 93.8 dB(A).

Aeroacoustic emissions are a strong function of size. With a diameter of 19.1m, the ***North Wind 100*** is larger than others in the test group. Comparisons [10] to similar turbines indicate that its sound pressure level is typical for machines of its size.

COMPARISON OF TESTED TURBINES

We wish to compare the acoustic signatures of all the turbines on a common basis, but owing to the difficulty of separating wind turbine noise from background noise for the quieter machines, a complete database is not available for all the turbines tested. For example, as noted above, it was not possible to calculate an apparent sound power level for the Bergey ***XL.1***. Still, important observations may be made from the data that are available. Table 1 and Figure 9 provide this information.

The ***AOC 15/50*** and the early version of the ***Excel*** with BW03 blades have the highest noise levels of the turbines tested. Because it was one of the largest turbines tested, we expected the ***AOC 15/50*** to be somewhat noisier. Test engineers also observed that mechanical noise was more prevalent than on other turbines. Furthermore, the ***AOC 15/50*** employs tip plates that are likely to add aeroacoustic noise. In support of this hypothesis, we note that tests of an ***AWT-26*** turbine at the NWTC measured an increment of almost 2 dB(A) for similar tip plates. These tests were conducted with a tip plate on one blade and conventional tip on the other, thus leaving no question of differences in test conditions or instrumentation.

Significantly, improvements made to the ***Excel*** reduced acoustic emissions to the point that turbine noise could not be separated from background noise. For this reason, the ***Excel*** with SH3052 airfoils does not appear in Figure 9, but Figures 1 and 2 corroborate this assertion.

The ***Air 403*** data do not exhibit the smooth trends of the other turbines. By listening to the sound recordings, we learned that several of the measurements actually captured the noise of the blades in flutter. Figure 3, which was discussed previously, clearly illustrates this.

Considering the difficulties introduced by variations in background noise, it is interesting to compare the levels from different tests. Several of these are shown in Figure 10, where it can be seen that a range of 10 dB(A) is typical for most wind speeds. It appears that the variation in background noise is greater at low wind speeds than at high wind speeds where the noise of the wind itself masks some of the other constituents of background noise. We also observed that at low wind speeds, the highest background noise levels correspond to the test sites closest to the concrete plant. This was expected because of the relationship between sound pressure level and the distance from the source, as seen in Equation (3). Recognizing the importance of a quiet site for acoustic testing, we are exploring other locations at the NWTC (further from known noise sources) for future tests.

SUMMARY

A series of field tests were conducted to measure the acoustic noise of several small wind turbines. Rigorous procedures for both testing and data analyses were followed. Because the NWTC is a turbulent site, the wind turbines, some of which have temperamental controls sometimes have different acoustic signatures on different days even at the same wind speed. Particularly vexing is the variation in background noise and the inability to separate it from turbine noise for the quieter machines. This has prompted NREL researchers to seek quieter sites that are less susceptible to background noise variations.

In considering individual turbines, we conclude that for the Bergey ***Excel*** and Southwest Windpower ***AIR*** turbines, the manufacturers' efforts to reduce noise through the use of new airfoils or control techniques have resulted in quieter turbines.

In normal operation, the ***Excel*** turbine with SH3052 blades exhibits significantly lower noise than its predecessor with BW03 blades. NREL researchers attribute this improvement to the new airfoils and reduced tip speed owing to smaller rotor diameter. In high wind conditions and unloaded (inverter offline), both turbines become much noisier.

In normal power-production mode, the ***AIR 403*** and the ***AIR X*** exhibit similar noise characteristics. In high wind conditions, when the blades flutter, the ***AIR 403*** becomes much noisier than in normal operation. Control improvements in the ***AIR X***, which stall the blades when rotor speed exceeds set limits, reduced the occurrence of this flutter-induced noise.

For the ***Excel*** with SH 3052 blades, the ***XL.1***, and the ***Whisper H40*** at virtually all wind speeds above 7 m/s, separation between operating turbine and background noise levels was less than 6 dB(A)

ACKNOWLEDGEMENTS

Conducting multiple test campaigns over many years while maintaining scientific rigor is a formidable challenge. Arlinda Huskey and Jeroen van Dam spent countless hours calibrating instruments, setting up experiments, some in miserable weather, listening to recordings; analyzing and plotting data; and writing reports. It is difficult to overstate their accomplishments as documented in this paper and the NREL report [1].

REFERENCES

[1] Migliore, P., van Dam, J. and Huskey, A., (2003). *Acoustic Tests of Small Wind Turbines*. NREL SR-500-34601. Golden, CO: National Renewable Energy Laboratory

[2] International Electrotechnical Commission, First Edition, (1998). International Standard IEC 61400-11, "Wind Turbine Generator Systems – Part 11: Acoustic Noise Measurement Techniques".

[3] NREL National Wind Technology Center, (2001). "Test Manual for the Acoustics Testing of Wind Turbines per ISO Guide 25, 1990".

[4] Wagner, S., Bareiß, R. and Guidati, G, (1996). "Wind Turbine Noise," Springer-Verlag, Berlin, pp. 14-21

[5] Huskey, A. and Meadors, M., (2001). *Wind Turbine Generator System, Acoustic Noise Test Report for the Whisper H40 Wind Turbine.*

[6] Huskey, A. and van Dam, J., (2003), *Wind Turbine Generator System, Acoustic Noise Test Report Revision 1 for the AOC 15/50 Wind Turbine*, NREL Test Report.

[7] Huskey, A. and Meadors, M., (2003). *Wind Turbine Generator System, Acoustic Noise Test Report for the Bergey Excel Wind Turbine*, NREL Test Report

[8] Huskey, A. and Meadors, M., (2002). *Wind Turbine Generator System, Acoustic Noise Test Report for the NW100 Wind Turbine*, NREL Test Report

[9] "Measnet Acoustic Noise Measurement Procedure", (1997) www.measnet.org

[10] van Dam, J., (1999). *"Trend in de akoestische bronsterktes van windturbines" (Trend in the acoustic sound power level of wind turbines)*, Energieonderzoek Centrum Nederland (Energy Research Center of the Netherlands ECN), Proceedings of the Netherlands Renewable Energy Conference.

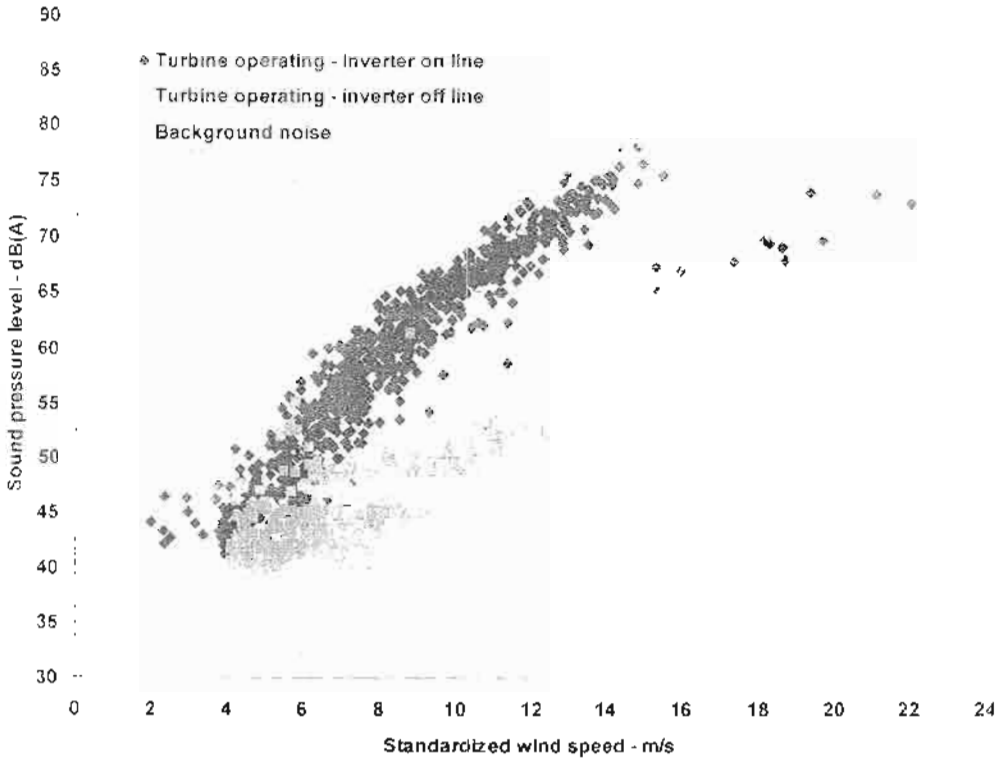


Figure 1. 10-second average sound pressure level for Bergey Excel-S with BW03 airfoils

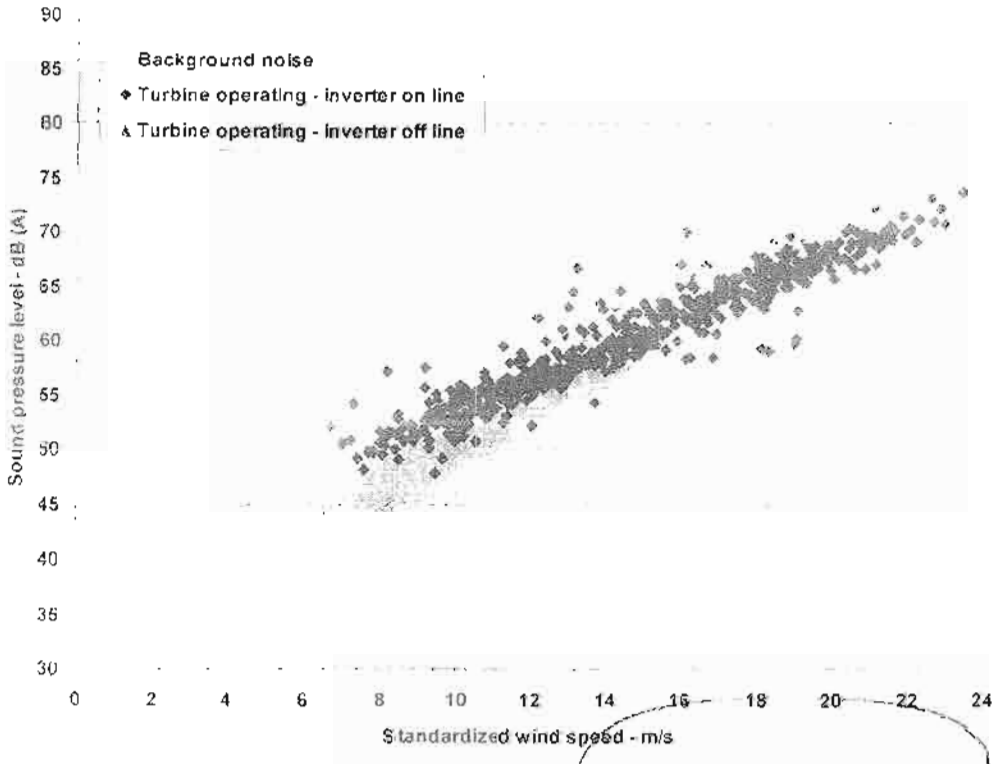


Figure 2. 10-second average sound pressure level for Bergey Excel-S with SH3052 airfoils

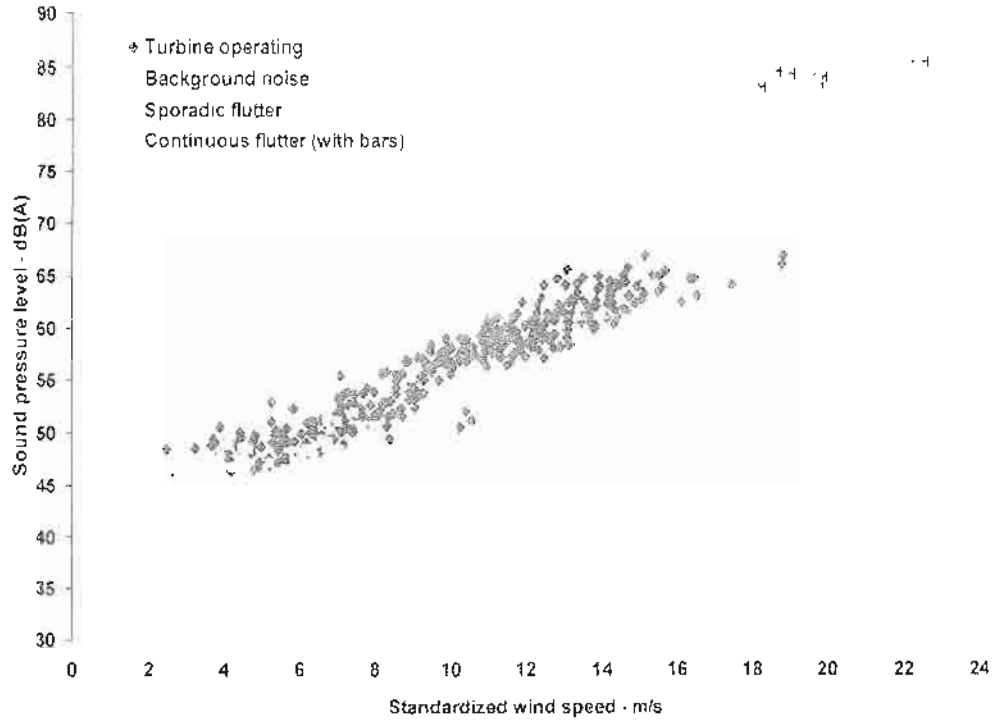


Figure 3 10-second-average sound pressure level for Southwest Windpower AIR 403

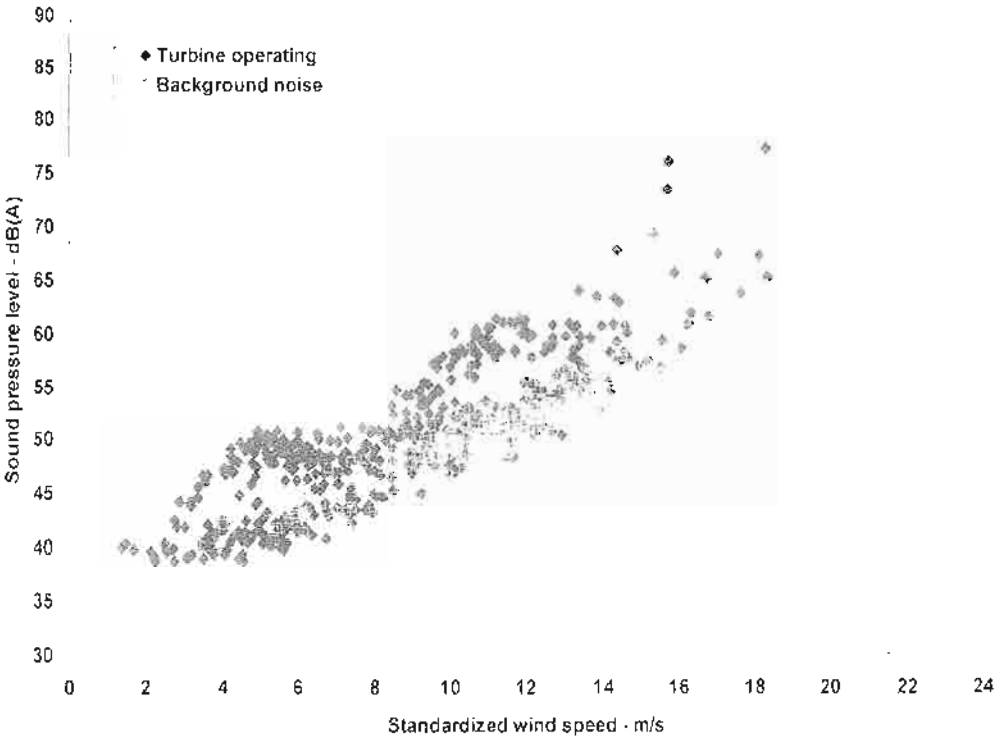


Figure 4. 10-second average sound pressure level for Southwest Windpower AIR X

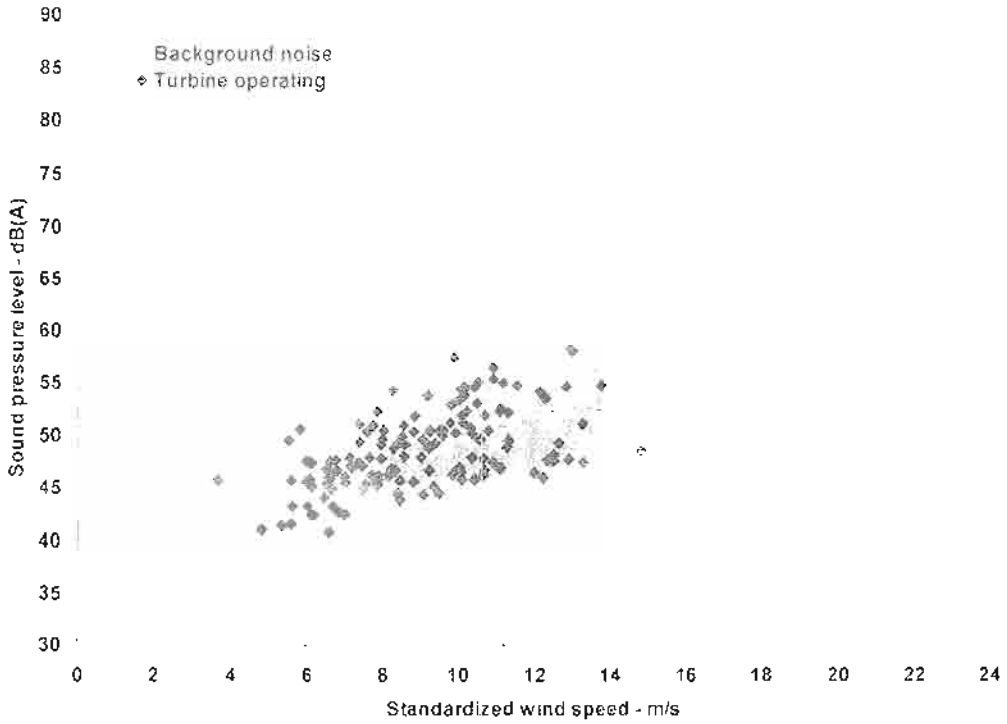


Figure 5. 10-second-average sound pressure level for Bergey XL 1

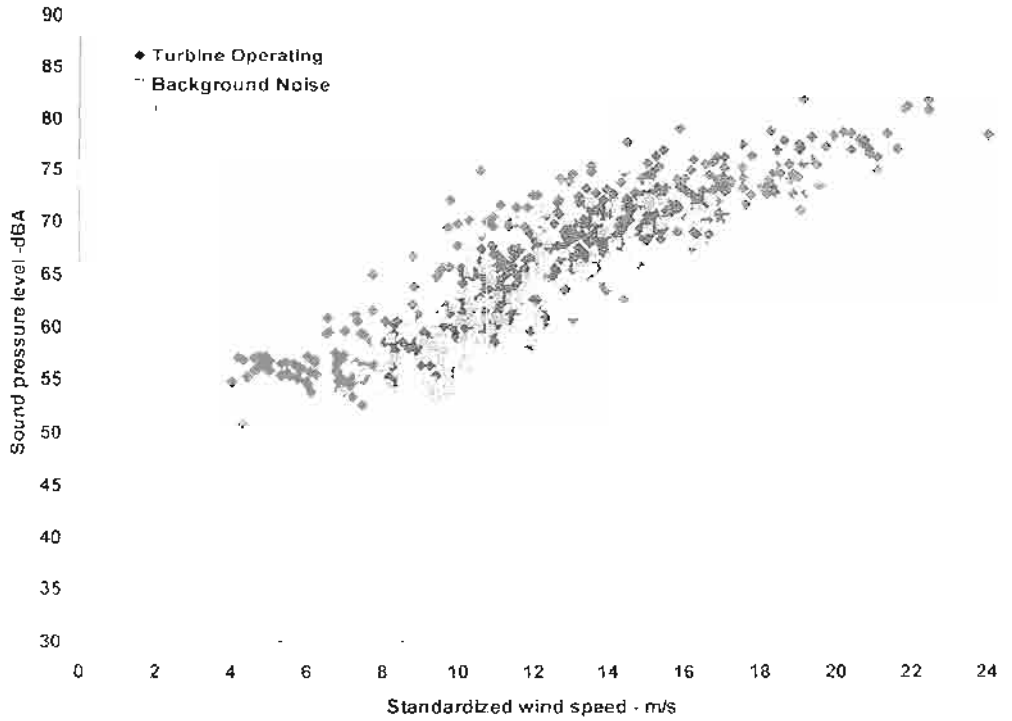


Figure 6 10-second-average sound pressure level for Southwest Windpower Whisper H40

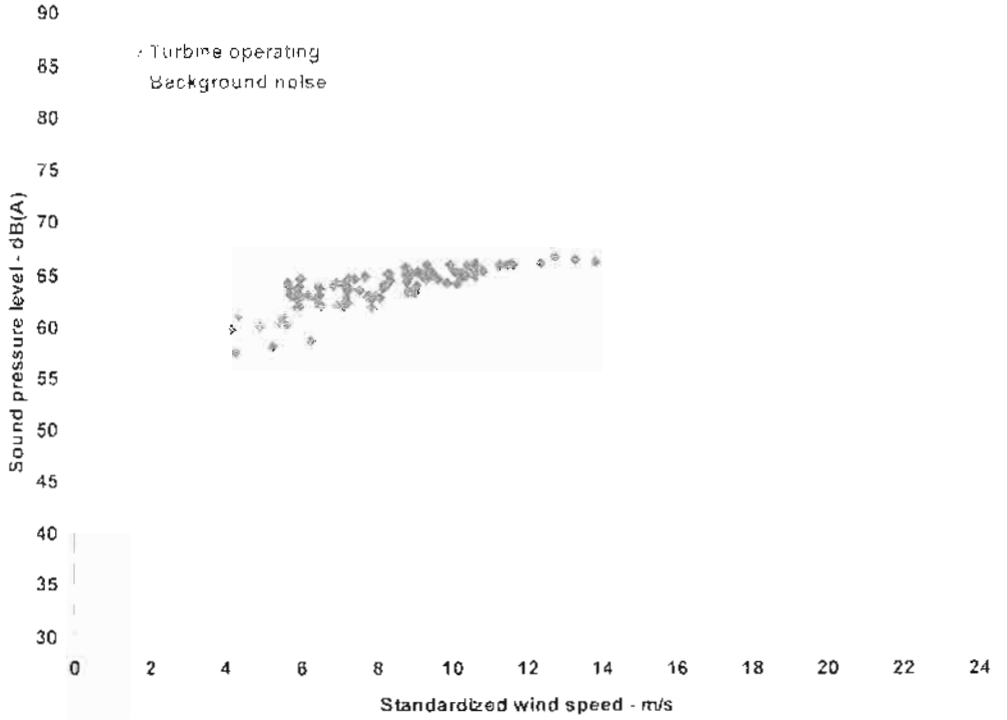


Figure 7. 1-minute-average sound pressure level for Atlantic Orient Corporation AOC 15/50

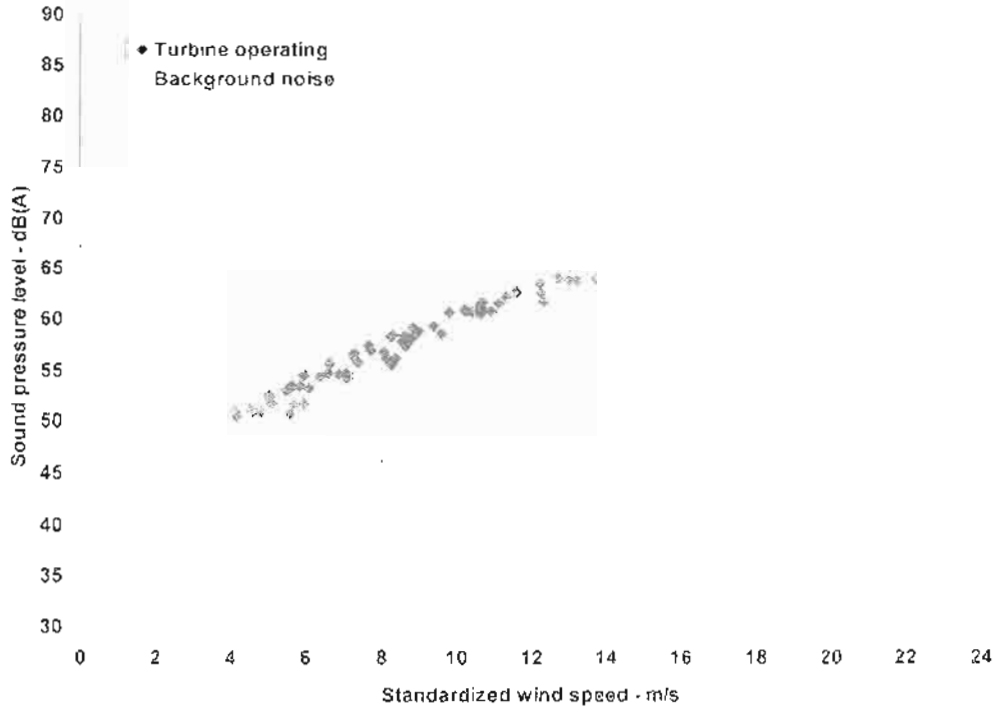


Figure 8 1-minute-average sound pressure level for Northern Power Systems North Wind 100

	Wind Speed (m/s)													
	3	4	5	6	7	8	9	10	11	12	13	14	15	16
AIR 403	--	--	--	--	--	*80.9*	*84.2*	*86.7*	*92.9*	*90.5*	*97.7*	*98.0*	--	--
AIR X	*73.1*	*76.6*	*78.8*	*77.7*	*77.5*	**	*81.3*	*85.2*	*88.9*	*90.0*	*88.8*	*92.0*	*94.0*	*101.6*
Whisper H40		*82.6*	*83.8*	*82.8*	*83.5*	*85.3*	*87.4*	*91.0*	*92.4*	**	*96.3*	**	**	**
XL.1	--	--	--	**	**	**	*75.8*	*78.7*	*78.0*	**	*80.8*	--	--	--
Excel BW03	--	**	*87.2*	91.0	96.1	99.5	102.2	105.4	107.6	109.8	112.2	--	--	--
Excel SH3052	--	--	--	--	*90.7*	*90.7*	*92.3*	*93.4*	*95.1*	*96.9*	*99.0*	*100.3*	*101.5*	--
AOC 15/50	--	96.9	96.9	100.1	100.8	--	101.9	--	--	--	--	--	--	--
North Wind 100	--	--	--	89.6	91.9	93.9	95.1	97.6	98.1	99.6	100.8	--	--	--

-- *Insufficient data are available*

** *Separation between operating turbine and background noise is less than 3 dB*

b Numbers in italics have separation between operating turbine and background noise of between 3 and 6 dB

Table 1. Apparent sound power level for turbines with at least 3 dB(A) separation from background noise. Values were obtained by the bin analysis method described on page 3

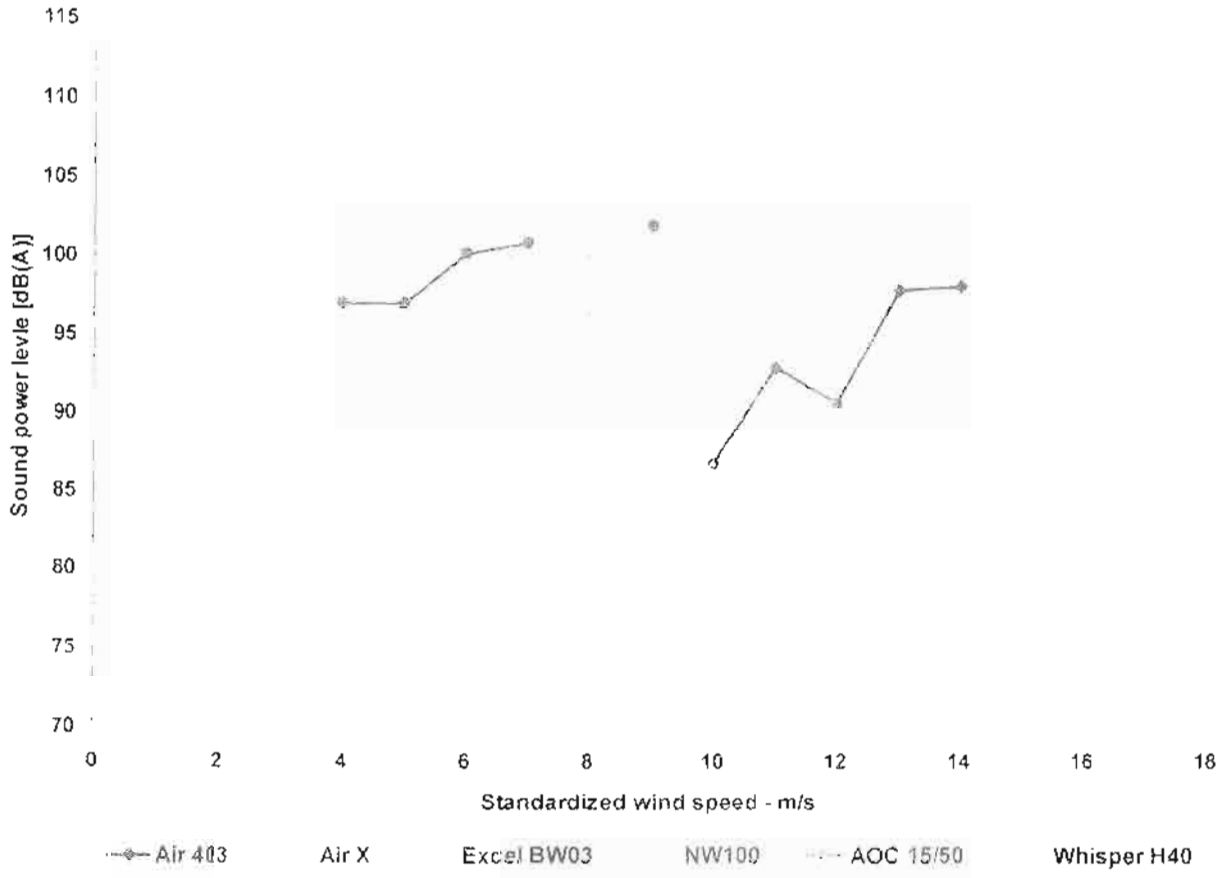


Figure 9 Apparent sound power level for turbines with at least 6 dB(A) separation from background noise. Values were taken from Table 1.

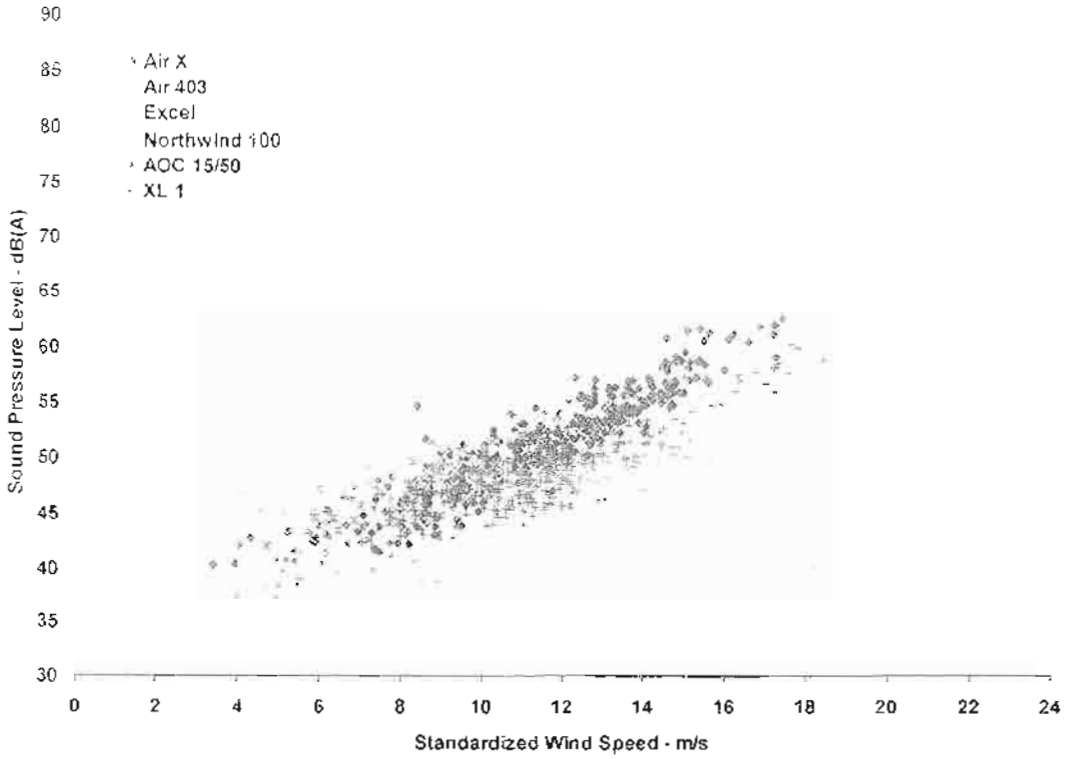


Figure 10. Background sound pressure level for several of the turbines tested.

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13. ABSTRACT *(Maximum 200 words)*

Eight small wind turbines ranging from 400 watts to 100 kW in rated power were tested for acoustic emissions at the U.S. Department of Energy's National Renewable Energy Laboratory. Rigorous test procedures based on international standards were followed for measurements and data analyses. Results are presented in the form of sound pressure level versus wind speed, where the sound was recorded downwind of the turbine at a distance equal to the hub height plus half the rotor diameter. When there was sufficient separation between wind turbine noise and background noise, the apparent sound power level was calculated. In several cases, this was not possible. The implications of this problem are discussed briefly. Some of the configurations tested were specifically developed to reduce the noise level of their predecessors. Test data for these machines demonstrate marked progress toward quieter turbines.

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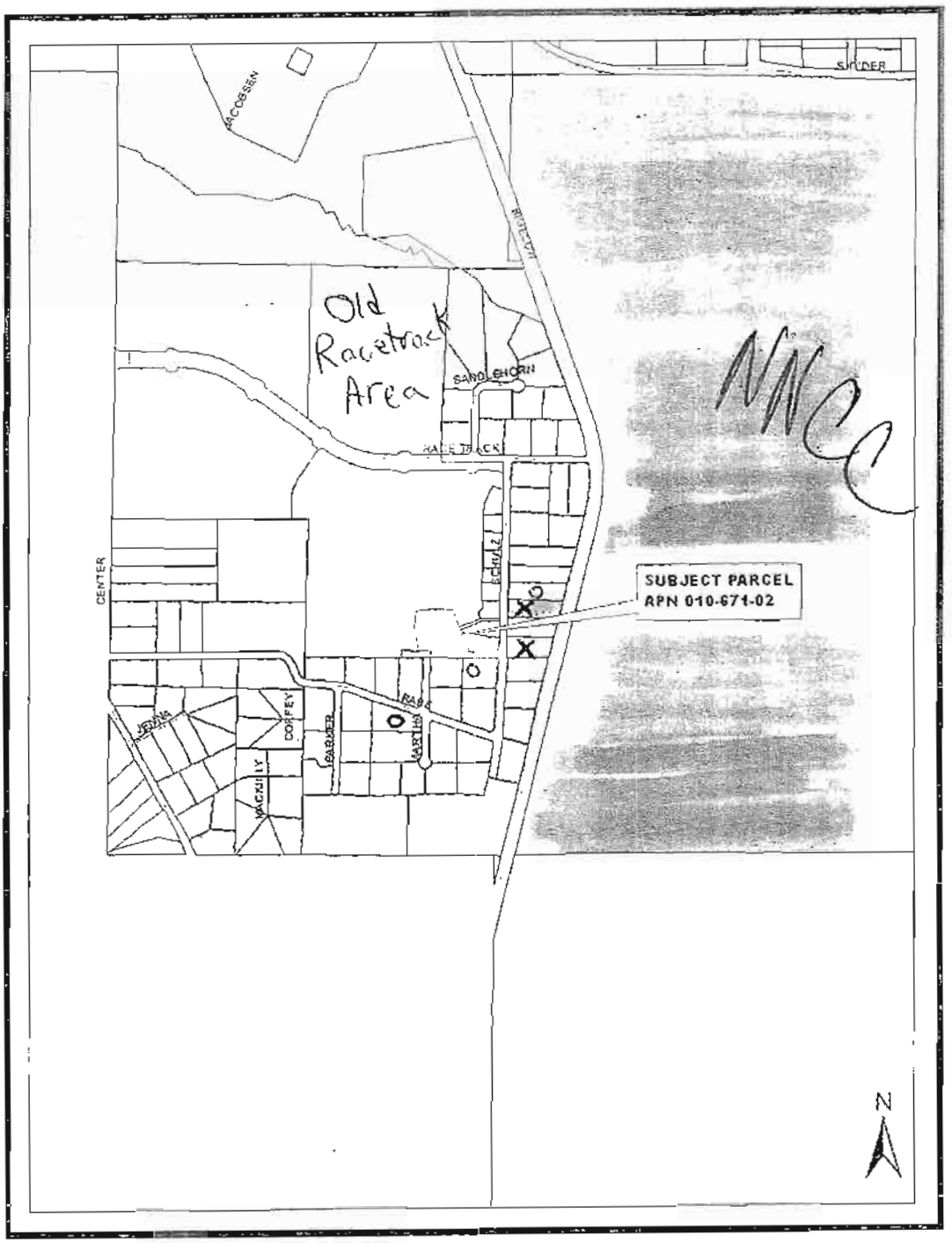

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E

S

Occupied Homes
My House
Undeveloped Land
N. Nv. Correctional Center

X = Disabled Person Residence

O = Elderly Residence

Rea Thompson - SUP-10-114 special use permit

From: George Frazier <george391@webtv.net>
To: <planning@carson.org>
Date: 2/21/2011 10:13 AM
Subject: SUP-10-114 special use permit

File No. SUP-10-114?Misc-11-009 request for height variance for wind tower. I think that the adopted standards for wind energy systems adopted in 2009 should be adhered to with no variance allowed. George R Frazier