PUBLIC UTILITIES COMMISSION
505 VAN NESS AVENUE
SAN FRANCISCO, CA 94102-3298

Mr. Jeffrey Durocher
Wind Permitting Manager
Iberdrola Renewables
1125 NW Couch Street, Suite 700
Portland, OR 97209
(sent via email: Jeffrey.Durocher@iberdrolaren.com)

March 30, 2011

Subject: Tule Wind Project - Data Request No. 14

Dear Mr. Durocher:

The California Public Utilities Commission (CPUC) requests additional information in support of the East County Substation, Tule Wind, and Energia Sierra Juarez Gen-Tie Projects Final EIR/EIS. Please provide information requested in Attachment A, which is based on the comment letters received during the Draft EIR/EIS public comment period. Copies of the comment letters can be found on the CPUC website, specifically at: *www.cpuc.ca.gov/environment/info/dudek/ECOSUB/ECOSUB_Comments.htm*.

We would appreciate your response to this data request no later than April 22, 2011, if not sooner. Please note earlier dates for the water and GIS data requests noted in Attachment A. If you have any questions regarding this letter or need additional information, please contact me by phone at 415.355.5580 or by e-mail at iain.fisher@cpuc.ca.gov.

Sincerely,

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Iain Fisher
Energy Division
California Public Utilities Commission

cc: Greg Thomsen, BLM (GThomsen@blm.gov)
Thomas Zale, BLM (Thomas_Zale@blm.gov)
Jeffery Childers, BLM (Jeffery_Childers@blm.gov)
Patrick O’Neill, HDR (Patrick.O'Neill@hdrinc.com)

Attachments A and B

Noise

The following data requests are based on various comment letters received during the Draft EIR/EIS public comment period. Several of the recurring comments in regard to noise were summarized in a letter from Richard James of E-Coustic Solutions; therefore, this letter is provided in Attachment B.

1. Please explain the characteristics of audible and inaudible sound as they relate to wind turbines, as well as a discussion regarding the appropriate metric for measuring both.

2. Please provide an explanation of the general level and amount of low frequency noise generated by wind turbines and how it compares to other noise sources. Please also respond to the comment that low frequency sound increases as the distance from wind turbines increases.

3. Please provide an explanation regarding how the existing ambient sound levels were calculated for the project, including the standards and measurement procedures adhered to in collecting this data. Please provide a discussion of how short term events or background wind noises were considered in calculating existing ambient sound levels.

4. Please provide an explanation regarding the sound characteristics of wind turbine noise, including a discussion of how noise from wind turbines compares to noise generated from other sources at comparable sound levels (e.g. aircraft or road noise) and how noise from wind turbines compares to other sources in terms of annoyance. Please take into consideration the modulating character of wind turbine noise, the mix of tones from wind turbines and how they relate to the thresholds of perception, low frequency energy (both audible and inaudible) generated by wind turbines, and the effect of spacing between wind turbines.

5. Please provide an explanation of the relative level of annoyance resulting from low frequency sound as it compares to perceptible, audible sound. Please take into consideration the thresholds of perception for single pure tones as compared to tones generated by wind turbines and the relative sensitivity of individuals to audible and inaudible sound levels.

6. Please provide an explanation of the methods used by HDR to measure sound generated by the wind turbines, including an explanation for the use of the dB(A) scale as a metric for determining noise impacts from wind turbines.

7. Please provide an explanation of how temperature inversion, uncharacteristic weather patterns, high wind shear above the boundary layer, periods of atmospheric turbulence (as it relates to turbines mounted on high locations with rough terrain), and inter-turbine turbulence resulting from inter-turbine spacing of less than 5 to 7 rotor diameters were addressed in the sound modeling.

8. It has been argued that the manufacturer's reported power levels for the wind turbines represents a standardized value assuming "typical" conditions of a neutral atmosphere with a moderate wind shear gradient; therefore, the manufacture's data does not represent worst-case conditions. Please respond.

9. Please provide an explanation of the appropriate scale for measuring low frequency noise levels or infrasound, including a discussion of how using different scales (A-weighting, C-weighting, and Z-weighting) may affect the measurement of low frequency noise. Please provide an analysis of the low frequency noise generated by the wind turbines, using dB(C) weighted noise analysis. Also, please provide available sound power level data for frequencies below 63 Hz for the proposed wind turbines.

10. Please provide a discussion of the sound and/or vibration effects that could result if two or more turbines are operating near each other, either "in sync" or "out of sync", including a discussion of the audible sound waves and low frequency sound waves that would be produced. Please also address the potential sound effects of the turbines in conjunction with proposed wind turbines in the area.

11. Please provide an explanation of how the American National Standards Institute's (ANSI) S12.9 and S12.18 procedures are applicable for measuring outdoor environmental sound in the case of the wind turbines as a ground based noise source and how they were considered in calculating sound levels resulting from the wind turbines. Please also comment on how these standards consider atypical operational conditions such as temperature inversion, uncharacteristic weather patterns, high wind shear above the boundary layer, and periods of atmospheric turbulence (as it relates to turbines mounted on high locations with rough terrain).

12. Please provide an explanation of how the International Organization for Standardization (ISO) Standard 9613 (Part 2) is applicable for addressing the attenuation of outdoor environmental sound in the case of the wind turbines as a ground based noise source and how it was considered in calculating sound levels resulting from the wind turbines.

13. Please comment on the recently promoted algorithm by the Swedish EPA for modeling sound from wind turbines, which applies for both onshore and offshore turbines. The model apparently incorporates enhancements to the ISO Standard 9613 (Part 2) that addresses the specific characteristics of wind turbine sound emissions to propagate at a decay rate of 3dB per doubling of distance for distances of several hundred meters away from the turbine (as opposed to the 6dB decay rate in the ISO Standard).

14. Please provide an explanation of how the International Electrotechnical Commission (IEC) Standard 614000 (Part 11) is applicable for measuring outdoor environmental sound in the case of the wind turbines as a ground based noise source and how it was considered in calculating

sound levels resulting from the wind turbines. Please also comment on how this standard considers atypical operational conditions such as temperature inversion, uncharacteristic weather patterns, high wind shear above the boundary layer, and periods of atmospheric turbulence (as it relates to turbines mounted on high locations with rough terrain).

15. Please provide an explanation of the existence and potential effects of amplitude modulation (blade thumping) from wind turbines during periods of high turbulence or wind shear levels, both on outdoor and indoor sound levels in the vicinity of the turbines.

16. Please provide an explanation of the tolerance assumed for instrumentation error. It has been argued that the HDR technical report included the 2dB tolerance level associated with IEC Standard 614000 (Part 11) for measuring the sound power produced by wind turbines instead of the 3dB tolerance applied by the ISO 9613-2 methodology. Please discuss the use of an appropriate tolerance and the potential effect of the calculation if the other method would have been used (if appropriate).

17. Please provide a detailed description of the noise controls that would be incorporated into the design of the proposed wind turbine facilities.

18. Please provide a graphic depicting the specific area(s) that would be impacted by nighttime construction noise.

19. Please provide a graphic which identifies and labels the locations of the construction noise impacted boundary lines.

20. Please provide a graphic which identifies and labels the locations of the affected legally occupied properties and the locations where portable noise barriers would be required.

21. Please provide a noise evaluation for the proposed sonic detecting and ranging unit (SODAR). Provide quantitative data that determines whether this proposed noise generating unit complies with County Noise Ordinance, Section 36.404.

22. Please provide a detailed response to the following comment received on the Draft EIR/EIS:

    > *The concrete batch plant would be subject to the sound level limits within County Code Section 36.404 because it is not considered a temporary operation (e.g. it will operate for more than three months).*

    If the plant would be considered a potential long-term noise source, please provide an explanation of how this source would comply with County Noise Ordinance, Section 36.404.

23. Please provide detailed responses to specific comments 1 through 19 as identified in the letter from Richard James of E-Coustic Solutions provided in Attachment B.

Public Health and Safety

The following data requests are based on various comment letters received during the Draft EIR/EIS public comment period. Several of the recurring comments in regard to public health and safety were summarized in letters from Richard James of E-Coustic Solutions and Stephan Volker; therefore, these letters are provided in Attachment B.

24. Please provide a discussion of the potential health effects resulting from two or more turbines operating near each other and causing repetitive, low frequency “periodic beats”.

25. Please provide an explanation of the studies considered and addressed to evaluate potential health effects from low frequency noise.

26. Please provide an explanation of how the human body responds to extremely low levels of energy, such as inaudible low frequency sound and infrasound. Please also describe the potential health effects of infrasound and low frequency sound as compared to the effects of audible sound levels. Please take into consideration the auditory system’s response to levels of low frequency sound and infrasound at pressures significantly lower than what is necessary to reach the threshold of audibility.

27. Please provide justification for the noted 1,000 foot setback (from Epsilon Associates report) from wind turbines to residences and an explanation of the methodology used to determine this setback. Please comment on how the elevation of wind turbines as compared to residences, based on topography and terrain, was considered in determining setbacks. Please comment on the appropriateness of a 1.25-mile or 2-mile setback from turbines to residences and sensitive receptors, including justification supporting the response.

28. Please provide an explanation of the potential for shadow flicker to occur, taking into consideration the proposed location of the wind turbines in relationship to nearby residences and other sensitive receptors.

29. Please provide a graphic depicting the exposure of shadows from the wind turbines on adjacent properties, particularly residences and other sensitive receptors, considering the proposed locations of the turbines, topography, and day/night lighting. Please also provide calculations of the anticipated shadow exposure on adjacent residences and other sensitive receptors and a table summarizing this information.

30. Please provide an analysis of the potential health effects on adjacent residences and sensitive receptors as a result of shadow flicker.

31. Please provide an explanation of the safety concerns or hazards (e.g., vehicle driver distraction) that may occur as a result of shadow flicker.

32. Please provide a response to a comment that suggests that shadow flicker setbacks for current wind turbine designs should be 10 rotational diameters (approximately 1000 meters); flash frequency should not exceed three per second; and the shadows cast by one turbine on another should not have a cumulative flash rate exceeding three per second.

33. Please provide an explanation of the potential for ice throw to occur from wind turbine blades, as well as the associated potential safety hazard to people or passing vehicles.

34. Please comment on the structural integrity of the wind turbines in regard to withstanding extremely cold temperatures.

35. Please provide an explanation of the potential health effects of electromagnetic energy resulting from the wind turbines, also referred to as "dirty electricity".

36. Please provide detailed responses to comments 1, 7, 9 and 16 related to public and health and safety, as identified in the letter from Richard James of E-Coustic Solutions provided in Attachment B.

37. Please provide detailed responses to comments 1 and 2 related to shadow flicker and "dirty electricity", as identified in the letter and exhibit from Stephan Volker provided in Attachment B.

Visual Resources

38. Please provide the Tule Wind viewshed map (EIR/EIS Figure D.3-2) that reflects the "Modified Project Layout".

Water (April 8, 2011)

39. In addition to the water availability letters provided by Jacumba Community Services District and Live Oak Springs Water Company in August 2010, please provide additional documentation verifying the source and availability of water and/or will serve letters from well water providers as well as water purveyors to meet the proposed use of approximately 19 million gallons of water during construction of the Tule Wind Project.

GIS Information (April 8, 2011)

40. Please provide pole numbering for the revised transmission line route, to be added to the modified Tule Wind Project graphics in the Final EIR/EIS.

Attachment B

Selected Comment Letters

E-Coustic Solutions

Noise Control ● Sound Measurement ● Consultation | *Richard R. James*
Community ● Industrial ● Residential ● Office ● Classroom ● HIPPA Oral Privacy | *Principal*
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REVIEW OF NOISE STUDIES AND RELATED MATERIAL
SUBMITTED REGARDING
EAST COUNTY SUBSTATION/TULE WIND/ENERGIA SIERRA JUAREZ GEN-TIE PROJECTS
DATE: MARCH 4, 2011

Introduction

This review was conducted on behalf of Backcountry against Dumps, Inc.[1] for their public comments on the PUC/BLM DEIR/DEIS for the proposed East County Substation/Tule Wind/Energia Sierra Juarez Gen-Tie Projects, (referred to here as the proposed "Project"). The State Clearinghouse Number is: 2009121079 (DOI-BLM-CA-D070-2010-0027-EIS (ECO Sub) and DOI-BLM-CA-D070-2008-0040-EIS (Tule Wind)).

Although, the focus is on the Applicant's Environmental Document (Section 3.12 Noise) and the Tule Wind Project Draft Noise Analysis Report conducted on behalf of Iberdrola by HDR Engineering for the Tule Wind Project, comments and concerns expressed in this review should be considered as applying to all of the proposed Project, as appropriate for any differences.

My work with local communities and citizens groups around the U.S. and Ontario, Canada has focused on the question of how to integrate industrial wind turbines into rural communities. I would like to share my concerns about siting criteria for modern industrial scale wind turbines.

I have visited sites throughout the Midwest from western Iowa to the coast of Maine and Ontario to West Virginia where wind turbines were either operating or proposed. I have also reviewed the noise criteria and setbacks proposed by States, Provinces and local government bodies for wind farms. This has given me broad exposure to a number of different situations each with their own requirements. Based on this I find three issues that have a particular importance for my report.

I would like to focus on several points:

First, setbacks, from property lines to the nearest turbine of less than 2 kilometers (1.25 miles) are clearly inadequate for most quiet rural communities. The presence of nearby will not mask or otherwise offset the noise from wind turbines.[2] Wind turbine noise is distinctively annoying. The reports and documents submitted on behalf of the Project do not correctly or adequately describe the impact of the proposed project on the host community, or its residents whose homes and properties are close to the footprint of the project. This distance may seem extreme but is needed based on the experiences of communities with other wind turbine projects. People living at 1
distances up to 1 mile from wind turbines on flat land and, for turbines located on ridges above the homes at distances of up to 2 miles are experiencing adverse health effects from sleep disturbance at night from audible turbine noise. Other aspects of wind turbine sound emissions, especially amplitude modulated infra and low frequency sounds that may not be reach the threshold of audibility are currently believed to be caused by vestibular disturbances from rapid modulations of the infra and low frequency sound.

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[1] Backcountry Against Dumps, Donna Tisdale, President, P.O. Box 1275, Boulevard, CA 91905

[2] Pedersen, E., van den Berg, F., Why is Wind Turbine Noise poorly masked by road traffic noise?, Inter-noise 2010, Lisbon, Portugal June 13-16, 2010 (invited paper)

Second, background sound levels submitted on behalf of the Project's developers and/or operators often include sounds of short term events and 'wind noise' are reported. The measurements used to collect this information do not meet any recognized national or international standard[3]. Instead a novel procedure is substituted for recognized standard measurement procedures. The end result is a biased assessment of background sound levels that overstates the background sound levels of the community by as much as 10 to 15 dBA. Use of this data to evaluate the potential for negative impacts of the people living near the project as defined in the CEQA Guidelines leads to a conclusion that the wind turbine noise will not be a source of noise pollution[4] at the homes and properties near the project. Had the background noise been properly measured the conclusion would be that the Project will have a significant impact on the adjacent communities and wilderness areas. 2

Third, computer model estimates of operational sound levels from the proposed projects understate the impact of the turbines on the community. 3

Fourth, information provided by representatives and experts for the Project, on topic of health risks, infra and low frequency noise, noise limits and setbacks, background sounds in rural communities and computer modeling studies are incorrect, incomplete or otherwise misleading. The assertions that there is no research supporting a concern that wind turbine sound emissions at receiving properties and homes and cannot result in adverse health effects do not reflect current understanding of independent medical and acoustical research. 4

Had the background studies met the procedural and protocol requirements of the American National Standards Institute's (ANSI) S12.9 and S12.18 standards for measuring environmental sounds outdoors the study would have reported much lower background sound levels. The Project would have a "significant impact" under the rules of the CEQA Guidelines (Appendix G (VII)). Had the modeling properly addressed the increased sound power emitted by wind turbines from atmospheric conditions, rough downwind topography from the large boulders and outcroppings on the sides of the ridges, and small inter-turbine spacing, the dBA and dBC sound levels predicted for the sensitive receiving locations would have been much higher. These conditions include those of: 5

- nighttime atmosphere with a stable boundary layer (temperature inversion) and high wind shear above that boundary layer (e. g. high wind shear),
- periods of atmospheric turbulence, as is likely for turbines mounted on high locations with rough terrain, and
- inter-turbine wake-induced turbulence created when turbines are located in rows with inter-turbine spacing of less than 5 to 7 rotor diameters (new information indicates this may need to be more like 10 to 15 rotor diameters) to prevent inter-turbine wake turbulence. Turbines in the current layout are as close as 3 rotor diameters or less.

The specific CEQA rules that define when an impact is significant that would not be met if the background noise study and computer modeling had met the been conducted according to the practices identified in this report are: 6

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3 ANSI-ASA S12.9 Part 2, (R2008) Measurement Of Long-Term, Wide-Area Sound,
ANSI-ASA S12.9 Part 3 (1993 R 2008) Short Term Measurements with Observer Present,
ANSI-ASA_S12.9_Part_1_(R_2003) Quantities and Procedures for Description and Measurement of Env. Sound, and
ANSI-ASA_S12.18-1994_(R2009) Procedures for Outdoor Measurement of SPL.

4 Noise pollution: the emission of sound that unreasonably interferes with the enjoyment of life or with any lawful business or activity.

- Exposure of persons to or generation of noise levels in excess of standards established in the local general plan or noise ordinance, or applicable standards of other agencies;
- A substantial permanent increase in ambient noise levels in the project vicinity above levels existing without the project; 6 cont.

The combination of the above negative factors in the reports prepared as submittals regarding the Project's wind turbine noise emissions/pollution will result in sleep disturbance for a significant fraction of those who live within a mile away. Chronic sleep disturbance results in serious health effects. For a smaller portion of the community, there will be a risk of the adverse health effects currently described as Wind Turbine Syndrome mediated through the body's organs of balance (vestibular) and proprioception. This is a different set of symptoms and causes than what would be expected of higher levels of infra and low frequency sound and are not related to the audibility of the ILFN. The reports and other documents provided by the developer's of the Project focus on the adverse health effects that occur when the sound pressure level of the noise source exceeds the Threshold of Perception. The adverse health effects of concern are not related to this set of health effects. They are a result of modulated infra and low frequency sounds at levels below the threshold of audibility. 7

The result of these technical flaws along with an outdated understanding of how the human body responds to acoustical energy below the threshold of perception leads to a conclusion that if the Project, as proposed, is approved, it will, with a high degree of certainty, have negative noise impacts that are "significant." 8

I have reviewed the Applicant's Environmental Document, Section 3.12 Noise, and the Tule Wind Project Draft Noise Analysis Report prepared for Iberdrola by HDR Engineering of Minneapolis, Minnesota. I have also had the opportunity to review similar documents prepared for other wind turbine projects by HDR and other acoustical consulting groups that work for the wind turbine project developers. My experience with industrial wind projects leads me to conclude that wind turbine utilities that produce sound levels at the properties and homes of people adjacent or within the Project will exceed the 40 dBA (L(night-outside) limit provided by the World Helath Organization (WHO) for safe and healthful sleep. It will result in a high level of community complaints of both noise pollution, sleep disturbance, and nuisance. In addition, there is mounting evidence that for the more sensitive members of the community, especially children under six, people with pre-existing medical conditions, particularly those with diseases of the vestibular system and other organs of balance and proprioception, and seniors with existing sleep problems will be likely to experience serious health risks. 9

The review will address a number of topics. Those topics include:

- Discussion of terms and standards,
- Discussion of weather and its effect on turbines
- Discussion of spacing and its effects on turbine noise
- San Diego County CNEL of 45 requires that one hour Leq to be 37.7. A limit of 40 dBA Leq outside a home (per WHO for nighttime noise) would just slightly exceed the CENL of 45 limit.
- An Overview summarizing deficiencies in the Draft Noise Analysis Report (October 2010) by HDR Engineering Inc, Minneapolis, MN. (referred to as "HDR")
- Description of wind turbine noise as a source of environmental noise exposure and noise pollution for humans

- Specific issues with the Noise Analysis Report produced regarding the Project
- Evidence that the Project noise will exceed the permitted levels,
- Comments on the potential risks to health and welfare of persons living near the footprint of the Project specifically regarding wind turbine noise.

Review of Terms and Standards

Terms

L_{Aeq}: The equivalent energy level in dBA. A measure of the acoustic energy over some interval of time that expresses the total energy of time-varying sound as a single number. Leq is very sensitive to short duration high amplitude events. A one hour Leq measurement in a quiet rural area with sound levels of 25 dBA for 59 minutes will have an Leq of 42.3 dBA if, during that hour, a short term noise, such as a vehicle pass-by on a nearby road, raises the sound level to 60 dBA for one minute. Leq is not a good descriptor for the background sound level in a quiet community where there are extremes between the residual sound (all sounds from afar that are not short term) and short term events that have high sound levels.

L_{An}: A statistical value determined by sampling sounds for some period of time, often 10 minutes to an hour, but it could also be longer, constructing a histogram. The L_{A90} would be the sound level representing the quietest 10% of the time. It is traditionally associated with the long term background sound level or residual sound level. The L_{A10} would be the sound level representing the noisiest 10% of the time. It is traditionally used as a descriptor of noisiness. The L_{A50} would be the sound level representing the median of the distribution of sound levels. The L_{A50} is not the same as L_{Aeq}. However, the L_{A50} is less sensitive to short term events and thus is often used to represent an 'average' sound level.

Ambient sound[5]: at a specified time. the all encompassing sound associated with a given environment, being usually a composite of sound from many sources at many directions, near and far, <u>including</u> the specific sound source(s) of interest.

Residual sound[5]: at a specified time, the all-encompassing sound, being usually a composite of sound from many sources from many directions, near and far, remaining at a given position in a given situation when all uniquely identifiable discrete sound sources are eliminated, rendered insignificant, or otherwise not included. Specified in S12.9, Part 1 the residual sound may be approximated by measuring the percentile sound level exceeded during 90 to95 percent of the measurement period (e.g. L_{A90}).

Background sound[5]: all-encompassing sound associated with a given environment without the contributions from the source or sources of interest. In S12.9, Part 3, background sound is described as a combination of (one) Long-term background sound, and (two) short-term background sounds, with the durations for long and short defined according to application and situation.

Long-term background sound[5]: background sound measured during a measurement, after excluding the contribution of short-term background sounds in accordance with one of the methods specified in the standard S12.9, Part 3. Long-term background sound is assumed to be approximately stationary in a statistical sense[6], over the measurement duration, and it is describe

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[5] Reference standards are S12.9 parts 1 and 3 for these definitions.

[6] Seasonal and weather related sounds such as insects, birds, wind rustle in dry leaves, should also be considered short term sounds for the purpose of measuring the long term background sound level. In addition, the test instruments shall

solely by its sound exposure per unit time (in each frequency-weighted or frequency-filtered band of interest).

Short-term background sound[5]: background sound associated with one or more sound events which occur infrequently during the basic measurement period, the measurement interval with or without the source operating, and measured in accordance with one of the methods in the standard S12.9, Part 3.

Note: the sound exposure and time of occurrence of short-term background sounds cannot be described statistically during the basic measurement period. Examples of short-term background sounds include sounds from such sources as: a nearby barking dog, accelerating motor vehicle, radio music siren and aircraft flyover etc.

Standards Used in Assessing Land-Use Compatibility

EPA Levels Document (1973):_In the 1970's the EPA operated an Office of Noise Abatement and Control (ONAC) that was tasked with promulgating standards for communities and other non-occupational environments. In 1973, the EPA published the 'Levels" document which provided a resource for communities that were developing local or state level noise ordinances. This work was primarily focused on the needs of urban and sub-urban communities with existing noise exposure. The body of the document presents information for this target audience. For communities with different soundscapes, such as rural communities the tables and graphs presented in the body of the document were not appropriate. To address the needs of these other communities the Levels document included an Appendix that provided a method for adjusting the recommendations for noise exposed urban and suburban environments to account for differences from the urban/suburban ones. Table-7 in the Figure 1 shows the adjustment factors that are to be added to the 55/45 L_{dn} for the noise exposed urban/suburban environment to normalize the data to the equivalent annoyance level. For example, an urban or suburban community with prior experience with noise might find sound levels of 55 dBA during the day and 45 dBA during the night to be satisfactory. For a rural community with

Table D-7

Corrections To Be Added To The Measured Day-Night Sound Level (L_{dn}) Of Intruding Noise To Obtain Normalized L_{dn} d-3

Type of Correction	Description	Amount of Correction to be Added to Measured L_{dn} in dB
Seasonal Correction	Summer (or year-round operation)	0
	Winter only (or windows always closed)	-5
Correction for Outdoor Noise Level Measured in Absence of Intruding Noise	Quiet suburban or rural community (remote from large cities and from industrial activity and trucking)	+10
	Normal suburban community (not located near industrial activity)	+5
	Urban residential community (not immediately adjacent to heavily traveled roads and industrial areas)	0
	Noisy urban residential community (near relatively busy roads or industrial areas)	-5
	Very noisy urban residential community	-10
Correction for Previous Exposure & Community Attitudes	No prior experience with the intruding noise	+5
	Community has had some previous exposure to intruding noise but little effort is being made to control the noise. This correction may also be applied in a situation where the community has not been exposed to the noise previously, but the people are aware that bona fide efforts are being made to control the noise.	0
	Community has had considerable previous exposure to the intruding noise and the noise maker's relations with the community are good	-5
	Community aware that operation causing noise is very necessary and it will not continue indefinitely. This correction can be applied for an operation of limited duration and under emergency circumstances.	-10

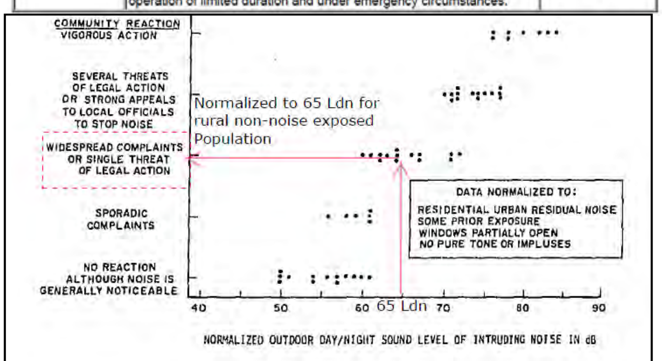

Figure D-7. Community Reaction to Intensive Noises of Many Types as a Function of the Normalized Outdoor Day Night Sound Level of the Intruding Noise D-3

Figure 1- Table and Figure D-7 from EPA Levels Document (1973)

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not be located near roads, poles, fences, trees, walls or other reflecting surfaces or sources of local noise not representative of the larger community. This also includes streams and locations near roads.

prior noise exposure these levels would not be appropriate. Applying the +10 dB normalizing factor to Figure-7 results in an L_{dn} of 65 dB. Thus, the 45 dBA night and 55 dBA day sound levels that produce little or no negative community response from an urban/suburban population with prior noise exposure will result in widespread complaints and threats of legal action if they are experienced in a rural community. To avoid complaints the rural community L_{dn} must not exceed 45 dBA during the day and 35 dBA at night. If the rural community had no prior experience with noise exposure then an additional 5 dB is added to the normalization process. This would result in a nighttime limit of 30 dBA and a daytime limit of 40 dBA to avoid complaints.

ANSI S12.9 Part 4 (R_2005): Noise Assessment and Prediction of Long-term Community Response

In 1980 the ONAC was defunded by the administration and has remained unfunded since that time. To cover the loss of the EPA the Acoustical Society of America (ASA) and the American National Institute (ANSI) promulgated a standard that incorporated the same basic concepts as the EPA Levels document and the normalizing process of Table and Figure D-7. This standard can be applied to assess a community's response to a new noise source. It will result in the same recommendations for a rural community as the EPA document. For a non-noise exposed rural community ANSI S12.9 Part 4 sets the nighttime sound level at 30 dBA (Leq) and the daytime to 40 dBA (Leq).

<u>Standards for Computer Modeling of Sound Propagation</u>

ISO 9613-2: Acoustics-Attenuation of Sound during propagation outdoors, Part 2: General Method of Calculation: This standard specifies engineering methods for calculating the attenuation of sound during propagation outdoors in order to predict the levels of environmental noise at a distance from a variety of noise sources. The method is applicable, in practice, to a great variety of noise sources environments. It is applicable, directly or indirectly, to most situations concerning road or rail traffic, industrial noise sources, construction activities, and many other <u>ground based</u> noise sources. It does not apply to sound from aircraft in flight, or to blast waves from mining, military, or similar operations. It is validated only for noise sources that are located close to the ground (approximately 30 m difference between the source and receiver height). It is also limited to noise sources that are within 1000 m of the receiving location. Meteorological conditions are limited to wind speeds of approximately 1 m/s and 5 m/s when measured at a height of 3 m to 11 m above the ground. When all constraints, including these, are met by the situation being modeled the procedure is accurate within a +/- 3 dB range. Its use has not been validated by any independent peer-reviewed process for use in siting wind turbines. However, it became the practice in the mid-1990s to use commercial software packages for modeling a general-purpose industrial and traffic noise such as the Cadna/A 10
software package which is based upon this iso-standard for wind turbine projects in Britain and many of its ex-colonies. This practice was promoted by the British Wind Energy Association (BWEA) and trade associations in other countries. This practice was not followed by many of the countries in the European Union because of their concern about the limitations of the method not being applicable to wind turbines. For example, there are alternate models that have been developed specifically for wind turbines in the Nordic countries. These models, have been validated by peer-reviewed independent studies and used in those countries.

The Swedish EPA has recently promoted a modeling algorithm for wind turbines that applies both for onshore and offshore turbines. This model incorporates enhancements to the iso-9613 part 2 algorithms that address the specific characteristic of wind turbine sound omissions to propagate at a decay rate of 3 dB per doubling of distance for distances of several hundred meters away from the turbine. The ISO-Standard assumes propagation occurs at the decay rate of 6 dB per doubling of distance. Later in this report the results of applying the Swedish model to the Project will be discussed and the impact of that model on sound levels both close to the turbines and at greater distances will be presented. Although it may be argued that the ISO-Standard is commonly used for 10 cont. wind turbine projects, it must be noted that there are many wind turbine projects where the initial models indicated there would be no problems that once operation started exhibit problems. Use of a model that understates real-world operational sound levels is a very likely cause of this problem.

IEC 61400-Part 11: acoustic noise measurement techniques: The purpose of this standard is to provide a uniform methodology that will ensure consistency and accuracy in the measurement and analysis of acoustical emissions by wind turbine generator systems. The standard was prepared for application to wind turbine manufacturers trying to meet well-defined acoustical emission performance requirements, and the purchaser in specifying such requirements. This standard is used to determine the sound power level emitted by wind turbines under conditions defined as normal operation. Normal operation is specified as weather conditions that are not severe and represent operation with low wind shear. Such conditions are normally defined as a "neutral" or "unstable" atmosphere where the windshear will generally be in the range of 0.15 or less and in general under 0.20. This weather condition is commonly observed during daytime of warm seasons and in particular can be described as a warm sunny afternoon in the temperate zone. Under low wind shear conditions the wind speed does not increase significantly between the height where the blade is lowest in this rotation and the top where it is at its highest peak. This allows the anemometer located on the turbine's hub to calculate the 11

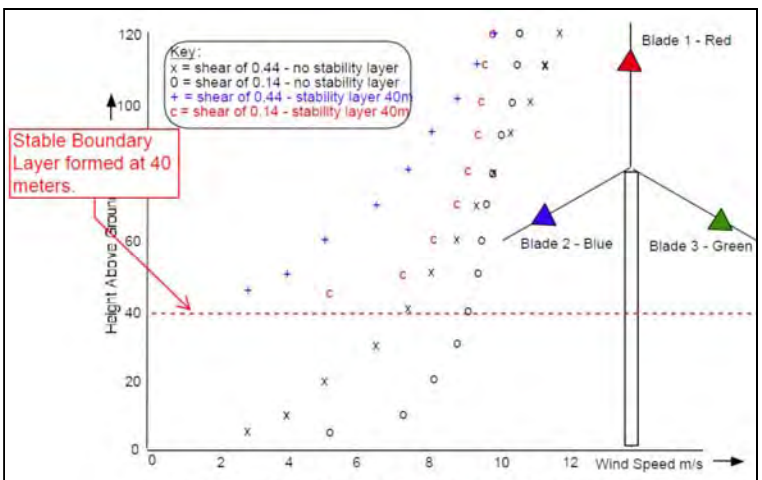

Figure 4 - Effect of Shear and Stability on Incident Wind Speed

Figure 2- Example of wind shear in neutral and stable atmospheres

optimum angle of attack of the blades and RPM of the hub for maximum efficiency in extracting energy. Because inefficiency in extracting energy results in increased noise, heat, turbulence, and additional stresses on the blades the lowest noise immission condition for wind turbine is when it is most efficiently extracting energy from the wind. In a paper by William Palmer, P.ENG., Ontario Canada the effect of varying wind shears on wind turbine noise is explored[7]. Figure 2 shows an example of the optimal weather conditions for a windshear of 0.14 with no stability layer (temperature inversion boundary). The second best situation is a higher-level windshear such as 0.44 again without a stable boundary layer. However, because there will be a significant difference in the wind speed at the bottom and at the top of the blades rotation path the windshear of 0.44 will be more difficult for the turbine to find the optimum operating mode then for the 0.14 windshear. Both of these conditions follows a logarithmic relationship described as the Power Law which permits the estimation of a wind speed at some arbitrary height such as the hub from the wind speed at a lower height such as a 10 m meteorological tower.

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[7] Palmer, W. P,Eng, "A new explanation for Wind Turbine Whoosh, Wind Shear," Third International Meeting on Wind Turbine Noise, Aalborg, Denmark, June 2009.

At night, after the sun's heating of the ground stops, the ground cools. The convection currents present in the daytime that cause the warmed air next the ground to rise upwards mixing with the upper level winds in a smooth gradient also stop. A cool layer of air forms that surface and get some altitude often between 20 m 200 m above the ground a boundary layer forms where the cool air meets the warmer higher-level air. This boundary layer causes a complete disconnect between the wind speeds below it and above it. Below the boundary layer winds are often calm or even still. There is insufficient wind to cause leaf rustle or other sounds associated with surface level winds. Figure 2 which is extracted from Mr. Palmer's paper shows the stable boundary at 40 m by stopping the markers for windshear at that height. These are the two curves on the left side of the figure. It is important to understand, that when a stable boundary layer forms the winds above the boundary layer are often moving at a very high rate and that rate increases rapidly with height. It is not uncommon to see wind shear coefficients of 0.7 to 1.0 or higher when these conditions form.

To compound the situation, if the stable boundary layer forms at an elevation higher than the bottom of the blades rotation path the blade will descend into it. Under these conditions the turbine blades which are under wind load above the stable boundary layer lose that load when they enter the still air below the boundary layer. This is situation that the turbine operating system which depends upon hub level anemometers cannot detect nor can it adjust the blades to account for this
change. Is this condition that Mr. Palmer believes produces the maximum sound power from the 11
turbine blades and is responsible for the deep blade whoosh that is the source of complaints during cont.
nighttime. Measurements of turbines operating this condition have shown blade whoosh (amplitude modulation) of 8 to 15 dBA above the normal sound levels. For the situation of high wind shear without the stable boundary layer blade whoosh (amplitude modulation) normally ranges from 5 to 8 dBA.

This phenomenon has also been studied by Dr. Fritz van den Berg for his graduate thesis titled: "The Sounds of High Winds. In "The Sounds of High Winds " Dr. van den Berg presents a method for determining the increased sound power emitted by wind turbines for various mismatches between the optimum angles of attack for the blades and what occurs when the blades are not at the optimum angle due to high wind shear. He shows that increases of 10 dB can be expected for angle mismatches of 9° or more. Even slight mismatches of 4 to 7° can increased sound power by 3 to 8 dBA.

To further complicate the assessment of a wind turbines sound power under real world situations the atmospheric condition of a stable atmosphere is a very common feature of warm season nights. In temperate zone climates it can occur as often as 60% of summer evenings. In a desert environment, where the solar heating and nighttime cooling can be even more extreme a stable atmosphere maybe even more common. Since the IEC 61400 – 11 measurement procedure only provides information for the sound power under the neutral atmosphere and low windshear use of the data from that standard will consistently under predict the sound levels of wind turbines during these, nighttime conditions.

Overview

This review identified a number of deficiencies in the report and information presented by HDR regarding the potential for excessive noise exposure on adjoining properties. Most are concerned
with the assumptions and methodology HDR used in constructing the computer model of sound 12
propagation. They fall into the following three categories.

First, the HDR model included the tolerances for instrumentation error of the IEC 61400-11 test procedures of 2 dB but did not include the tolerances for the ISO 9613-2 modeling procedure of ± 3 dB. If the HDR model had included this tolerance the results shown on the contour maps and tables of their report would be 3 dB higher than stated. 12 cont

A second, and equally significant fault is that the predicted sound levels underestimate the sound levels that will be received on the properties and at homes adjacent to the wind turbine utility under nighttime stable atmospheric conditions. The Sound Power data used in the sound propagation models does not represent the noise produced by wind turbines during nighttime operations with high wind shear and stable atmospheric conditions. The IEC 61400.11 test standard collects data under neutral atmospheric conditions that do not cause these louder "thumping" or "whooshing" type of noise emissions.

In "Effects of the wind profile at night on wind turbine sound" G.P. van den Berg states:

> "....measurements show that the wind speed at hub height at night is up to 2.6 times higher than expected, causing a higher rotational speed of the wind turbines and consequentially up to 15 dB higher sound levels, relative to the same reference wind speed in daytime. Moreover, especially at high rotational speeds the turbines produce a 'thumping', impulsive sound, increasing annoyance further. It is concluded that prediction of noise immission at night from (tall) wind turbines is underestimated when measurement data are used (implicitly) assuming a wind profile valid in daytime."[8] 13

The "thumping" referred to in the Van den Berg paper occurs in synchronization with blade rotation (about one "thump" or "whoosh" per second assuming the hub is rotating at 20 rpm). "Thumping" does not referring to the blade "swish" of 1-3 dBA present when the turbine is operating in a neutral atmosphere. This "swish" is included as part of the wind turbine sound power ratings provided by the manufacturer. The "thumping" of concern is the much louder noise that is not accounted for in the manufacturer's test data. This occurs typically at night under a stable atmosphere where there is high wind shear. This "thumping" can modulate by 5 to 10 dBA or more and is a result of increased sound power emissions from the wind turbine's blades.

Based on this reviewer's experience the nighttime noise is increased by at least 5 dBA over what is observed for similar hub level wind speeds during the day under a neutral atmosphere. If the increased sound power caused by the nighttime atmospheric conditions had been added to the manufacturer's sound power for neutral atmospheric conditions the predicted values would be 5 dBA or more higher than what is shown in the HDR report tables and contour map.

Third, the sound propagation modeling software used for the sound models is a general purpose model designed for modeling noise from common urban noise sources like industrial plants, roads, and railways. The ISO Standard limits use of the methods to noise sources that are no more than 30 meters above the receiving locations. A wind turbine with a hub height of 80 meters exceeds this ISO limitation by 50 meters. The HDR report did not disclose this limitation or make any effort to account for the errors that may accrue from the noise source exceeding the source height limits. Cadna/A is based on the ISO standard and thus limitations to the standard apply equally to the Cadna/A model. 14

The result of these three failings is that the HDR model does not address the types of audible noise from wind turbines that occurs as a result of the summer night time wind speed profile. The model does not represent the nighttime high wind shear conditions that people find most objectionable. If

[8] Van den Berg, G.P., "Effects of the wind profile at night on wind turbine sound" Journal of Sound and Vibration, 2003

the model had correctly addressed tolerances and the need to increase the IEC61400-11 sound power levels to account for increased sound emissions at night the contour map and tables would be at least eight (8) dBA higher. This increase would have expanded the boundary of the 40 dBA threshold to include many of the homes around the perimeter of the Project. As a rule of thumb, assuming that the increased sound power for nighttime operation results in a 5 dBA increase and the 3 dB ISO tolerances are included, all receiving properties that have sound level projections between 32 and 40 dBA will exceed 40 dBA.

Leq 1hr	Hours
$L_d := 37.75$	$H_d := 12$
$L_e := 37.75$	$H_e := 4$
$L_n := 37.75$	$H_n := 8$

$$H_{CNEL} := H_d + H_e + H_n$$

$H_{CNEL} = 24$ Hours per day

$$L_{CNEL} := 10 \cdot \log\left[\frac{H_d \cdot 10^{\left(\frac{L_d}{10}\right)} + H_e \cdot 10^{\left(\frac{L_e+5}{10}\right)} + H_n \cdot 10^{\left(\frac{L_n+10}{10}\right)}}{24}\right] \text{ dBA}$$

$L_{CNEL} = 44.145$ CNEL in dBA

Figure 3-37 Leq just meets the 45 CNEL criteria

Properly modeled, this project would not comply with San Diego County's 45 dB CNEL limit at sensitive receiving properties. To remain under the 45 CNEL criteria the wind turbine's evening and nighttime Leq would need to be under 38 dBA Leq.

Description of wind turbine noise

It is common for people to look at wind turbines as a separate type of noise source. However, some of the problems associated with them are easier to understand if we view wind turbines as a special case of very large exposed-blade industrial fan. For example, if we take a look at the spectrum from a fan, as shown in Figure 4, there are certain characteristics that all fans have in common. There is maximum energy at the blade passage frequency, tones above the blade passage frequency, and broadband noise. The harmonics of that tone have somewhat lower energy content. The broadband spectrum starts above the range where the tones no longer dominate. The energy is highest at the blade passage frequency and drops off as frequency increases.

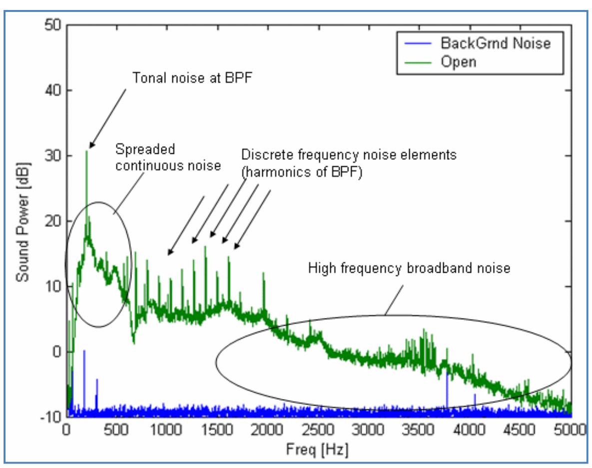

Figure 4-Typical Fan Noise Spectrum

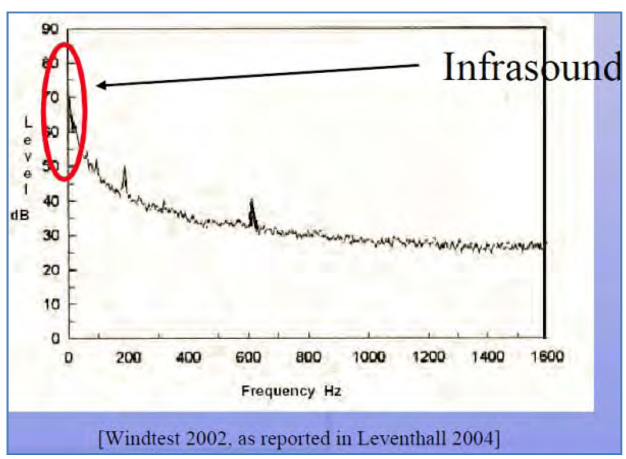

Figure 5-Vestas V-52 Spectrum (From NREL)

In Figure 5, the wind turbine spectrum for a Vestas V-52 shows some of the same spectral characteristics. It does not show the tones and harmonics at the blade passage frequency (BPF) because for industrial scale upwind turbines this is usually between 1 and 2 Hz and the harmonics occur below 10 Hz. Because this is a difficult range of frequencies to measure, especially in field test situations, most information about the spectral characteristics do not show the infrasound range (0-20Hz) sound pressure levels (SPL). This is further obscured by the practice of wind industry acoustical consultants to present data using of A-weighting (dBA). The practice masks the spectrum shape by creating a visual impression of minimal low-frequency sound content. Even when octave band (1/1 or 1/3) SPLs are presented the reports normally ignore frequencies below 31.5 or 63 Hz. The wind industry and its consultants often conclude that there is little or no infra or low frequency content. If that is true, then the customary reporting practices are understandable. But, if those assumptions are not accurate, then these practices mask a potential source of significant problems.

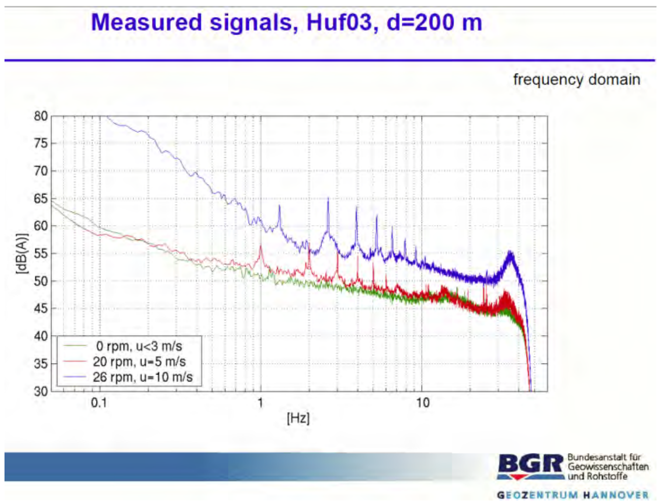

Figure 6-Wind Turbine Infrasound

The graphic to the left (Figure 6) is expanded in the lower frequency range to show a wind turbine's spectrum for the frequency range of 0-10 Hz. Now the tones and harmonics are clearer. Also, note the correlation of the frequency of the tones to rotational speed. This graph is from a study conducted by the Federal Institute for Geosciences and Natural Resources, Hannover, Germany, titled: "The Inaudible Noise of Wind Turbines" presented at the Infrasound work shop in 2005 (Tahiti).

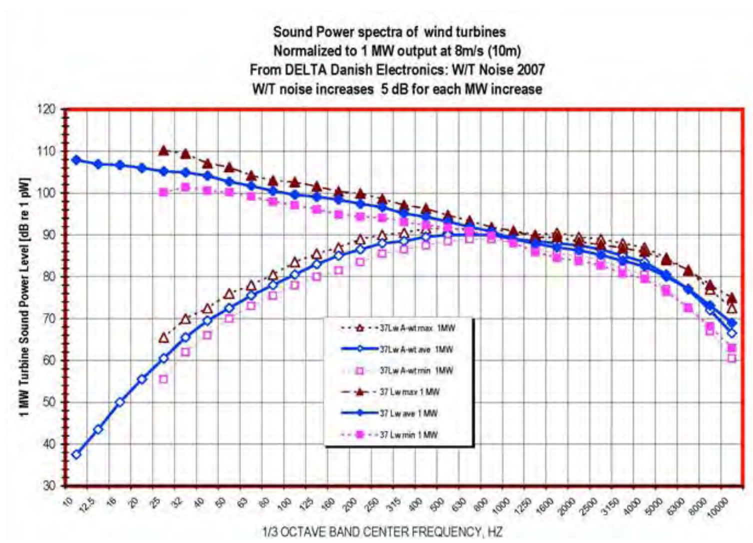

Figure 7-Sound Power Level of 37 Turbines Normalized to 1MW

The question is often asked: "Are the sound emission characteristics similar or different for different models and makes of wind turbines?" Figure 7 shows the general spectrum shape of 37 modern upwind turbines representing Turbines of the type anticipated for the Project. This graph shows the sound power data after normalizing the data for each turbine to 1 MW of power output.[9] It is clear that there is little deviation in spectral shape between any of the various models that is not related to power produced. However, as seen in the A-weighted curves of the same data, the use of A-weighting masks the low frequency energy content. All

[9] DELTA, Danish Electronics, Light & Acoustics, "EFP-06 Project, Low Frequency Noise from Large Wind Turbines, Summary and Conclusions on Measurements and Methods," April 30, 2008

modern upwind industrial scale wind turbines have similar high sound pressure levels and tones in these lowest frequencies. To say that wind turbines do not have significant infra and low frequency sound is to mischaracterize it's acoustic spectrum.

Wind turbine noise is distinctively annoying

There have been several studies, primarily conducted in European countries with a long history of wind turbines, showing that at the same sound pressure (decibel) level or less, wind turbine noise is experienced as more annoying than airport, truck traffic or railroad noise[10,11]. There are several reasons why people respond more negatively to wind turbine noise that are directly a result of the dynamic modulations of the noise, both audible and inaudible, more than the absolute level of the sounds received. Wind turbine noise has been shown to cause the same level of annoyance at 35 Leq as road, rail and air traffic at levels or 45 to 50 Leq.

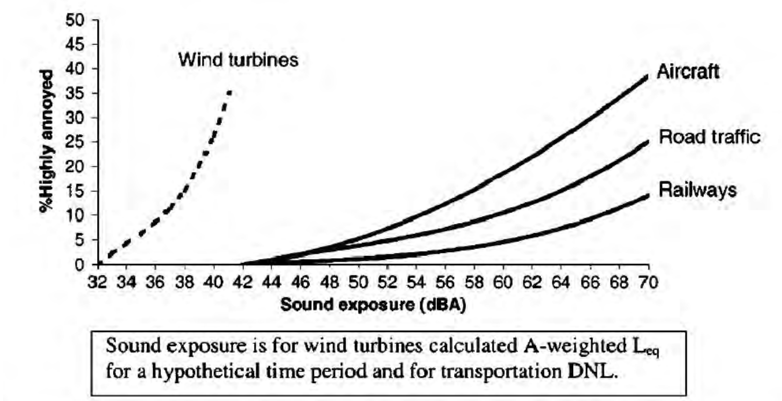

Figure 2. Percent of respondents reported high annoyance attitude as a function of sound level (Day-night average sound level for aircraft, road traffic, and railways; Leq for wind turbines). Source: Pedersen and Person Waye (2004), Figure 3.

Figure 8-Graph from Pedersen 2004

Amplitude Modulation (Audible Blade Swish)

It is not clear which characteristic of wind turbines makes them more annoying than other common sounds in the community. This is not because the sounds are hard to describe, but rather because wind turbine noise, especially at night, includes several annoying characteristics. Whether it is the distinctive rhythmic, impulsive or modulating character of wind turbine noise (all synonyms for "thump" or "whoosh" or "beating" sounds); its characteristic low frequency energy (both audible and inaudible, and also impulsive); the adverse health effects of chronic exposure to wind turbine noise (especially at night); in-phase modulation among several turbines in a wind farm (this can triple the impulse sound level when impulses of three or more turbines become synchronized); or 15
some combination of all of these factors that best explains the increased annoyance is not fully understood. One or more of these characteristics are likely present depending on atmospheric and topographic conditions, (especially at night)[12] as is the individual susceptibility of each person to them.

Nevertheless, reports based on surveys of those living near wind farms consistently find that, compared to surveys of those living near other sources of industrial noise, annoyance is significantly higher for comparable sound levels among wind utility footprint residents. In most cases, where relationships between sound level and annoyance have been determined, annoyance starts at sound

[10] E. Pedersen and K. Persson Waye, "Perception and annoyance due to wind turbine noise: a dose–response relationship," J. Acoust. Soc. Am. 116, 3460–3470 (2004).

[11] Vandenberg, G., Pedersen, E., Bouma. J., Bakker, R. "WINDFARMperception Visual and acoustic impact of wind turbine farms on residents" Final Report, June 3, 2008.

[12] G.P. Van den Berg, "The beat is getting stronger: The effect of atmospheric stability on low frequency modulated sound on wind turbines," Noise notes 4(4), 15-40 (2005) and "The sound of high winds: the effect of atmospheric stability on wind turbine sound and microphone noise" Thesis (2006)

levels 10 dBA or more below the sound level that would cause equivalent annoyance from the other common community noise sources. Whereas one would expect that people would be annoyed by 45 dBA nighttime sound levels outside their homes in an urban area, rural residents are equally annoyed by wind turbines when the sound levels are 35 dBA. Given that wind turbine utilities are often permitted to cause sound levels of 40 or higher at the outside of homes adjacent to or inside the footprint of wind utilities the negative reactions to wind turbines from many of those people is understandable. Their reactions provide objective evidence from currently operating wind utilities that a substantial number of people who live near the Kent Breeze project will complain that the noise level they experience is both causing nighttime sleep disturbance and creating other problems once operation commences.[13] [14]

Although there remain differences in opinions about what causes the amplitude modulation of audible wind turbine noise most of the explanations involve high wind shears and/or turbulence as it moves into turbine's blades[15]. There are a number of explanations that have been presented to explain this noise. For example, eddies in the wind, high wind shear gradients (e.g. different wind speeds at the higher reach of the blades compared to the lower reach), slightly different wind directions across the plane of the blades, and interaction among turbines, have each been identified as causes of modulating wind turbine noise from modern upwind turbines.[16]

15 cont.

Consultants for wind utility developers often claim that wind turbine sound emissions inside and adjacent to the project footprint estimated by the sound propagation model's represent "worst-case" conditions. The IEC 61400-11 test procedures used to derive this data states that the turbine's reported sound power levels represent the turbine's sound emissions at or above its nominal operating wind speeds under standardized weather and wind conditions. These weather conditions require a neutral atmosphere where the wind shear fits the assumptions of the power law for winds at 10 meters and the hub level. This condition is often associated with a warm, sunny afternoon. That is reasonable given that the purpose of these tests is to produce standardized data to permit a prospective buyer of turbines to compare the sound emissions from various makes and models. This needs to be understood as being similar to the standardized gasoline mileage tests for new vehicles. One does not get the mileage posted on the vehicle sticker since each person's driving habits are different. The same is true for wind turbines and the environments in which they operate. The IEC test data does not account for the increased noise from turbulence or other weather conditions that cause higher sound emissions. A review of the IEC 61400-11, Wind Turbine Systems-Part 11: Acoustic Noise Measurement Techniques' assumptions in the body and appendices (esp. Appendix A) show that the IEC test data reported to turbine manufacturers is not 'worst case' for real world operations. Weather can introduce additional deviations from model results along its propagation path. ANSI standards for outdoor noise caution that turbulence in the air can increase the downwind sound levels by several decibels. It should be clear that any assertions by the acoustical modeler that the models represent "worst case" sound level estimates rely on careful phrasing or ignorance of the underlying standards and methods.

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[13] Kamperman and James (2008); James (2009b); Minnesota Department of Health (2009), pp. 19-20.

[14] Bajdek, Christopher J. (2007). *Communicating the Noise Effects of Wind Farms to Stakeholders*, Proceedings of NOISE-CON (Reno, Nevada), available at http://www.hmmh.com/cmsdocuments/ Bajdek_NC07.pdf

[15] Van den Berg (2006, pp. 35-36); Oerlemans/Schepers (2009).

[16] Bowdler, "Why Turbine Noise Annoys – Amplitude Modulation and other things," Where Now with Wind Turbines, Environmental Protection U.K. Conference, Sept. 9, 2010 Birmingham, U.K.

Impulsive sound was considered more problematic for older turbines that had rotors mounted downwind from the tower[17]. The sound was reduced by mounting the rotor upwind of the tower, common now on all modern turbines[18]. Initially, many presumed that the change from downwind to upwind turbine blades would eliminate amplitude modulated sounds (whooshes and thumps) being received on adjacent properties. However, in a landmark study by G. P. van den Berg[19], it was shown that the impulsive swishing sound increases with size because larger modern turbines have blades located at higher elevations where they are subject to higher levels of wind shear during times of ground level "atmospheric stability." This results in sound fluctuating 5 dBA or more between beats under moderate conditions and 10 dBA or more during periods of higher turbulence or wind shear[20].

15 cont.

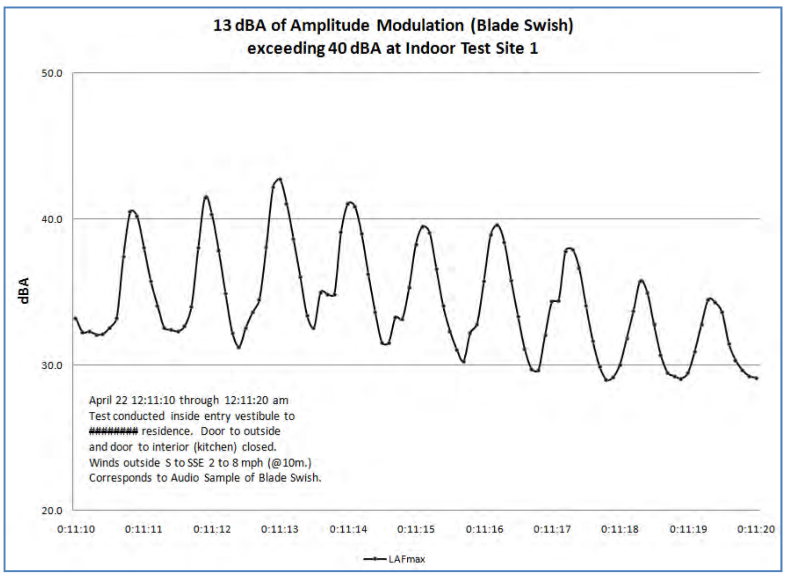

Figure 9-Audible Blade Swish inside home from New York Wind Utility

This author has confirmed night time amplitude modulation (blade thumping) at every wind project he has investigated. During periods of high turbulence or wind shear levels the sound levels produced by blade "thump" have been as high as 10-13 dBA. Figure 9's graph shows the rise and fall of the A-weighted sound levels from blade swish measured inside a closed entry vestibule to a home. This test site is approximately 1500 feet from two (2) turbines with sound emission characteristics similar to the turbines proposed for the Project. It should be noted that other tests measured sound levels exceeding 40 dBA inside the home in the rooms facing the turbines with a window partly open.

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[17] Rogers (2006, p. 10)
[18] *Id.*, pp. 13, 16; Van den Berg (2006), p. 36.
[19] Van den Berg (2006, p. 36)
[20] *Id.*,

To compensate for the added annoyance of fluctuating or impulsive sound, the sound power levels of the turbine must be increased above what is reported for neutral atmospheric conditions under IEC 61400-11. The impact of this increased annoyance from short term fluctuations in sound levels is cited in the Minnesota Department of Public Health report of 2009.[21] The evidence collected by this reviewer as demonstrated in Figure 5 shows that this increase in noise emissions is generally applicable. It is the days and nights when the amplitude modulation is at its worst that cause complaints. It is not the 1-3 dB swishes of a summer afternoon, but the 6-9 dB whooshes of a late evening or the 10 -14 dB thumps during warm season night time weather with high turbulence or wind shear that matter. These conditions are common in warm weather months and at any time when significant vertical and horizontal turbulence and wind shear may occur.

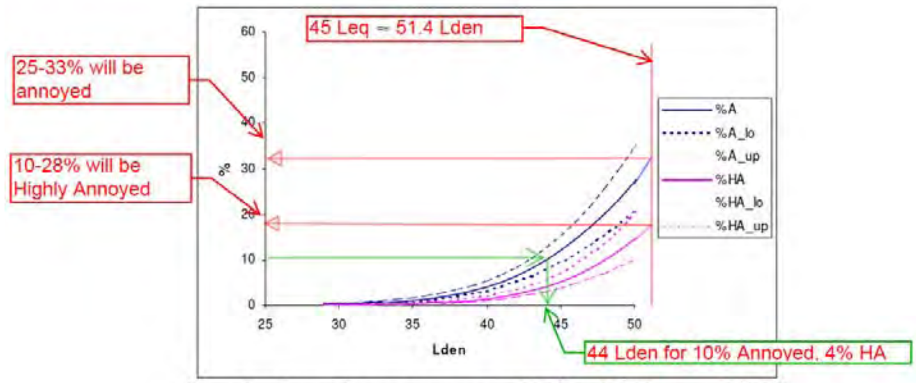

Figure 2 – Expected percentages annoyed (%A) and highly annoyed (%HA) indoors by wind turbine noise, with 95% confidence intervals.

Figure 10-Annoyance inside a home for outside wind turbine noise.

A recent paper by Drs. Pedersen and van den Berg assessed the annoyance felt by people inside their homes for various sound levels of wind turbine noise outside the homes. Figure 10 shows the annoyance level for the situation of 45 Leq outside the home. This results in an annoyance value of about 1 out of every 3 people. The position that 45 dBA wind turbine noise outside a home is compatible with sleeping inside the home (even with the windows closed) is shown to be false.

15 cont.

Frequency of Conditions that Cause Blade Swish

The phenomenon of wind shear coupled with ground level atmospheric stability refers to the boundary that forms between calm air at ground level and winds above the boundary at a higher altitude. *"A high wind shear at night is very common and must be regarded a standard feature of the night time atmosphere in the temperate zone and over land."*[22] A paper presented at the 2009 Institute of Noise Control Engineers, Noise-Con 2009 conference in Ottawa, Canada on background noise assessment in New York's rural areas noted: *"Stable conditions occurred in 67% of nights and in 30% of those nights, wind velocities represented worst-case conditions where ground level winds were less than 2 m/s and hub-height winds were greater than wind turbine cut-in speed, 4 m/s."*[23]

Based on a full year of measurements every half-hour at a wind farm in Germany, Van den Berg found:

> *"the wind velocity at 10 m[eters] follows the popular notion that wind picks up after sunrise and abates after sundown. This is obviously a 'near-ground' notion as*

[21] Van den Berg (2006), p. 106; Minnesota Department of Public Health (2009), p. 21. *See also* Pedersen, "Wind turbine noise, annoyance and self-reported health and well being in different living environments," 2007, p. 24)

[22] Van den Berg (2006, p. 104). *See also* Cummings (2009)

[23] Schneider, C. "Measuring background noise with an attended, mobile survey during nights with stable atmospheric conditions" Noise-Con 2009

> *the reverse is true at altitudes above 80 m. . . . after sunrise low altitude winds are coupled to high altitude winds due to the vertical air movements caused by the developing thermal turbulence. As a result low altitude winds are accelerated by high altitude winds that in turn are slowed down. At sunset this process is reversed.*[24]"

In other words, when ground-level wind speed calms after sunset, wind speed at typical hub height for large wind turbines (80 meters, or 262 feet) commonly increases or at least stays the same. As a result, turbines can be expected to produce noise while there is no masking effect from wind-related noise at the ground where people live. "*The contrast between wind turbine and ambient sound levels is therefore at night more pronounced*.[25]" The blade angle is calculated for the average wind speed (at the hub) but the wind speeds at the top and bottom can require different settings to avoid producing noise. As the turbine's blades sweep from top to bottom under such conditions the blade encounters different wind velocities that do not match the blade's angle of attack resulting in rhythmic swishing noise from the parts of the rotation where blade angle mismatches occur[26]. Such calm or stable atmosphere at near-ground altitude accompanied by wind shear near turbine hub height occurred in the Van den Berg measurements 47% of the time over the course a year on average, and most often at night[27].

Infra and Low Frequency Sounds

The level of annoyance produced by wind turbine noise also increases substantially for **low frequency sound,** once it exceeds a person's threshold of perception. Annoyance and the sense of loudness increase more rapidly than the more readily audible mid-frequency sounds. Sound measured as dBA is biased toward 1,000 Hz, the center of the most audible frequency range of sound pressure. Low frequency sound is in the range below 200 Hz and is more appropriately measured as dBC for low frequency sound or in dBG for infrasound. Because infra and low frequency sounds from wind turbines include significant dynamic modulation in the frequency range from the Blade Passage Frequency of about 1 Hz up to about 10 Hz standard acoustical instruments such as 1/3 octave band analyzers and FFT analyzers using band filtering cannot be used to measure the short duration pulsations. Using instrumentation that can provide 1/3 octave band resolution of the spectrum sound pressure levels can only be used for assessing relatively long periods of the infrasound (minutes or hours, not seconds or milliseconds) and even then the readings may understate the total acoustic energy and the maximum sound pressure levels during those pulsations[28].

16

Sound below 20 Hz, termed infrasound, is generally presumed to not be audible to most people. *See* Leventhall (2003, pp. 31-37); Minnesota Department of Public Health (2009, p. 10); Kamperman and James (2008, pp. 23-24). However, if these criteria are applied to the most sensitive people, the thresholds drop approximately 6-12 dB. But the Thresholds of Perception are for a single steady pure tone under laboratory conditions. Wind turbine sounds are a complex mix of tones, all within the same critical band. Because the auditory system integrates the energy of the various tones it is possible that for some people they will be audible at levels lower than what is required for a single

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[24] (Van den Berg 2006, p. 90)
[25] *Id.*, p. 60
[26] *Id.*, p. 61. *Cf. also* Minnesota Department of Public Health (2009), pp. 12-13 and Fig. 5.
[27] Van den Berg 2006, p. 96
[28] A paper co-written by this reviewer and Wade Bray of Head Acoustics is being prepared to present the findings of an analysis of wind turbine low and infrasonic sound that shows these micro-time pulsations at the July 2011 Noise-Con to be held in Portland, OR.

pure tone. The combination of people with extra sensitivity and the presence of a complex set of tones in the range from 0 to 20 Hz puts the infrasound sound pressure levels measured on receiving properties and inside homes within the threshold of perception for a subset of the population. However, when someone states that wind turbine infra sound is not significant because it does not reach the amplitudes needed to exceed the Thresholds of Perception they are mischaracterizing the situation. The truth is we only know the Thresholds of Perception for single pure tones. When the sounds are more complex as for wind turbines with their multiple combinations of tones with varying types of amplitude and frequency modulation we do not know the Threshold of Perception. All we know is that it is likely to be lower than for a single pure tone.

For many years it has been presumed that only infra and low frequency sounds that reached the threshold of audibility for people posed any health risks. Many acoustical engineers were taught that <u>if you cannot hear a sound, it cannot harm you</u>. Recent research has shown that the human body and auditory system is more sensitive to infra and low frequency noise (ILFN) than previously believed. This perception is not one that is 'heard' but rather it is one that involves the organs of balance (vestibular systems). The vestibular portion of our auditory system can respond to levels of infra and low frequency sound at pressures significantly lower than what is needed to reach the thresholds of audibility.[29]

16 cont.

Dr. Nina Pierpont has conducted a study of the effects of infra and low frequency sound on the organs of balance that establishes the causal link between wind turbine ILFN and medical pathologies. This research is discounted by the wind industry as not meeting standards for epidemiology and that it is not 'peer-reviewed.' Neither accusation is correct. The type of epidemiological study conducted by Dr. Pierpont is termed a case-crossover study. Dr. Carl Philips, a highly respected epidemiologist not associated with the wind industry has said: [30]

> "*In particular, my scientific analysis is based on the following points, which are expanded upon below:*
>
> "*1. Health effects from the turbine noise are biologically plausible based on what is known of the physics and from other exposures.*
>
> "*2. There is substantial evidence that suggests that some people exposed to wind turbines are suffering psychological distress and related harm from their exposure. These outcomes warrant the label "health effects" or "disease" by most accepted definitions, though arguments about this are merely a matter of semantics and cannot change the degree of harm suffered.*
>
> "*3. The various attempts to dismiss the evidence that supports point 2 appears to be based on a combination of misunderstanding of epidemiologic science and semantic games. Multiple components of this point appear below.*" *Also,*
>
> "*There is ample scientific evidence to conclude that wind turbines cause serious health problems for some people living nearby.*" *And,*
>
> "*The reports that claim that there is no evidence of health effects are based on a very simplistic understanding of epidemiology and self-serving definitions of what does not count as evidence.*

---

[29] Alves-Pereira, Marianna and Nuno A. A. Branco (2007a). *VibroAcoustic disease: Biological effects of infrasound and low-frequency noise explained by mechanotransduction cellular signaling*, 93 PROGRESS IN BIOPHYSICS AND MOLECULAR BIOLOGY 256–279, available at http://www.ncbi.nlm.nih.gov/ pubmed/17014895><
and, Alves-Pereira, Marianna and Nuno A. A. Branco (2007b). *Public health and noise exposure: the importance of low frequency noise*, Institute of Acoustics, Proceedings of INTER-NOISE 2007,

[30] Philips, Carl v., " An Analysis of the Epidemiology and Related Evidence on the Health Effects of Wind Turbines on Local Residents," for Public Service Commission of Wisconsin docket no. 1-AC-231, Wind Siting Rules, July 2010.

> *Though those reports probably seem convincing prima facie, they do not represent proper scientific reasoning, and in some cases the conclusions of those reports do not even match their own analysis."*

Further, the report was peer-reviewed by some of the top experts in the U.S. and Britain who have experience with vestibular disturbances and adverse health conditions. These reviews were included in the published final report. The criticisms leveled at Dr. Pierpont's work are not supported by the facts.

The new research is not from the traditional fields that have provided guidance for acoustical engineers and others when assessing compatibility of new noise sources and existing communities. Instead it comes from the field of research into auditory and vestibular function. A recent peer reviewed paper by NIDCD/NIH researcher Dr. Alec Salt, reported that the cochlea responds to infrasound at levels 40 dB below the threshold of audibility.[31] These studies show how the body responds to extremely low levels of energy not as an auditory response, but instead as a vestibular response.

In a personal communication, this reviewer asked Dr. Salt the question: "Does infrasound from wind turbines affect the inner ear?" Dr. Salt responded:

> "There is controversy whether prolonged exposure to the sounds generated by wind turbines adversely affects human health. The un-weighted spectrum of wind turbine noise slowly rises with decreasing frequency, with greatest output in the 1-2 Hz range. As human hearing is insensitive to infrasound (needing over 120 dB SPL to detect 2 Hz) it is claimed that infrasound generated by wind turbines is below threshold and therefore cannot affect people. The inner hair cells (IHC) of the cochlea, through which hearing is mediated, are velocity-sensitive and insensitive to low frequency sounds. The outer hair cells (OHC), in contrast, are displacement-sensitive and respond to infrasonic frequencies at levels up to 40 dB below those that are heard."
>
> "A review found the G-weighted noise levels generated by wind turbines with upwind rotors to be approximately 70 dBG. This is substantially below the threshold for hearing infrasound which is 95 dB G but is above the calculated level for OHC stimulation of 60 dB G. This suggests that most wind turbines will be producing an unheard stimulation of OHC. Whether this is conveyed to the brain by type II afferent fibers or influences other aspects of sound perception is not known. Listeners find the so-called amplitude modulation of higher frequency sounds (described as blade "swish" or "thump") highly annoying. This could represent either a modulation of audible sounds (as detected by a sound level meter) or a biological modulation caused by variation of OHC gain as operating point is biased by the infrasound. Cochlear responses to infrasound also depend on audible input, with audible tones suppressing cochlear microphonic responses to infrasound in animals. These findings demonstrate that the response of the inner ear to infrasound is complex and needs to be understood in more detail before it can be concluded that the ear cannot be affected by wind turbine noise."

16 cont.

During the summer of 2009, this reviewer conducted a study of homes in Ontario where people had reported adverse health effects that they associated with the operation of wind turbines in their communities[32]. The study involved collecting sound level data at the homes and properties of these people, many of who had abandoned their homes due to their problems. This study found that sound levels in the 1/3 octave bands below 20 Hz were often above 60 dB and in many cases above 70 dB. Since the shape of the spectrum for wind turbine sound emissions is greatest at the blade passage frequency which was below the threshold for the instruments used it can be assumed that the sound pressure levels in the range of 0 to 10 Hz exceeded 70 dBA. Given the statement by Dr. Salt that vestibular responses would start at levels of 60 dBG or higher this data supports the

[31] Salt, Alec, "Responses of the ear to low frequency sounds, infrasound and wind turbines", Hearing Research, 2010. This work was supported by research grant RO1 DC01368 from NIDCD/NIH

32 James, R. R., "Comments Related to EBR-010-6708 and -010-6516" Comment ID 123842, 2009

hypothesis that there is a link between the dynamically modulated infra sound produced by wind turbines and reported adverse health effects.

Adverse health effects related to inaudible low frequency and infra sound have been encountered before. Acoustical engineers in the Heating, Cooling and Air Conditioning (ASHRAE) field have suspected since the 1980's and confirmed in the late 1990's that dynamically modulated, but inaudible, low frequency sound from poor HVAC designs or installations can cause a host of symptoms in workers in large open offices[33]. The ASHRAE handbook devotes considerable attention to the design of systems to avoid these problems and has developed methods to rate building interiors (RC Mark II) to assess them for these low frequency problems[34]. The report on Ontario by this reviewer includes an Appendix that provides more detail on this aspect of how inaudible infra and low frequency sound can cause adverse health effects.

When infra and low frequency sound is in the less-audible or inaudible range, it is often felt rather than heard. Unlike the A-weighted component, the low-frequency component of wind turbine noise "*can penetrate the home's walls and roof with very little low frequency noise reduction*.[35]" Further, as discussed in the 1990 NASA study the inside of homes receiving this energy can resonate and cause an increase of the low frequency energy over and above what was outside the home. Acoustic modeling for low frequency sound emissions of ten 2.5 MW turbines indicated "*that the one mile low frequency results are only 6.3 dB below the 1,000 foot one turbine example*.[36]" This makes the infra and low frequency sound immissions from wind turbines a potential problem over an even larger area than the audible sounds, such as blade swish and other wind turbine noises in the mid to high frequency range. 16 cont.

The acoustical consultant that does not practice in this field may not be as aware of the problems of amplitude modulated, in-audible low frequency sound identified by the ASHRAE engineers. Many have not integrated these new understandings of how infra and low frequency sound can affect the vestibular organs into their work on community noise. These levels were only a few years ago considered too low to cause any physical response. Today, there is a renewed interest in these effects. A paper titled: Infrasound, The Hidden Annoyance of Industrial Wind Turbines, by Prof. Claude Renard of the Naval College and Military School of the Fleet (France) concludes:

> "*The information given above is enough to understand that it is better not to be exposed to infrasound which propagates far from its point of origin and against which it is impossible to protect oneself due to the long wavelengths.*
>
> "*Those most affected by exposure to infrasound are rural inhabitants living in proximity to wind turbines, and those working in air-conditioned offices.*
>
> "*The people in the former category are exposed to the infrasound 24 hours a day, whereas people in the latter category are only exposed to infrasound 6 hours a day.*
>
> "*The most important issue is therefore to know what intensity of infrasound can be tolerated without inconvenience over these periods of time.*
>
> "*We do not have the answer to this question.*"

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33 Persson Waye, Kirsten, Rylander, R., Benton, S., Leventhall, H. G., Effects of Performance and Work Quality Due to Low Frequency Ventilation Noise, Journal of Sound and Vibration, (1997) 2005(4), 467-474.

34 The study also showed that NC curves are not able to predict rumble. This use of NC curves was disproved in the 1997 Persson Waye, Leventhall study. Use of the RC Mark II procedures is more appropriate for this use.

35 Kamperman and James (2008), p. 3.

36 *Id.*, p. 12

Specific Issues with the HDR Noise Assessment Report

Problems with Cadna/A (Limitations on Use of ISO 9613-2 Algorithms)

As discussed earlier in this review the sound propagation modeling presented by HDR and used as the basis for conclusions about the impact of the Project on nearby properties and residences underestimates the sound levels that will be received on the properties and homes adjacent to the wind turbine utility. The sound propagation modeling software used for the sound models (Cadna/A and others) are general-purpose commercial packages for use in modeling noise from noise sources like industrial plants, roads, and railways, not wind turbines. Although this does not completely preclude the use of the Cadna/A software package, it does call into question the implied assertion by HDR by representing the predicted sound levels to a tenth of a decimal precision that the predicted values can be assumed to be precise. We need to apply reasonable safety factors and give consideration to the known tolerances and limits to the accuracy of the procedures in our conclusions. Further, it must be understood that there are other computational methods and algorithms that can be used to model wind turbines other than the ISO method that produce different results. For example, the Swedish model that was mentioned in the discussion about ISO 9613-2 has been validated by independent researchers for use with wind turbines. This model was used by this reviewer to predict the sound pressure levels in dBA and dBC for a home near a row of wind turbines and one at a distance of about 1 to 1.25 miles to demonstrate the difference in 17
outcomes. A table comparing the outcomes is presented later in this report.

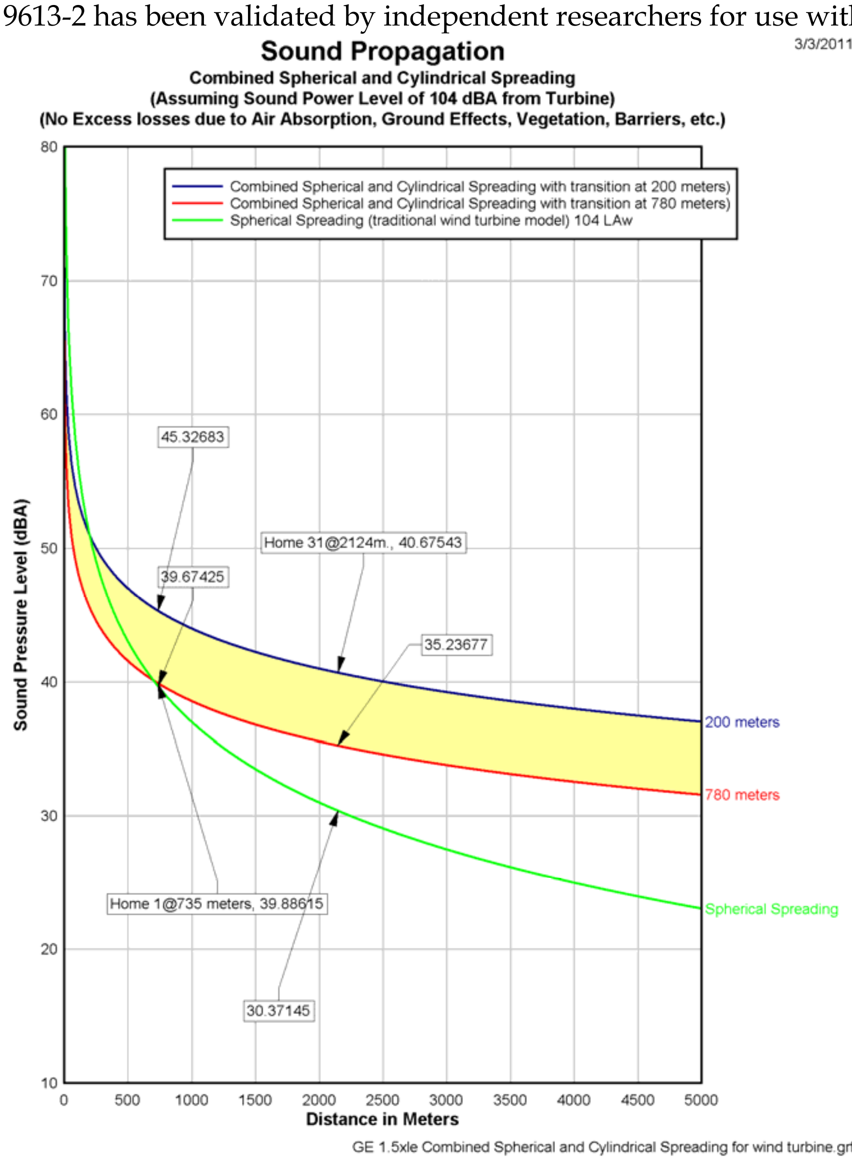

Figure 11-Comparison of decay rate for ISO 9613-2 and Swedish model

The graph shown in Figure 11 shows the decay rate for the two modeling methods. The Swedish method includes a new variable that adjusts the distance from the turbine where the sound field converts from a decay rate of 6 dB per doubling of distance (ISO 6913-2 also known as spherical spreading or point source calculations) to 3 dB decrease per doubling (known as Cylindrical spreading or line source calculations). For reflective surfaces like water, ice or hard rock this value is about 200. For ground surfaces that absorb part of the acoustic energy this may be 800 or higher. The graph shows the ISO decay rate as the bottom green trace. For a single

turbine with a sound power level of 104 dBA the sound pressure at about 735 meters (a little less than the distance from turbine R12 to Home #1) would be 39 dBA. This is about the same as the Swedish model when the variable is set to 780 meters. If the ground was highly reflective as might be expected for rocky hard packed desert land the sound level would only have dropped to 45 dBA. At 2124 meters (a little less than the distance from turbine G17 to Home #31) the difference between the two models is much greater. Here the ISO model would predict 30 dBA but the Swedish model would predict 35 to 40 dBA depending on the ground absorption assumption. Based on this graph 17 cont.
the HDR model is understating the sound levels for homes at distances of 4000 meters by 8 dBA or more. These differences do not consider the increased sound power levels due to wind shear at night. Under those conditions the sound levels predicted by both methods would be 5 to 8 dBA higher. This demonstrates why the Project cannot claim with any degree of assurance that it will not produce sound levels at sensitive properties that exceed the 45 CNEL limits set by San Diego County. In fact, it is quite likely that these exceedances will occur and they will occur most often at night when the create a serious challenge to residents for sleep disturbance.

Use of Tolerances

HDR included the 2 decibel tolerance associated with instrumentation error from the IEC 61400 – 11 test protocol for measuring the sound power produced by wind turbines. However, HDR does not include the three (3) dB tolerance associated with errors when applying the ISO-methodology (See Table 5 from the ISO standard Figure 12).

If HDR had included the three (3) dB tolerance for the ISO methodology, the results of the models for daytime and nighttime operating modes would have shown many of the homes proximate to the project being exposed to sound levels over 45 dBA CNEL (38 Leq is required for compliance if the turbines operate at night). ISO 9613-2, Table 5, Section 9, "Accuracy and limits of the method" (Figure 12), shows the tolerance as plus/minus 3 dB for predictions. This applies when the noise source is at a height greater than 5m and less than 30 m above the receiver and the receiver is within 18
1000 m. of the noise source.

Table 5 — Estimated accuracy for broadband noise of L_{AT}(DW) calculated using equations (1) to (10)

Height, h *)	Distance, d *)	
	$0 < d < 100$ m	100 m $< d < 1\ 000$ m
$0 < h < 5$ m	± 3 dB	± 3 dB
5 m $< h < 30$ m	± 1 dB	± 3 dB

*) h is the mean height of the source and receiver.
d is the distance between the source and receiver.

NOTE — These estimates have been made from situations where there are no effects due to reflection or attenuation due to screening.

Figure 12-Table of Tolerances for ISO Model if all assumptions are met.

It essential to include the three (3) dB tolerance in the predictions. Further, the predicted values should be viewed as estimates, not precise values even with the tolerance included because the wind turbine does not fit the model's assumptions for height and spherical spreading.

Use of Sound Power Data Representing Sound Emissions in a Neutral Atmosphere

Sound power levels must represent the conditions that cause the intrusive blade swish that is commonly associated with nighttime sleep disturbance and complaints. The manufacturer's
reported power levels represents a standardized value for 'typical' conditions of a neutral 19
atmosphere with a moderate wind shear gradient. The HDR report made no attempt to address this deficiency.

Evidence of wind farm noise exceeding certificate of approval levels

A spreadsheet model was developed for two of the properties near the wind project that applies the ISO tolerances as they should be applied. In addition, a model using the Swedish algorithms was also developed. Two homes were selected as representing the sensitive receiver sites. They are home #1, which is one of the closest homes to the turbines (approx. 1/2 mile), and home #31, which is about a mile and a quarter away from the nearest turbines. They were selected as representatives of other properties for comparison to the sound levels reported by HDR. These models were constructed using spreadsheets and are attached as appendix materials for review.

Evidence of Tule Wind Exceeding 45 dBA CNEL (38 L_{Aeq} during nighttime hours)

Residence	Nearest turbine (m)	HDR Study Report (w/o ISO tolerance) dBA/dBC	E-CS Study ISO Model (no ground absorption) dBA/dBC	E-CS Study Swedish Model variable of 780 for partly absorptive ground	E-CS ISO model with 5 dBA increase in Turbine Sound Power Level* dBA/dBC
1	735 m. (R12)	47/58	45/58	51/62	50/63
31	2142 m. (G17)	39/51	35/50	47/58	40/55

* Adjustment for Nighttime Blade Thump under a stable atmosphere with high wind shear. This could be considered the Predictable Worst Case Condition.

The two ISO models are in general agreement with the E-CS ISO model having slightly lower dBA levels for Homes 1 and 31. This is likely because the E-CS model only considered the nearest turbines where the HDR model considered the effect of the nearby turbines as well as those at greater distances. The E-CS model based on the Swedish model that combines spherical and cylindrical sound propagation shows a large increase over either of the two ISO models. For Home #1 the increase is 3 dBA over the HDR ISO model and 6 dBA over the E-CS ISO model. As expected the E-CS Swedish model shows a much lower decrease in sound with distance than the ISO models. This is explained above in the narrative for Figure 11 as a result of the propagation decrease changing from 6 dB per doubling of distance to 3 dB per doubling of distance. For Home #31, located at a mile and a quarter from the nearest turbine the daytime sound level is projected to be as high as 47 dBA. This is only 4 dBA lower than at Home 1 whereas the ISO models show a difference of about 10 dBA. If we were to consider the increased sound power for nighttime stable atmospheric conditions with high wind shear above the stable boundary layer the nighttime sound levels at Home #1 would be approximately 50 dBA. This reviewer has measured similar high sound levels at similar distances during stable atmospheres at several wind utility projects. For the same nighttime conditions homes at a distance of a mile may experience sound levels of 40 dBA.

In the 2008 manuscript by George Kamperman, Bd. Cert. INCE, P.E. and myself we set criteria designed to protect the public health we stated that a setback of at least 1.25 miles was needed to achieve this goal[37]. Given that the World Health Organization's 2009 Nighttime Noise Guidelines find that the Threshold for Adverse Health Effects is 40 dBA at night outside a home the results shown in the above Table confirm the need for such distances. For specific topographies that

[37] Kamperman, G.W., Bd.Cert. INCE, P.E., James, R.R. INCE, "The 'How To' Guide to Siting Wind Turbines To Prevent Health Risks Fro Sound, 2008.

increase the distance that sound travels or increase sound power emissions due to in-flow turbulence from wake interference due to layout or rough terrain downwind of the turbines, or that are more susceptible to the daytime warming and nighttime cooling of the ground and atmosphere this 1.25 mile setback may not be sufficient.

Conclusion

It is the opinion of this reviewer, based on his personal experience and the review described in this document that a properly conducted study would identify many more homes in the vicinity of the wind turbines where the receiving properties will have sound levels that exceed 40 dBA. When adjusted for known tolerances of algorithms and measurements used to construct the model and the increased sound power emitted by wind turbines at night under conditions of high wind shear, a common situation during the warm season most of the homes in the areas bounding the Project will have sound levels that exceed 40 dBA at night. The San Diego County CNEL limit of 45 dBA for sensitive receivers will be exceeded at any location were the nighttime L_{Aeq} exceeds 38 dBA. This is likely to be most of the area within 1.25 miles of the perimeter of the Project. For the non-residential areas used for campgrounds and outdoor recreation the soundscape will no longer be the natural sounds of nature but instead the industrial sounds of wind turbines. The belief that the noise from the highways will somehow 'mask' the wind turbine sounds is not supported by current research. Wind turbine noise, especially at night under stable atmospheric conditions or during weather that causes increased turbulence in the in-flow air the wind turbine sounds will be characterized by large swings in sound level synchronized with turbine blade rotation of about one 'whoosh" or "thump" per second. This amplitude modulation is an additional reason that it can be expected that sleep disturbance will be a common factor for people living or camping in the area. Further, there is reason to be concerned that for a sub-set of the people in the community the infrasound and low frequency content of the wind turbine noise will pose additional health risks due to interactions with their organs of balance. These concerns are not hypothetical. There are many similar large scale wind turbine projects operating in the U.S. and around the world. A fair number of these projects result in complaints from people living near or inside the project's footprint of night time sleep disturbance and symptoms that are part of wind turbine syndrome. These projects were granted permits based on the same process of assessing background sound levels and computer modeling that were used for the Project. Given the analysis above it is reasonable to conclude that this project will join the ranks of wind utilities that cause adverse health conditions and noise pollution if it is approved.

This project should be rejected based on the concerns raised in this report. There may be other arrangements of turbines that might be compatible with the community and current land use. However, this current arrangement, with inter turbine spacing of less than three rotor diameters, hard dense reflective ground surfaces, desert heating and cooling cycles being likely to create stable nighttime atmospheric conditions, and the rough terrain which will increase the in-flow turbulence all result in increased noise levels for residents and visitors.

In the opinion of this reviewer the Project will result in the exposure of persons to or generation of noise levels in excess of standards established in the San Diego County noise ordinance, and also exceed the WHO 2009 nighttime guidelines setting 40 dBA (Leq) at night as the threshold for adverse health effects. It will also result in a substantial permanent increase in ambient noise levels in the project vicinity above levels existing without the project.

The Project, as currently proposed should be rejected.

End of Review

Richard R. James, INCE
For E-Coustic Solutions

March 4, 2011

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March 4, 2011

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Re: Comments of Backcountry Against Dumps, The Protect Our Communities Foundation, East County Community Action Coalition and Donna Tisdale on the Draft Environmental Impact Report/Draft Environmental Impact Statement for East County Substation Project, the Tule Wind Project and the Energia Sierra Juarez Gen-Tie Project

Dear Officials:

Pursuant to the California Environmental Quality Act ("CEQA"), California Public Resources Code ("P.R.C.") section 21000 *et seq.*, and the National Environmental Policy Act ("NEPA"), 42 U.S.C. section 4321 *et seq.*, and in accordance with the public notices provided by the California Public Utilities Commission ("CPUC") and the Bureau of Land Management ("BLM") (collectively "reviewing agencies"), Backcountry Against Dumps, The Protect Our Communities Foundation, East County Community Action Coalition and Donna Tisdale (hereinafter "Conservation Groups") submit the following Comments on the reviewing agencies' joint Draft Environmental Impact Report/Draft Environmental Impact Statement ("DEIR") for the East County ("ECO") Substation Project, the Tule Wind Project and the Energia Sierra Juarez Gen-Tie Project ("ESJ Project") (collectively, "the Project"). These comments follow Conservation Groups' scoping comments on the Project, submitted on February 15, 2010 (attached hereto as Exhibit 1).

At the outset, Conservation Groups wish to express their opposition to this Project as an unnecessary industrialization of pristine desert wilderness areas. Echoing a growing chorus of opinions on this subject, Conservation Groups reiterate their suggestion that the reviewing agencies adopt as an alternative to the proposed project the development of wide-spread non-fossil fuel distributed generation projects near demand centers in already-disturbed areas.[1] The reviewing

[1] Distributed generation has been recently referred to by CPUC as electricity provided by "non-centralized electricity power production facilities less than 20 MW interconnected at the distribution side of the electricity system. [Distributed generation] technologies include solar,

agencies dismiss this alternative in the DEIR as being infeasible and unable to fulfill the Project objectives, but as discussed below these conclusions are erroneous. The EIR must provide a robust analysis of DG alternatives that would obviate the need for all three components of the project.

Additionally, Conservation Groups believe that this environmental review process will not adequately address impacts because it has been improperly segmented from the environmental reviews of other energy development and transmission projects, including, most notably, the Sunrise Powerlink Transmission Line ("Powerlink") EIR/EIS, which was approved by CPUC on December 18, 2008 and by BLM on January 20, 2009. The projects here are intimately linked to the Powerlink project and other large-scale energy development projects in the works. Conservation Groups therefore request that, before continuing with the environmental review and approval process for the Project, the reviewing agencies prepare a comprehensive, programmatic-level EIR/EIS. The programmatic EIR/EIS should (1) study the impacts of widespread industrial-scale energy developments in the southern California deserts and elsewhere in the Southwest, (2) provide guidance on where, if anywhere, to locate the developments, and (3) analyze alternatives to developing renewable energy facilities in sensitive desert ecosystems far from load centers, including locally distributed generation such as roof-top solar arrays. In further expression of these two major concerns and others, Conservation Groups offer the following comments on the DEIR.

I. <u>Project Description</u>

In its description of the ESJ Project, the DEIR asserts that "[o]nly renewable energy would be transmitted via the gen-tie line." DEIR at ES-11. At best, this statement is entirely unsupported by evidence. At worst, it is erroneous and misleading. While Sempra Generation (ESJ's parent company) requested in an August 28, 2009 letter to the federal Department of Energy ("DOE") that "power on [the gen-tie] line be limited to renewable energy projects," there is no evidence in the DEIR – or the Draft EIS prepared by DOE on the ESJ Project – that any such limitation has been or would be imposed.[2] Moreover, there are currently no CPUC-approved contracts for wind power in the Baja area. It thus appears that the statement is erroneous. The reviewing agencies must either strike the statement – and any conclusions based on it – from the EIR or explain its accuracy.

II. <u>Project Purpose and Need</u>

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wind and water-powered energy systems; and renewable and fossil-fueled internal combustion (IC) engines, small gas turbines, micro-turbines and fuel cells." CPUC, "Impacts of Distributed Generation, Final Report," January 2010, p. 3-3, available at: http://www.cpuc.ca.gov/NR/rdonlyres/750FD78D-9E2B-4837-A81A-6146A994CD62/0/ImpactsofDistributedGenerationReport_2010.pdf

[2] Sempra's letter is available at: http://esjprojecteis.org/docs/DOE_Presidential_Permit_clarification.pdf

NEPA requires EISs to show the "underlying purpose and need to which the agency is responding in proposing the alternatives including the proposed action." 40 C.F.R. § 1502.13. BLM must not "adopt[] private interests to draft a narrow purpose and need statement" because "the Department of Interior has promulgated no regulations emphasizing the primacy of private interests." *National Parks & Conservation Assn. v. U.S. Bureau of Land Mgmt* ("*NPCA v. BLM*"), 606 F.3d 1058, 1071, 1072 (9th Cir. 2010). The Department of the Interior's "NEPA handbook explains that the 'purpose and need statement for an externally generated action must describe the BLM purpose and need, *not an applicant's or external proponent's purpose and need.*'" *Id.* at 1071 n. 9 (emphasis in original).

Here, the DEIR states that BLM's purpose and need is merely to "respond to [San Diego Gas and Electric Company's ("SDG&E's")] and Pacific Wind Development's applications under Title V of the Federal Land Policy Management Act (FLPMA, 43 U.S.C. 1701 et seq.) for [a right-of-way ("ROW")] grant to construct, operate, and decommission a wind energy facility (Tule Wind Project) and a 138 kV transmission line on public lands (ECO Substation Project) in compliance with FLPMA, BLM ROW regulations, and other applicable federal laws." DEIR at ES-3. This is entirely inadequate for NEPA purposes. It is not enough for BLM to reiterate its statutory duty to review applications submitted to it. BLM must actually show the "*underlying* purpose and need" for the Project itself (40 C.F.R. section 1502.13 (emphasis added)), based on the agency's *own* purposes and needs, not those of the Project applicants. *NPCA v. BLM*, 606 F.3d at 1071.

III. <u>A Programmatic EIR/EIS Should Be Prepared</u>

In addition to requiring analysis of connected actions in project-specific EISs, such as the Project DEIR here, NEPA requires agencies to prepare a programmatic EIS where the agency is considering a group of related actions, including actions that are connected, cumulative or similar. *Piedmont Environmental Council v. Federal Energy Regulatory Commission*, 558 F.3d 304 (4th Cir. 2009) (citing 40 C.F.R. § 1508.25(a)(1)-(3)); *see also* 14 Cal. Code Regs. ("CEQA Guidelines") § 15168 (discussing when a "Program EIR" can be prepared under CEQA). Agencies may not "unreasonably constrict[] the scope of . . . environmental evaluation" by segmenting review of an overall program or group of related actions. *National Wildlife Federation v. Appalachian Regional Commission*, 677 F.2d 883, 888 (D.C. Cir. 1981).

As discussed above, the Project is intimately linked to the Powerlink project and other energy development and transmission projects in the area. The ECO Substation Project, Tule Wind Project and ESJ Project are just three of the many proposed renewable energy projects in the southern deserts of California that either require BLM, CPUC and/or San Diego County's approval, or could not proceed without approval by one of those agencies of a related facility (such as the Powerlink). Other such projects include, *inter alia*, the Powerlink, the Ivanpah Solar Electric Generating System, the Esmeralda-San Felipe Geothermal Project, the Genesis Solar Energy Project, the Chevron Energy Solutions Lucerne Valley Solar Project, the Calico Solar Project, the Blythe Solar Project, and the Wind Zero Project.

These projects are interrelated in multiple ways. For one, as mentioned, all the projects are located in whole or in part in the California desert and require some form of BLM, CPUC and/or San Diego County approval. Additionally, all the projects would connect to the high-voltage wholesale power grid managed by the California Independent System Operator. Further, they are all intended to help California – and the utilities therein – meet their Renewables Portfolio Standard. The projects are also intended to help fulfill the Obama Administration's goal of harnessing renewable energy resources. Indeed, most of the projects are reliant on federal funds made available for renewable energy facilities by American Recovery and Reinvestment Act of 2009.

Before continuing with project-specific environmental review and approval processes for each of these interrelated renewable energy projects, like the Project here, BLM and CPUC should have, and must now, prepare a programmatic EIR/EIS to (1) study the impacts of widespread industrial-scale energy developments in the southern California deserts and elsewhere in the Southwest, (2) provide guidance on where, if anywhere, to locate the developments, and (3) analyze alternatives to developing renewable energy facilities in sensitive desert ecosystems far from load centers, including locally distributed generation such as roof-top solar arrays. Without such a programmatic EIR/EIS, BLM and CPUC have improperly segmented – and will continue to improperly segment – their environmental review of the unprecedented development of renewable energy facilities in the deserts of southern California and the greater Southwest.

BLM, along with the Office of Energy Efficiency and Renewable Energy, is currently developing a Solar Energy Development Programmatic EIS, but its zones of analysis do not include the Tule Wind Project site or many of the other sites in California for which renewable energy developments have been or are likely to be proposed. Thus, while commendable, the Solar Energy Development Programmatic EIS cannot satisfy NEPA with respect to the Project here and many other similar projects in California.

IV. <u>Alternatives</u>

NEPA requires that an EIS "[r]igorously explore and objectively evaluate all reasonable alternatives" so that "reviewers may evaluate their comparative merits." 42 U.S.C. §4332; 40 C.F.R. § 1502.14. "The existence of a viable but unexamined alternative renders an environmental impact statement inadequate." *Friends of Yosemite Valley v. Kempthorne*, 520 F.3d 1024, 1038 (9th Cir. 2008). Similarly, to comply with CEQA, agencies must consider a "reasonable range" of alternatives. CEQA Guidelines §15126.6(a); *Village of Laguna Beach, Inc. v. Board of Supervisors* (1982) 134 Cal.App.3d 1022, 1028. A project *cannot* be approved if its significant impacts can be feasibly reduced to insignificance through project alternatives or mitigation measures. P.R.C §§ 21002, 21081.

Here, the reviewing agencies unacceptably eliminated feasible – and less environmentally damaging – alternatives from careful review. Most notably, they dismissed the ECO System

Alternative 6 and the Distributed Generation alternative. DEIR at C-18 to 19, 24. As elucidated in the Declaration of Bill Powers (attached hereto as Exhibit 2), both of these alternatives are commercially and technically feasible. Moreover, they would both meet the Project objectives of increasing renewable energy development, meeting state Renewables Portfolio Standards and federal renewable energy mandates, and improving the reliability of power delivery to Boulevard, Jacumba and other nearby communities. DEIS at A-11. Engineer Bill Powers' expert conclusions are summarized and further substantiated below.

A. The ECO System Alternative 6

The ECO System Alternative 6 was proposed as an alternative to the ECO Substation and ESJ Project. The ECO System Alternative 6 is described in the DEIR as follows:

> Use existing Comision Federal de Electricidad (CFE) 230 kV line located in northern Mexico and Path 45 to transmit ESJ Energy, and upgrade East County 69 kV substations combined with upgrading existing East County 69 kV substation(s) and lines to accommodate local wind development combined with microgrid reinforcement of local transmission infrastructure to meet load requirements from rooftop solar or other local, small-scale resources.

DEIR at C-18. The DEIR dismisses this alternative because (1) there is not enough capacity on the CFE 230 kV line and Path 45 to "interconnect all of the ESJ Wind Project" in the La Rumorosa area of Mexico, or "all the region's planned renewable generation;" (2) the alternative "would not meet reliability objectives;" (3) upgrades to the CFE and Path 45 systems "may pose substantial regulatory and legal constraints to achieving delivery of renewable energy;" and (4) the "alternative may not meet environmental criteria because up to 100 miles of reconductering or rebuilding projects would be required to integrate planned renewable generation in the Boulevard area." *Id.* The DEIR is wrong; the ECO System Alternative 6 is feasible and would meet the Project objectives.

First, there is ample capacity. It is undisputed that Path 45 has at least 800 MW in unused capacity. *See* DEIR at C-18; Exhibit 2 at ¶¶ 3-6. However, the available capacity could be doubled if the lines were reconductered with composite conductors.[3] With a capacity of 1,600 MW, the "planned generation of 1,200 MW from the ESJ Wind Project" would be easily accommodated. DEIR at C-18. As for the other renewable generation planned in the region, some of it could be accommodated via upgrades to existing East County substations. *See* DEIR at C-55. And local distributed generation could supplant the need for any additional industrial-scale renewable generation facilities in the

[3] *See* Bill Powers, "San Diego Smart Energy 2020: The 21st Century Alternative," October 2007, pp. 54-55, available at: http://www.sdsmartenergy.org/20-may-08_Smart%20Energy%202020_2nd%20printing_complete.pdf

region. *See* Exhibit 2 at ¶¶ 8-17.

Second, the alternative would meet the reliability objectives for the Boulevard and Jacumba area. As noted, upgrading the existing East County substations would improve reliability, as would increased distributed generation in the area. Further, as Bill Powers explains, the "reliability of the combined Boulevard/Jacumba area load could be completely assured with a 3 MW peak gas turbine at a cost of less than $4 million." Exhibit 2 at ¶ 7.

Third, the legal and regulatory barriers to implementation of the ECO System Alternative 6 are significantly overblown in the DEIR. As Bill Powers ably explains, "Sempra is clearly comfortable operating in the Baja California legal and regulatory environment," and "[i]t is not credible for CPUC and BLM to claim in the DEIR that there are sufficient capacity, legal, or regulatory impediments to exporting wind power from Baja California over Path 45 to make its use infeasible." Exhibit 2 at ¶ 6; *see also id.* at ¶¶ 3-5. Furthermore, jurisdictional irregularities are not enough to allow dismissal of an otherwise feasible alternative. Agencies are required by NEPA to consider alternatives they do not have the authority to implement. *Sierra Club v. Lynn*, 502 F.2d 43, 62 (5th Cir. 1974).

Fourth, the reviewing agencies provide no evidentiary support for their bare conclusion that the "alternative may not meet environmental criteria because up to 100 miles of reconductering or rebuilding projects would be required to integrate planned renewable generation in the Boulevard area." DEIR at C-55. It is unclear how the upgrading and reusing of existing infrastructure would be more environmentally damaging than the construction of new gen-tie lines, transmission lines, substations and other associated facilities.

In sum, the ECO System Alternative 6 is feasible and would meet the Project objectives. The reviewing agencies must fully examine this alternative.

B. The Distributed Generation Alternative

The DEIR describes the distributed generation alternative as follows:

> Under this alternative, the ECO Substation, Tule Wind and ESJ Gen-Tie projects would not be built. Instead, distributed generation including but not limited to residential and commercial rooftop solar panels, biofuels, hydrogen fuel cells, and other renewable distributed energy sources would be installed in the place of the Proposed PROJECT.

DEIR at C-60. The DEIR dismisses the distributed generation alternative on the grounds that it would (1) not meet renewable energy goals within the 2010-2020 time horizon; (2) only partially solve reliability issues to Boulevard and Jacumba communities; and (3) would be infeasible from a technical and commercial standpoint within the 2010-2020 time horizon. DEIR at C-24, 60 to 62. The DEIR is wrong; distributed generation is feasible and would meet the Project objectives.

First, as Bill Powers explains, "800-1,000 MW of distributed [photovoltaic solar generation] will be installed in SDG&E territory [by 2020] if the current 80-100 MW per year distributed PV installation rate is maintained." Exhibit 2 at ¶ 10; *see also id.* at ¶¶ 8-9. Furthermore, there is significantly more distributed generation potential with other sources, such as combined heat and power plants, of which there is "nearly 400 MW of cost-effective . . . potential in SDG&E's service territory" according to a 2005 study. *Id.* at ¶ 15. Combined, these and other distributed generation sources could meet renewable energy goals within the 2010-2020 time horizon.

Second, as Bill Powers' analysis shows, distributed generation sources – at least solar photovoltaics and combined heat and power plants – are more cost effective than most other generation sources, including those that the Project would tap. *Id.* at ¶¶ 11-17. Furthermore, distributed generation reduces the vulnerability of SDG&E's electrical grid to fires and other natural disasters. *Id.* at ¶¶ 11, 14.

Finally, as discussed above, distributed generation would aid the reliability of power supply in the Boulevard and Jacumba area. Moreover, the "reliability of the combined Boulevard/Jacumba area load could be completely assured with a 3 MW peak gas turbine at a cost of less than $4 million." Exhibit 2 at ¶ 7.

In sum, a distributed generation alternative is feasible and would meet the Project objectives. The reviewing agencies must fully examine this alternative.

V. <u>Environmental Impacts</u>

The EIR/EIS must take a "hard look" at the environmental impacts of proposed major federal actions and provide a "full and fair discussion" of those impacts. 40 C.F.R. § 1502.1; *see also National Parks & Conservation Ass'n v. Babbitt*, 241 F.3d 722, 733 (9th Cir. 2001). From a CEQA point of view, the EIR must inform the public and agency decisionmakers of all potentially significant environmental impacts prior to project approval. As the California Supreme Court has previously explained, "[t]he environmental impact report is the heart of CEQA and the environmental alarm bell whose purpose it is to alert the public and its responsible officials to environmental changes before they have reached ecological points of no return." *Sierra Club v. State Board of Forestry* (1994) 7 Cal.4th 1215, 1229 (quotations and citations omitted).

Here, the reviewing agencies must fully analyze all of the environmental impacts of the project. Accordingly, CPUC and BLM must evaluate the effects of the Project in both the United States *and* Mexico. *See, e.g., Hirt v. Richardson*, 127 F. Supp. 2d 833 (W.D. Mich. 1999); *National Organization for Reform of Marijuana Laws v. United States Department of State*, 452 F. Supp. 1226, 1232-33 (D.D.C. 1978); *cf.* Exec. Order No. 12114, 44 Fed. Reg. 1957 (1979), reprinted in 42 U.S.C.A. § 4321 app. However, the DEIR entirely fails to discuss the Project's effects in Mexico. Furthermore, its discussion of many environmental impacts in the United States is absent or inadequate, as explained below.

A. Noise Impacts

One of the DEIR's most glaring inadequacies is its omission of *any* analysis of infra- and low-frequency noise ("ILFN"), particularly as would be produced by the Tule Wind Project's wind turbines. The DEIR not only fails to analyze the impacts of ILFN, it fails to even calculate or discussion how much ILFN the Project would produce. The Project – and particularly the Tule Wind Project – is likely to produce enough ILFN to cause a significant adverse environmental impact, and the reviewing agencies' failure to identify, let alone analyze and mitigate, this impact flouts both CEQA and NEPA.

Wind turbine noise expert Richard James has submitted to CPUC and BLM an extensive wind turbine noise impact review of the Project. Carmen Krogh has also submitted comments on the DEIR detailing the adverse health impacts of industrial wind turbines. Conservation Groups generally agree with, and therefore incorporate by reference, Richard James' March 4, 2011 review and Carmen Krogh's March 1, 2011 comments. Conservation Groups also provide the following discussion of wind turbine noise impacts.

1. ILFN Can Produce Significant Adverse Health and Environmental Impacts

Health impacts from wind turbine noise can be severe. And as emerging research is consistently showing, the noise does not even have to be audible to cause substantial health impacts. As one researcher concluded, "non-aural physiological and psychological effects may be caused by levels of low frequency noise below the individual hearing threshold."[4] As another wind turbine noise research stated, "[t]here is no doubt that some humans exposed to infrasound experience abnormal ear, [central nervous system], and resource induced symptoms that are real and stressful."[5]

Health impacts from ILFN can include sleep disturbance, visceral vibratory vestibular disturbance, vertigo, headaches, dizziness, unsteadiness, tinnitus, ear pressure or pain, external

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[4] M. Schust, "Effects of low frequency noise up to 100 Hz," *Noise & Health*, 23(6):73-85, 2004, p. 73, available at: http://www.noiseandhealth.org/article.asp?issn=1463-1741;year=2004;volume=6;issue=23;spage=73;epage=85;aulast=Schust. *See also* Alec N. Salt & Timothy E. Hullar, "Responses of the ear to low frequency sounds, infrasound and wind turbines," *Hearing Research*, 268 (2010) 12-21 (attached hereto as Exhibit 3).

[5] Geoff Leventhal, "Review of Published Research on Low Frequency Noise and Its Effects," *prepared for* Defra (U.K. Department of Environment, Food and Rural Affairs), May 2003, p. 60, available at: http://www.defra.gov.uk/environment/quality/noise/research/lowfrequency/documents/lowfreqnoise.pdf.

auditory canal sensation, fatigue, irritability, memory and concentration effects, loss of motion, cardiac arrhythmias, stress and hypertension, among others.[6] "The energy generated by large turbines can be especially disturbing to the vestibular systems of some people, as well as cause other troubling sensations of the head, chest, or other parts of the body." Exhibit 4 at 24.

Here, there are dozens of residences within 1.25 miles of the Tule Wind Farm (*see* DEIR at D.10-109, D.8-25 to 27), a distance within which experts are increasingly finding wind turbine noise impacts, as discussed below. Thus, the impacts described above are likely to significantly and adversely impact Project area residents. Just because ILFN "is not yet [explicitly] recognized as a disease agent, is not covered by legislation" and "permissible exposure levels have not yet been established" does not mean the DEIR can *entirely* ignored this issue. *See Berkeley Keep Jets Over the Bay Committee v. Board of Port Commissioners* (2001) 91 Cal.App.4th 1344, 1370 ("The fact that a single methodology does not currently exist that would provide" the reviewing agencies with a "precise, or 'universally accepted,' quantification" of the Project's ILFN noise impacts "does not excuse the preparation of any health risk assessment"). CPUC and BLM must analyze and mitigate the Project's ILFN impacts.

2. A-Weighted and Averaged Noise Measurements Are Insufficient to Capture ILFN

As shown in DEIR Section D.8, all the noise measurements presented and analyzed are A-weighted. Furthermore, many of them are time-averaged. These types of measurements are inadequate for evaluating ILFN production and exposure.

With respect to A-weighting, as the DEIR itself states "the A-weighted scale . . . correlates well with human *perceptions* of the annoying aspects of noise." DEIR at D.8-2 (emphasis added). It does not correlate well with the impacts caused by inaudible sound pressures. Instead, the research uniformly shows that A-weighting underestimates the sound pressure level of noise with low-

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[6] *See, e.g.,* Punch, Jerry, Richard James & Dan Pabst, 2010, "Wind-Turbine Noise: What Audiologists Should Know," *Audiology Today*, July/August 2010, pp. 20-31 (attached to these comments as Exhibit 4); Pierpont, Nina, 2009, *Wind Turbine Syndrome: A Report on a Natural Experiment*, K-Selected Books: Santa Fé, NM; The Society for Wind Vigilance, January 2010, *Wind Industry Acknowledgment of Adverse Health Effects: An Analysis of the American/Canadian Wind Energy Association Sponsored "Wind Turbine Sound and Health Effects: An Expert Panel Review, December 2009*, available at http://www.windvigilance.com/awea_media.aspx.

frequency components. Exhibit 3 at 19.[7]

The problem with time-averaged measurements is that through them "information on fluctuations [is] lost."[8] This is an significant issue in measuring ILFN because "[m]any complaints of low frequency noise refer to its throbbing or pulsing nature."[9] Numerous studies have confirmed that "amplitude-modulated sound is more easily perceived an more annoying than constant-level sounds and that sounds that are unpredictable and uncontrollable are more annoying than any other sounds." Exhibit 4 at 23.

Thus, in order to better measure ILFN and fully take into account the impacts of inaudible sound pressures, the reviewing agencies should (1) use non-averaged noise measurements in addition to the averaged measurements they use for other purposes, and (2) use C-, G- and/or Z-weighted measurements, which give more weight to infrasound and lower frequencies, in addition to A-weighted measurements (which are useful for measuring audible noise impacts).

3. Even the A-Weighted Noise Impacts Will be Significant

Evidence demonstrates that "[a]nnoyance and sleep disruption are common when sound levels are 30 to 45 dBA."[10] And as Richard James explains on page 23 of his review, the "San Diego County

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[7] *See also,* World Health Organization, "Guidelines for Community Noise," 1999, section 2.3.3, available at: http://www.who.int/docstore/peh/noise/guidelines2.html; Minnesota Department of Health, Environmental Health Division, "Public Health Impacts of Wind Turbines," May 22, 2009, available at: http://www.health.state.mn.us/divs/eh/hazardous/topics/windturbines.pdf; M. Schust, "Effects of low frequency noise up to 100 Hz," *Noise & Health*, 23(6):73-85, 2004; HG Leventhall, "Low frequency noise and annoyance," *Noise & Health*, 23(6):59-72, 2004, available at:
http://www.noiseandhealth.org/article.asp?issn=1463-1741;year=2004;volume=6;issue=23;spage=59;epage=72;aulast=Leventhall.

[8] Geoff Leventhal, "Review of Published Research on Low Frequency Noise and Its Effects," *prepared for* Defra (U.K. Department of Environment, Food and Rural Affairs), May 2003, p. 35.

[9] *Id.*

[10] Karen Rideout, Ray Copes and Constance Bos, "Wind Turbines and Health," *National Collaborating Centre for Environmental Health*, January 2010, p. 4, available at: http://www.ncceh.ca/sites/default/files/Wind_Turbines_January_2010.pdf. *See also* Eja Pedersen & Kerstin Persson Waye, "Perception and annoyance due to wind turbine noise – a does-response relationship," *Journal of the Acoustical Society of America*, 116(6), December

CNEL limit of 45 dBA for sensitive receivers will be exceeded at any location [where] the nighttime L_{Aeq} exceeds 38 dBA. This is likely to be most of the area within 1.25 miles of the perimeter of the Project." Since, there are dozens if not hundreds of sensitive receivers such as residences within 1.25 miles of the perimeter of the Project (*see* DEIR at D.8-25 to 27, D.10-107 to 109), the Project is likely to have significant *long-term* noise impacts. The DEIR is wrong in its conclusion that the ECO Substation and Tule Wind projects would only have *short-term* significant and adverse impacts, and that the ESJ projects would have *no* significant noise impacts. CPUC and BLM must revise their analysis to take these long-term noise impacts into account and mitigate them to the extent feasible.

4. Greater Mitigation Is Required

As shown in DEIR Section D.8, Project facilities, including wind turbines, the ECO Substation and others would be located well within 1.25 miles of residences and other sensitive receptors. As discussed above, this is an inadequate setback. To avoid the negative health impacts from wind turbines, Dr. Nina Pierpont recommends setbacks from large wind projects of at least *1.25 miles*.[11] A similar setback has been called for by the French National Academy of Medicine.[12] In his report for the Academy, Claude-Henri Chouard writes:

> The harmful effects of sound related to wind turbines are insufficiently assessed . . . . The sounds emitted by the blades being low frequency, which therefore travel easily and vary according to the wind, . . . constitute a permanent risk for the people exposed to them. . . . The Academy recommends halting wind turbine construction closer than 1.5 km from residences.[13]

Here too the setbacks should be 1.25 miles – at least the setbacks from the Tule Wind Project wind turbines.

B. Public Health Impacts – Dirty Electricity 1

2004, available at: http://maine.gov/dep/blwq/docstand/sitelaw/Selected%20developments/Spruce_Mountain/additional_information/9_24_2010/fsm/exhibit_17.pdf.

[11] Nina Pierpont, 2009, *Wind Turbine Syndrome: A Report on a Natural Experiment*, K-Selected Books: Santa Fé, NM.

[12] Chouard, Claude-Henri, 2006, *Rapport: Le Retentissement du Fonctionnement des Éoliennes sur la Santé de l'Homme*.

[13] *Id.*

Another impact overlooked in the DEIR is that of dirty electricity. As electrical pollution expert David Colling describes in his Declaration (attached hereto as Exhibit 5), "dirty electricity refers to the electromagnetic energy that flows along a conductor and deviates from a pure 60-Hz sine wave." Exhibit 5 at 1. Mr. Colling has tested for electrical pollution at multiple wind farms and substations and has found that "[w]ind turbines can produce significant electrical pollution in the form of dirty electricity. Additionally, if not adequately filtered, dirty electricity can be propagated through the substations and onto transmission and distribution lines." Exhibit 5 at 8. As Mr. Colling has discovered, dirty electricity can travel significant distances both along power lines and through the ground, commonly impacting people and structures for more than 0.5 miles from the source (e.g. a wind turbine). Exhibit 5 at 3.

The impacts of dirty electricity, like those of ILFN, can be severe. Until recently, dirty electricity had not been widely studied by the scientific community, but this is beginning to change. Recent studies have linked dirty electricity with an increase in ailments such as diabetes, fibromyalgia, chronic fatigue syndrome and attention deficit disorder, among others.[14] Anecdotal evidence, such as the horrific stories recounted by Paul Thompson in his comments on the DEIR, also bears out the negative effects of dirty electricity.

Nonetheless, the DEIR "does not consider [electromagnetic frequencies ("EMFs")] in the context of CEQA/NEPA for determination of environmental impact because there is no agreement among scientists that EMFs create a health risk and because there are no defined or adopted CEQA/NEPA standards for defining health risks from EMFs." DEIR at D.10-93. However, as discussed above, "[t]he fact that a single methodology does not currently exist that would provide" the reviewing agencies with a "precise, or 'universally accepted,' quantification" of the Project's dirty electricity impacts "does not excuse the preparation of any health risk assessment." *Berkeley Keep Jets Over the Bay Committee v. Board of Port Commissioners* (2001) 91 Cal.App.4th 1344, 1370

1 cont.

Furthermore, even the "non-CEQA/NEPA" discussion that follows that pronouncement focuses solely on *magnetic fields* and not *electrical fields*, such as those propagated by dirty electricity. Thus, the DEIR omits any analysis of dirty electricity and lacks an adequate rationale for its omission. To comply with CEQA and NEPA, the reviewing agencies must analyze the Project's dirty electricity output and its impacts on people and the environment.

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[14] *See, e.g.,* Magda Havas, "Electromagnetic Hypersensitivity: Biological Effects of Dirty Electricity with Emphasis on Diabetes and Multiple Sclerosis," *Electromagnetic Biology and Medicine*, 25:259-268, 2006, available at: http://www.next-up.org/pdf/Magda_Havas_EHS_Biological_Effets_Electricity_Emphasis_Diabetes_Multiple_Sclerosis.pdf; The National Foundation for Alternative Medicine, "The health effects of electrical pollution," available at: http://d1fj3024k72gdx.cloudfront.net/health_effects.pdf.

C. Visual Impacts – Wind Turbine Shadow Flicker

Shadow flicker is one of the many side effects of wind turbines.[15] A Michigan State University paper describes shadow flicker thusly:

> Shadow flicker is caused by the sun rising or setting behind the rotating blades of a turbine. The shadow created by the rotating blades can cause alternating light and dark shadows to be cast on roads or nearby premises, including the windows of residences, resulting in distraction and annoyance to the residents. A related phenomenon, strobe effect, is caused by the chopping of sunlight behind moving blades, similar to the effect of the setting sun behind trees when driving along a roadway in the winter.[16] 2

The Minnesota Department of Health has also found that the "[r]hythmic light flicker from the blades of a wind turbine casting intermittent shadows has been reported to be annoying in many locations."[17] Shadow flicker can also present numerous dangers, such as distracting drivers on roads close to turbines. As a result of this road hazard, Ireland established guidelines requiring wind turbines to be set back at least 300 meters from roads.[18] Other mitigation measures for shadow flicker include shutting down the wind turbines during the time when shadow flicker would occur.

Here, the DEIR entirely fails to analyze shadow flicker, let alone mitigation measures to reduce the impact. CPUC and BLM must now do so.

D. Biological Impacts

There are numerous biological impacts the reviewing agencies failed to adequately analyze in the DEIR. First, the DEIR improperly dismisses impacts to the Peninsular bighorn sheep, stating that the "Proposed PROJECT area is located outside of [the regional Peninsular bighorn sheep corridors]." DEIR D.2-59. Contrary to the DEIR's statement, the ESJ Project and the associated wind energy

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[15] For a video of shadow flicker at a rural residence in Illinois, see: http://lifewithdekalbturbines.blogspot.com/2010/05/shadow-flicker-videos.html.

[16] Michigan State University, "Land Use and Zoning Issues Related to Site Development for Utility Scale Wind Turbine Generators," 2004, p. 1, available at: http://web1.msue.msu.edu/cdnr/otsegowindflicker.pdf.

[17] Minnesota Department of Health, Environmental Health Division, "Public Health Impacts of Wind Turbines," May 22, 2009, p. 14.

[18] Michigan State University, "Land Use and Zoning Issues Related to Site Development for Utility Scale Wind Turbine Generators," 2004, p. 1.

projects in the La Rumorosa region of Baja California would be located adjacent to and, in some places, on top of an international migration corridor for the Peninsular bighorn sheep. The ESJ gen-tie transmission route and portions of the three phases of the ESJ Wind Project in Baja California would be located directly adjacent to and/or overlap with the Peninsular Ranges of Mexico, an area which the United States Fish and Wildlife Service views as "the *only possible route* for a natural connection with other bighorn sheep populations for the [distinct population segment of sheep] in the U.S." 74 Fed.Reg. 17288, 17311 (2009) (emphasis added). For example, the two Mexican lease areas where the subsequent phases of the ESJ Wind Project would occur are situated on the Sierra de Juarez and Cordillera Molina mountain ranges, both of which are part of the Peninsular Ranges of Mexico. Thus, both the ESJ Gen-Tie Project and the related ESJ Wind Project in Baja California have the potential to substantially impact Peninsular bighorn sheep genetic diversity and long-term population viability in the United States.

Second, the DEIR fails to properly analyze the Project's noise impact on birds. As discussed in DEIR Section D.8, the Project's construction noise levels would be very high, reaching 80 dBA at a distance of 50 feet from the ECO Substation construction equipment and 75 dBA within 200-feet of various construction activities for the ECO Substation Southwest Powerlink Loop-in, for example. In addition, the Project's operation noise levels could exceed 60 dBA at close distances and during storms. These noise levels present a potentially significant adverse effect for avian species in the area.

The threshold for noise significance is substantially lower for some sensitive avian species than what the Project will likely produce. Particularly sensitive species in – or potentially in – the Project area include the horned lark, loggerhead shrike, least Bell's vireo, gray vireo and Southwestern willow flycatcher. DEIR Appendix 1-37 to 39, 42, 43. Expert testimony from Dr. Travis Longcore, given in the CPUC proceeding on the SDG&E's application for a certificate of public convenience and necessity for the Powerlink and attached as Exhibit 6 hereto, shows that the threshold for significant negative impacts on bird species similar to the birds just listed is much lower than 60 dBA. After summarizing studies of other small passerine birds, like the California horned lark, loggerhead shrike, least Bell's vireo and southwestern willow flycatcher, Dr. Longcore concludes that "[f]rom the published literature . . . a reasonable threshold based on similar species for least Bell's vireo and southwestern willow flycatcher would be 40 dB(A) or below." Exhibit 6 at 12. Dr. Loncore then goes on to discuss empirical data from California "indicating with certainty that territory occupancy is reduced by sound levels in the 50 - 60 Db(A) range" for the southwestern willow flycatcher (*id.* at 13), which is similarly susceptible to noise impacts as the California horned lark and loggerhead shrike since all three species are "small songbirds that rely on hearing songs to attract mates and defend territories." *Id.* at 12.

These noise impacts on birds must be taken particularly seriously given that all five species listed above are special-status species that have been observed or are reasonably likely to occur the Project site. DEIR Appendix 1-37 to 39, 42, 43. Unless the Project's noise levels are reduced much below 60 dBA, the Project would have significant impacts on these and other avian species, impacts that must be analyzed and mitigated.

Another consideration that should have been omitted from the DEIR's biological impact analysis is the color of the Tule Wind Project wind turbines. While lighter color turbines may be visually preferable for humans, at least one report concludes that white, light gray and yellow turbines may attract the most flying insects – and hence birds and bats that feed on those insects.[19] The report found that purple was the color least likely to attract insects. The reviewing agencies should further analyze the choice of Project facility colors.

A final inadequacy of the DEIR's biological resources analysis is its deferral of Quino checkerspot butterfly protocol surveys until "within 1 year prior to project construction acitivities in occupied habitat." DEIR at ES-30.

E. Conservation Initiatives

The DEIR fails to discuss the Project's negative impacts on the region's conservation initiatives. The construction of the Project, and all of the other energy production facilities dependent upon the ESJ gen-tie line and the ECO and Boulevard substations, would substantially impair the ecological value of the ECO Substation, Tule Wind and ESJ project sites themselves as well as miles of surrounding mountains and high desert. This degradation of the mountain and desert ecosystems in the region will likely affect conservation decisionmaking, turning money and protection away from the area as conservationists look for less-developed lands to preserve. Some of the conservation initiatives that could be affected by the Project but were not discussed in the DEIR include The Nature Conservancy's purchase of the Jacumba-Eade property in January 2008 for inclusion into the Anza Borrego State Park, the Las Californias Binational Conservation Initiative, and the Parque to Park proposal, which seeks to connect Anza Borrego State Park (and the Jacumba property purchased for the Park mentioned above) with Baja Mexico's Parque Nacional Constitucion de 1857 and the Parque Nacional San Pedro Martir. This omission violates CEQA and NEPA and must be remedied by the reviewing agencies.

F. Fire Impacts

As discussed in the DEIR, the ECO Substation, Tule Wind and ESJ projects would all have significant adverse environmental impacts. DEIR at Section D.15. Conservation Groups agree with,

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[19] Laura Roberts, "Wind turbines should be painted purple to deter bats, scientists claim," *The Telegraph*, October 15, 2010, available at: http://www.telegraph.co.uk/earth/earthnews/8066012/Wind-turbines-should-be-painted-purple-to-deter-bats-scientists-claim.html.

and therefore incorporate by reference, the February 8, 2001 comments of Boulevard/Jacumba/La Posta Fire Safe Council on additional fire dangers and mitigation measures that CPUC and BLM should analyze in their environmental review of the Project.

G. Hydrological Impacts

The proposed location of the ECO Substation, Tule Wind and ESJ projects is very arid and water supplies are limited. Therefore it is critically important that the reviewing agencies ensure that the Project would have minimal impacts to the region's surface and groundwater supplies. This entails analysis and mitigation of the Project's potential water quality impacts, as well as identification of sufficient water supplies to meet the Project's needs and analysis of the impacts of procuring that water. *See Vineyard Area Citizens for Responsible Growth, Inc. v. City of Rancho Cordova* (2007) 40 Cal.4th 412, 446 (EIRs must "demonstrate a reasonable likelihood that water will be available for the project from an identified source").

With respect to water supplies, the DEIR is deficient because it does not demonstrate with reasonable certainty that water will be available for the Project. For instance, the only somewhat assured source of water identified for the ECO Substation Project is the Sweetwater Authority's "[c]onfirmation" that it has "sufficient water capacity to provide 25-million gallons of water to [the project] during construction." DEIR at D.12-27. However, this is *5 million gallons less* than the identified water demand during construction. *Id.* Furthermore, the DEIR says nothing about the ECO Substation Project's operational water demands except that the "insulators" would not need to be washed. This is unacceptable. The DEIR also fails to identify a reasonably assured water source for the ESJ Project, noting that if the Jacumba Community Services District does not provide the requisite water a well could be sunk instead, but failing to discuss the feasibility of doing so. *See* DEIR at B-162.

Instead of fully analyzing the Project's water supplies, the DEIR merely includes a mitigation measure providing that "[p]rior to construction, the applicant will prepare comprehensive documentation that identifies one or more confirmed, reliable water sources that when combined meet the project's full water supply *construction* needs." DEIR at 12-28 (emphasis added). This is inadequate – water supplies must be identified *now* for both construction *and* operational demand for the ECO Substation, Tule Wind and ESJ projects.

With respect to water quality, the DEIR states that the ECO Substation would involve the construction of two retention ponds, the lining of which would "either be removed or punctured to allow water seepage into the ground." DEIR at B-22. However, nowhere does the DEIR discuss the potential for groundwater pollution when the liners are removed, exposing the soils to potentially toxics-laden water, sludge and/or residual dust. The reviewing agencies must analyze this impact.

H. Climate Change Impacts

The reviewing agencies assert in the DEIR that the ESJ Project would only transmit "renewable energy." DEIR at ES-11. However, as discussed, this statement is left wholly unsupported and is likely false. Unless the reviewing agencies provide concrete evidence that the ESJ Project would only transmit renewable energy, they must address the likelihood that the gen-tie lines and the ECO and Boulevard substations would cause more fossil-fuel-based generating facilities to be built in Mexico or near the substation in the United States. Notably, Sempra's Bajanorte Gasducto liquified natural gas ("LNG") line and a newly constructed water line run through Sempra's leased land directly south of the proposed location for the ECO Substation. With the construction of the ESJ gen-tie line, Sempra will have all the necessary ingredients for a new gas-fired power plant on the Mexican side of the international border: gas, water, and transmission. Sempra has previously indicated that LNG will serve as its primary fuel for decades to come and has invested billions in its LNG infrastructure in Baja, including the construction of the Energia Costa Azul LNG terminal near Ensenada, Mexico. The reviewing agencies should fully investigate the potential for the Project to increase fossil fuel consumption and analyze the consequent effects on greenhouse gas emissions, global warming, and air quality in the Project area and elsewhere.

I. Cultural Resource Impacts

As the DEIR states, there are at least 40 previously recorded archaeological sites within the right-of-way proposed for the Tule Wind Project, and more than 30 archaeological investigations that have taken place previously within the proposed right-of-way. DEIR at D.7-3. There are "traditional cultural properties" in the footprints of all three projects, and the DEIR states that the impacts to those cultural resources would be significant and unmitigable. DEIR at D.7-113.

To help mitigate these devastating and tragic impacts, the reviewing agencies should analyze the feasible mitigation measure of creating a permanent fund for the creation and continued operation of one or more museums in San Diego County. The museums would contain cultural artifacts discovered in the Project area and surrounding lands that would otherwise be removed and sent to museums, universities and government offices elsewhere. The Native Americans in and around the Project area have the right to preserve their cultural heritage and it is the government's duty to ensure that it is not taken from them.

J. Economic Impacts

Environmental reviews under CEQA and NEPA cannot ignore economic impacts. Under CEQA, a "social or economic change related to a physical change may be considered in determining whether the physical change is significant." CEQA Guidelines § 15382; *see also Bakersfield Citizens for Local Control v. City of Bakersfield* (2004) 124 Cal.App.4th 1184, 1208 (court concluded that the proposed Supercenter project could result in business closures and economic problems that would potentially cause "urban decay," which the respondent city had failed to consider in the EIR). Similarly, under NEPA "[w]hen an environmental impact statement is prepared and economic or social and natural or physical environmental effects are interrelated, then the environmental impact statement will discuss all of these effects on the human environment." 40 C.F.R. § 1508.14.

Here, the Project would have significant and adverse noise, EMF and visual impacts. As a result of and hence intimately "interrelated" with these impacts, property values in the Project area would likely decline substantially. These likely property value declines are thoroughly analyzed in property appraisal expert Michael McCann's evaluation of the Project (attached hereto as Exhibit 7). In his professional opinion, the "Project will cause substantial diminution and injury to property values in the area, averaging approximately 25% as far as 2 to 3 miles, and with approximately 5% value loss from the nearest turbines [of the Tule Wind Project] out to as far as 5 miles." Exhibit 7 at 2. Furthermore, Michael McCann explains how the literature review relied on by the reviewing agencies to discount the property value impacts of wind turbines actually *supports* the conclusion that this Project *would have substantial impacts.* Exhibit 7 at 12-15. Moreover, as the DEIR notes, at least one residence would be destroyed and its occupants relocated. DEIS at D.16-13.

These property value and forced relocation impacts are significant and must be identified and analyzed as such by the reviewing agencies. Instead, the DEIR states that "social and economic effects are not treated as significant effects on the environment in this analysis and, therefore, no CEQA significance conclusions are presented for such effects." DEIR at D.16-11. Further, the DEIR states that any "decrease in property values" occasioned by all the construction and operation of the three projects would be "Not Adverse." DEIR at D.16-12. This flouts CEQA, NEPA and common sense.

K. Growth-Inducing Impacts

The DEIR's discussion of growth related to the provision of additional electric power consists of just one short paragraph. DEIR at G-2 to 3. The DEIR admits that "the Proposed PROJECT is an important element in developing additional renewable energy resources required to meet the current and future California Renewable Portfolio Standard and federal Energy Policy Act goals for developing renewable energy." *Id.* Nonetheless, the DEIR omits any analysis of the type, number and impacts of the energy development the Project would induce. Instead, the DEIR concludes that "the Proposed Project would not directly induce growth related to provision of additional electric power in a predictable manner or defined location." DEIR at G-3. This is evasive maneuver is unacceptable. It impermissibly sidesteps both NEPA's and CEQA's requirement that growth-inducing impacts be discussed. 40 C.F.R. § 1508.8(b); CEQA Guidelines § 15126.2(d).

At the very least, the EIR must acknowledge the extent to which the Project would enable future development of energy facilities, as well as the type of such facilities. As the DEIR states, the ECO Substation would be designed to ultimately expand to include "[f]our 500/230 kV, 1,120 megavolt ampere (MVA) transformer banks with two single-phase operational spares." DEIR at B-21. This equates to the capacity to accommodate as much energy throughput as 4,480 MW. Yet the DEIR *never* discusses this fact, nor the substantial energy-related development it would induce. BLM and CPUC must remedy this gross omission.

VI. Improper Deferred Specification of Mitigation Measures

The DEIR improperly deferred specification of numerous mitigation measures until after the completion of environmental review. The improperly deferred measures include, among others, the Noxious Weeds and Invasive Species Control Plan, Habitat compensation, the Stormwater Pollution Prevention Plan, the Dust Control Plan, Avian Protection Plans, the Cultural Resources Treatment Program, the traffic control plan, the Construction Fire Prevention/Protection Plan and site-specific noise mitigation plans. This flouts CEQA and NEPA and must be remedied by CPUC and BLM.

VII. Conclusion

Conservation Groups again emphasize their concern that the environmental impacts of the projects that threaten to industrialize eastern San Diego County and western Imperial County must be comprehensively reviewed in a programmatic EIR/EIS before any further project-specific actions are taken. The combined effects of all of the energy projects proposed in the deserts of Southern California and the Southwest in general, including the present Project, the Powerlink project, and all other reasonably foreseeable energy developments in the area will fundamentally alter the region in ways that have not been fully revealed or analyzed to date. The best way to provide for the future energy needs of Southern Californians – and the United States as a whole – is not through destructive development of their irreplaceable wildlands, but rather through the deployment of distributed generation facilities at already disturbed locations within or near the urban demand centers.

Sincerely,

Steph C Volker (JV)

Stephan C. Volker
Attorney for Backcountry Against Dumps,
The Protect Our Communities Foundation, East County Community Action Coalition and Donna Tisdale

EXHIBIT 5

BEFORE THE PUBLIC UTILITIES COMMISSION
OF THE STATE OF CALIFORNIA

In the Matter of the Application of SAN DIEGO GAS & ELECTRIC COMPANY (U902 E) for a Permit to Construct Electrical Facilities with Voltages between 50 kV and 200 kV and New Substations with High Side Voltages Exceeding 50 kV: The East County Substation Project	Application 09-08-003 (Filed August 10, 2009)

DECLARATION OF DAVID COLLING IN SUPPORT OF BACKCOUNTRY AGAINST DUMPS' COMMENTS ON THE DRAFT ENVIRONMENTAL IMPACT REPORT/ENVIRONMENTAL IMPACT STATEMENT FOR THE EAST COUNTY SUBSTATION, TULE WIND AND ENERGIA SIERRA JUAREZ GEN-TIE PROJECTS

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Attorneys for Party and Protestant
Backcountry Against Dumps

March 3, 2011

I, David Colling, declare as follows:

Qualifications

1. I am an electrical pollution assessor for Bio-Ag Consultants and Distributors, Inc. ("Bio-Ag"). After a long career as a dairy farmer in the Ripley area of Ontario, Canada, I began working for Bio-Ag as a sales representative in 1991. I subsequently received two years of training in electrical engineering at Ryerson Polytechnical Institute, and obtained specialized training in electrical pollution from recognized electrical pollution experts Dave Stetzer and Dr. Andrew Michrowski. I have worked as an electrical pollution assessor for Bio-Ag since 2005. In that time, I have performed electrical pollution testing on over 300 homes, offices and farms, which includes the measuring of ground current. I have tested for electrical pollution in residences adjacent to the Ripley, Underwood, Melancthon/Amaranth and Kingsbridge wind farms in Ontario. I have also tested for electrical pollution in a residence adjacent to the Amaranth Substation, which receives and transmits electricity produced by the Melanchton/Amaranth Wind Farm.

My Testing Shows that Wind Turbines Can Produce Harmful Electrical Pollution

2. Dirty electricity refers to electromagnetic energy that flows along a conductor and deviates from a pure 60-Hz sine wave. These deviations occur in the KHz and MHz range, the intermediate frequency portion of the nonionizing part of the electromagnetic spectrum.

3. Dirty electricity is produced by both electricity-consuming equipment, such as computers and televisions, and electricity-generating equipment. Wind turbines are one of the latter sources of dirty electricity. To enable variable speed operation of

wind turbines, the alternating current they generate is first converted to direct current and then converted back into alternating current with the correct voltage and frequency. These conversions create higher frequency electrical currents that "ride" the 60-Hz sine wave and radiate from the collector lines that transmit the wind-generated electricity to substations. If not adequately filtered, the dirty electricity can be propagated through the substations and onto transmission and distribution lines.

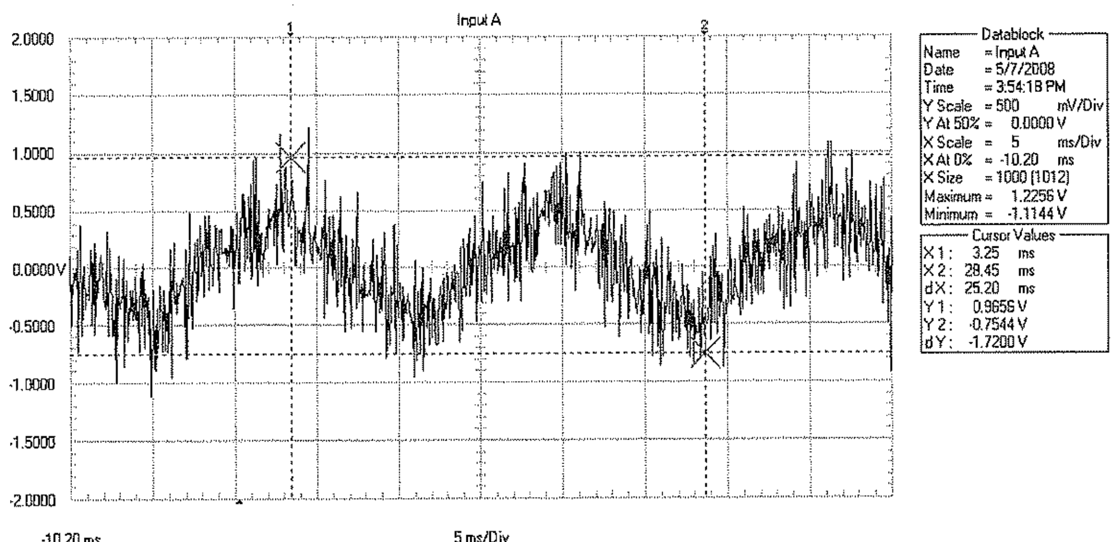
4. The dirty electrical currents reach and impact people and the environment in two ways. The currents are propagated from the electrical transmission facilities through both the atmosphere and the ground. Ground current is typically propagated through grounding rods extending from neutral conductor wires.

5. At the behest of residents experiencing health problems after wind farms began operating nearby, I have tested for dirty electricity emanating from the Ripley, Underwood, Melancthon/Amaranth and Kingsbridge wind farms in Ontario. Not only did my tests confirm that all four of these wind farms were emitting dirty electricity, they confirmed that the dirty electrical currents were – and in some cases still are – propagated in the form of ground currents to numerous nearby residences. As an example, the Ripley Wind Farm and its electrical pollution are discussed in more detail below. Electrical pollution measurements for the Underwood Wind Farm are reproduced in Exhibit 1, along with measurements from additional Ripley Wind Farm sites.

6. The Ripley Wind Farm is located in Ripley, Ontario, off the southeastern shores of Lake Huron. The farm consists of 38 Enercon E82 2 MW turbines, with a total maximum production of 76 MW. The waveforms shown below were measured at one of the many nearby residences I tested for electrical pollution, Residence 1. Residence 1 is

located 900-plus meters from 10 wind turbines. Measurements were taken between the primary ground wire at the transformer pole and a remote rod, and in the residence's home between the kitchen sink and an ECG electrode on the floor, as indicated in the caption for the figures. As figure 1 shows, the wind turbines were creating significant electrical pollution. The frequency profile of the primary neutral to earth voltage ("PNEV") shown in figure 1 is littered with higher frequency distortions of the 60-Hz sine wave.

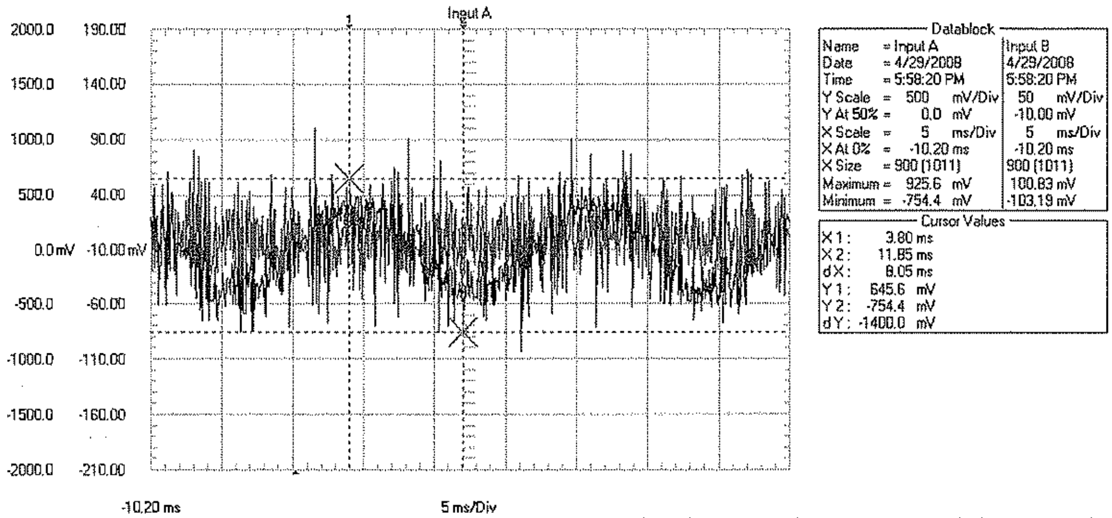
Figure 1.



Residence 1, Primary neutral to remote rod, windmills on, before collection lines buried.

7. Figure 2, on the following page, shows that the dirty electrical current produced by the Ripley wind turbines was propagated as a ground current that reached Residence 1, as measured by sink-to-floor readings in the kitchen with the power to the home turned off. A frequency comparison of the PNEV and sink-to-floor readings confirmed that the source of the ground current was the Ripley Wind Farm.

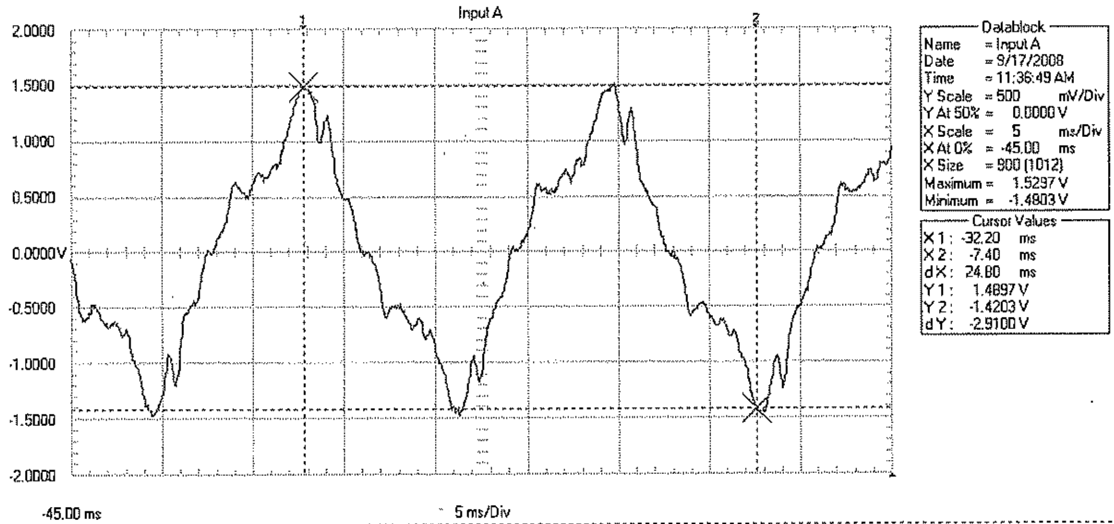
Figure 2.



Residence #1, Input A(blue wave) is PNEV. Input B(red wave) is sink to floor. The power was shut off to the house. Windmills running.

8. A few months after I took the measurements shown in figures 1 and 2, the Ripley Wind Farm developers – Suncor Energy and Acciona Energy – buried the collector lines leading from the wind turbines to the substation. The undergrounding substantially reduced the PNEV frequency distortions, though it did not eliminate them. This change is shown in figure 3, on the following page.

Figure 3.



Residence #3, Primary Neutral to remote rod, windmills on, collection line now buried.

9. The electrical pollution testing I did at other locations on the Ripley Wind Farm and nearby residences yielded similar results, as exemplified by the measurements for Residence 3 shown in Exhibit 1. The testing I did at the Underwood, Melancthon/Amaranth and Kingsbridge wind farms also yielded comparable results, with the wind turbines producing significant PNEV frequency distortions. Examples of the measurements I took at the Underwood Wind Farm is also included in Exhibit 1.

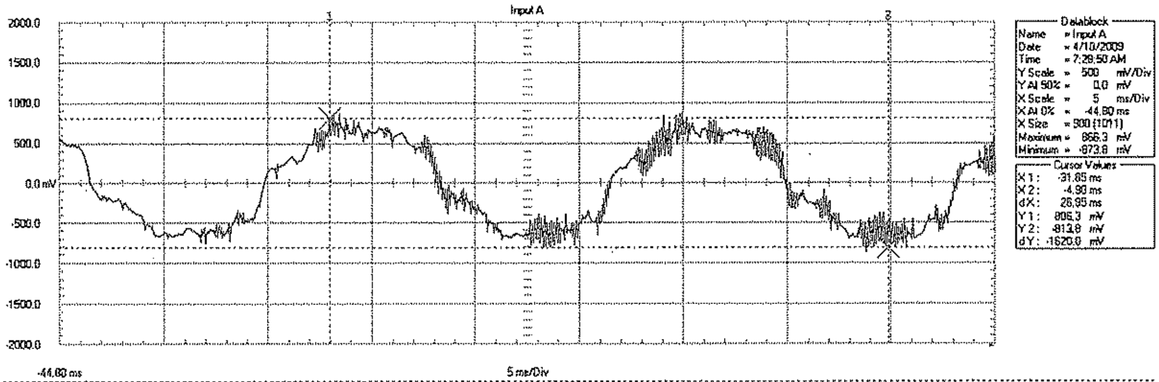
My Testing Shows that Electrical Substations Can Propagate Harmful Electrical Pollution

10. As discussed, if not adequately filtered, dirty electricity can be propagated through electrical substations and onto transmission and distribution lines. I observed and measured this precise phenomenon at a residence approximately 300 meters from the Amaranth Substation. This substation is connected to the same distribution lines that power the residence as the substation requires power for the wind turbine control network. The power from the wind turbines comes into the substation on a separate set

electrical lines called collection lines that are of higher voltage than the distribution lines. The substation requires power from the distribution lines as the only power coming in on the collection lines is from wind turbines. Therefore when the wind turbines are off power is needed from the distribution lines to keep control systems on. Measurements were taken at the ground wire on a distribution pole at the road entrance to the substation. The measurements were taken in the same manner as described above for the Ripley Wind Farm measurements. As figure 4 on the following page shows, the substation was creating significant electrical pollution that propagated along the distribution lines leading to the residence. The frequency profile of the primary neutral to earth voltage ("PNEV") measured at the entrance to the Amaranth substation shown in figure 4 is littered with higher frequency distortions of the 60-Hz sine wave.

11. Figures 5 and 6 show that the dirty electrical current flowing through the Amaranth Substation was propagated as a ground current that reached the residence, as measured by sink-to-floor readings in the kitchen with the power to the home turned off and no body contact (shown as the red waveforms in both figures; the blue waveform in figure 6 is the PNEV frequency profile). The PNEV was measured at the residence transformer pole. A frequency comparison of the PNEV and sink-to-floor readings confirmed that the source of the ground current was the Amaranth Substation.

Figure 4.



Amaranth Substation, PNEV at the service entrance pole ground wire

Figure 5.

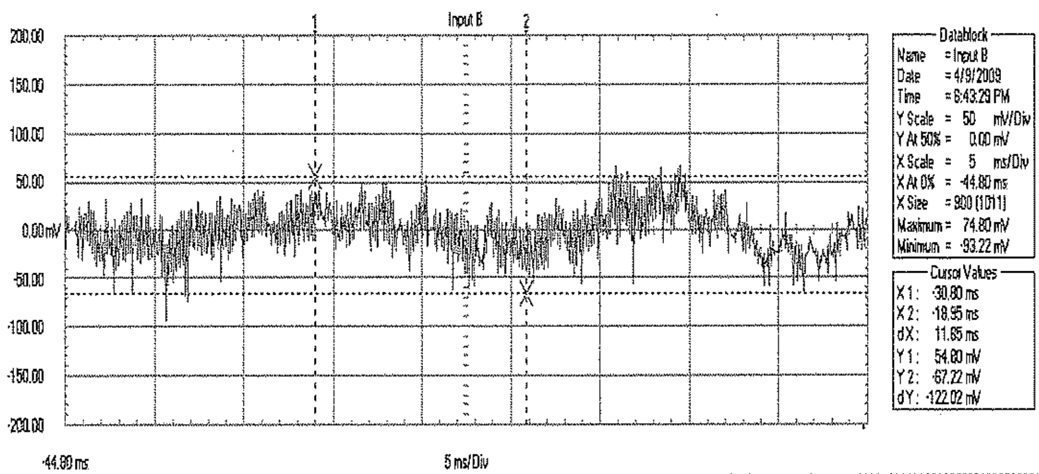
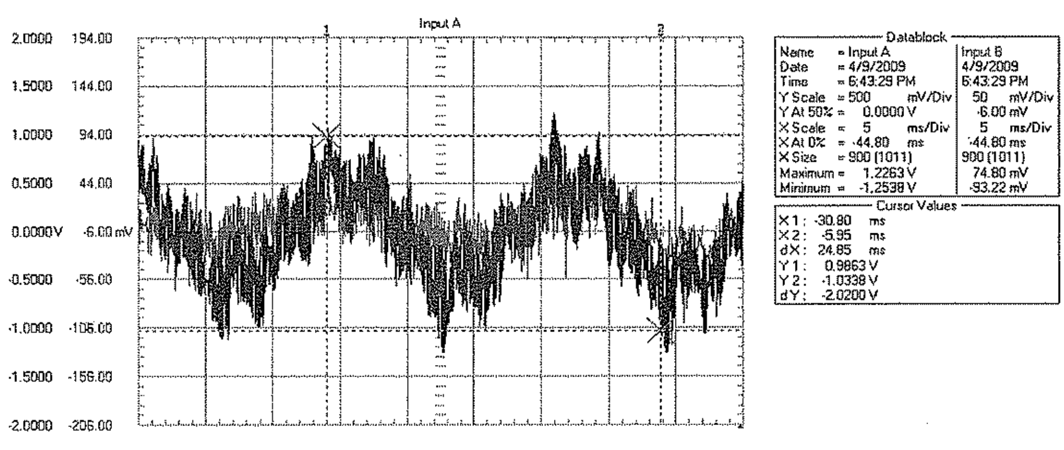


Figure 6.



Conclusions

12. Wind turbines can produce significant electrical pollution in the form of dirty electricity. Additionally, if not adequately filtered, dirty electricity can be propagated through the substations and onto transmission and distribution lines. I have tested for dirty electricity emanating from the Ripley, Underwood, Melancthon/Amaranth and Kingsbridge wind farms, as well as the Amaranth Substation, all in southern Ontario. Not only did my tests confirm that all four wind farms and the substation were emitting dirty electricity, they confirmed that the dirty electrical currents were – and in some cases still are – propagated in the form of ground currents to numerous nearby residences.

I declare, under penalty of perjury, that the foregoing is true and correct based on my personal knowledge and best professional judgment, and that this declaration was executed on March 3, 2011 in Ripley, Ontario, Canada.

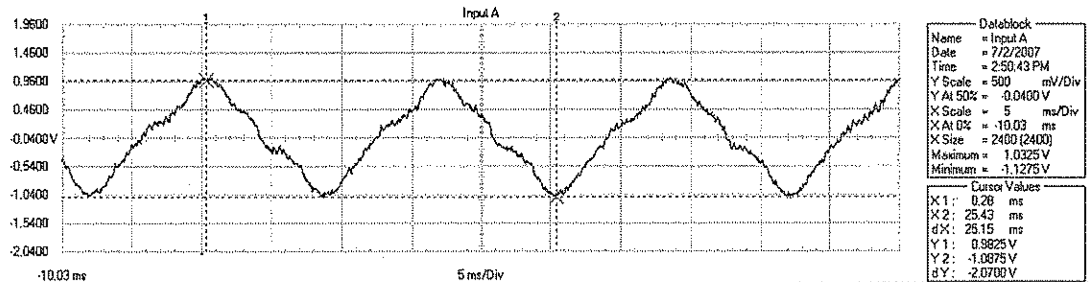
DAVID COLLING

EXHIBIT 1

Ripley Wind Farm, Electrical Pollution Testing Near Residence 3

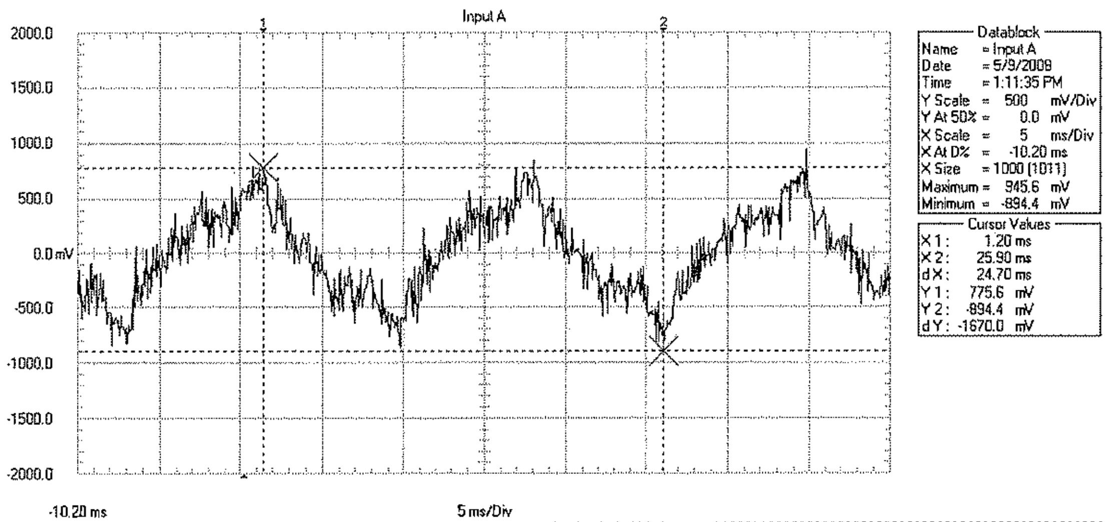
I took the measurements shown below in figures 1 through 3 in the same manner as described for the Ripley Wind Farm measurements discussed in the main body of my declaration.

Figure 1.



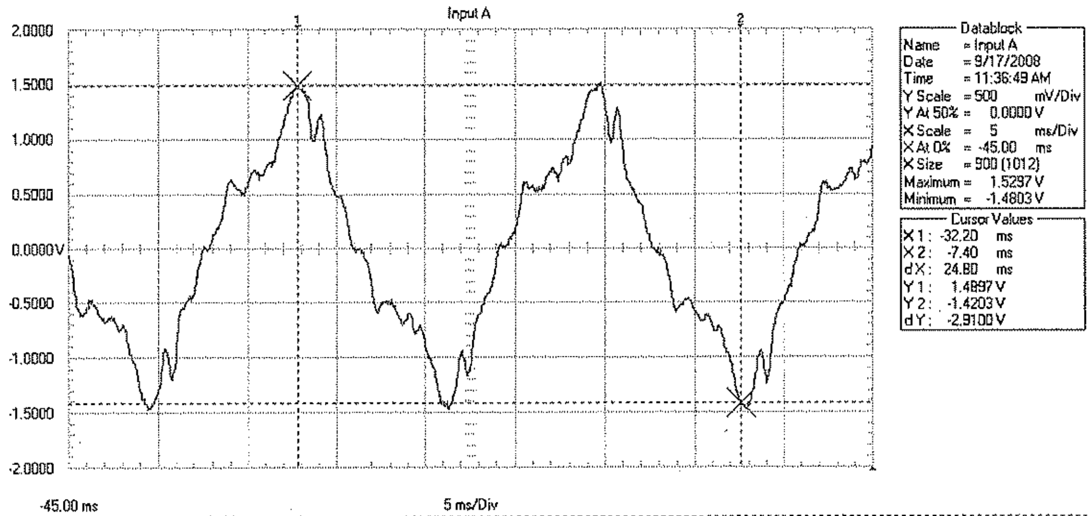
Residence #3, Primary Neutral to remote ground rod, before windmills were installed and running.

Figure 2.



Residence #3, Primary Neutral to remote rod, windmills running before the collection line was buried.

Figure 3.

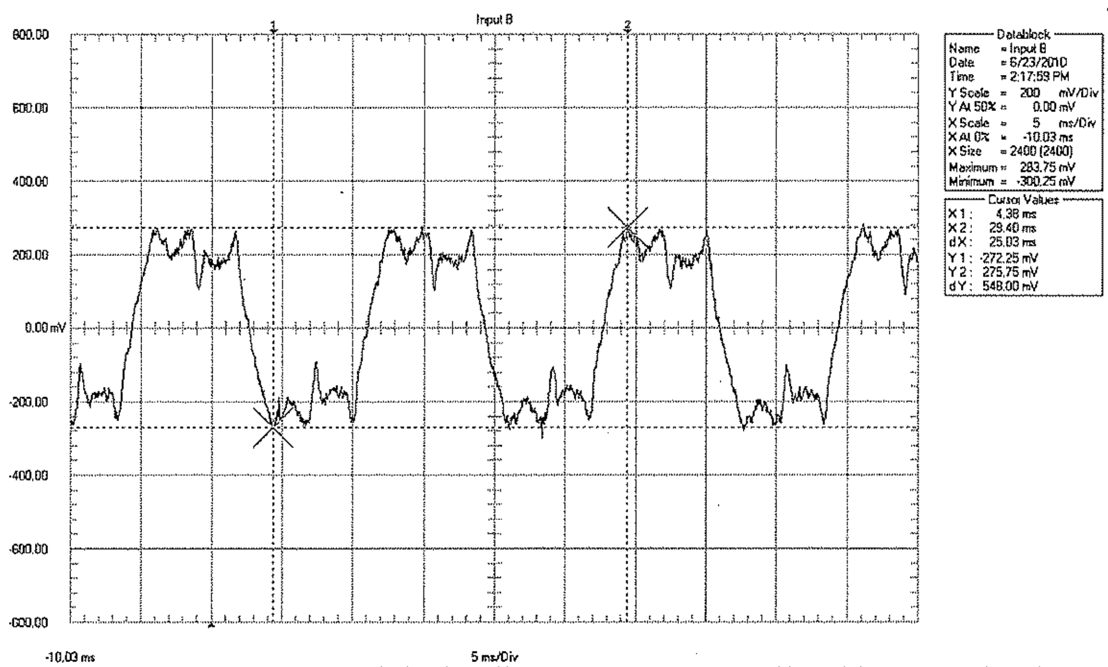


Residence #3, Primary Neutral to remote rod, windmills on, collection line now buried.

Underwood Wind Farm

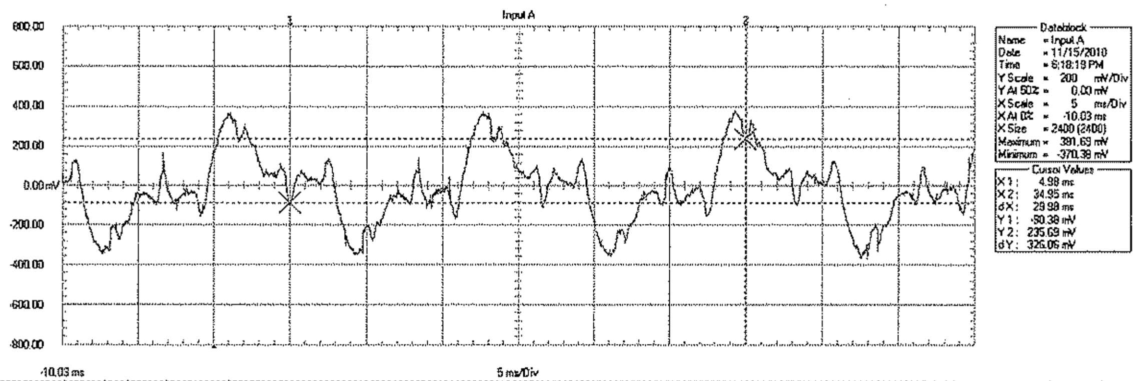
The Underwood Wind Farm, developed and operated by Enbridge, Inc., is located just north of Kincardine, Ontario. It consists of 110 Vestas V82 1.65 MW wind turbines, with a maximum generation capacity of 181.5 MW. I took the measurements shown below in figures 4 through 6 in the same manner as described for the Ripley Wind Farm measurements.

Figure 4.



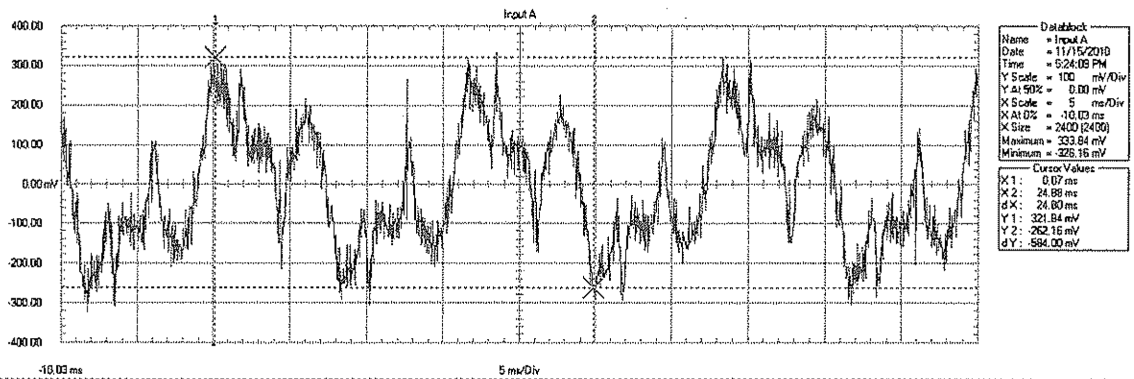
Residence 5, PNEV power off to house. Wind Turbines on.

Figure 5.



Residence 5, PNEV, power off to farm, wind turbines off.

Figure 6.



Residence 5, PNEV, power off to farm,turbines on.