Acoustical Analysis of the Desert Wind Power Project

TO: Michael Clayton/Iberdrola Renewables, Inc.

FROM: Mark Bastasch, P.E./CH2M HILL

DATE: April 22, 2011

The purpose of this memorandum is to document the development of the sound contours for Iberdrola Renewables, Inc. (IRI) Desert Wind Power Project. The proposed layout consists of 156 Gamesa wind turbines on 90 meters towers. The attached Figure 1 was developed by IRI and presents the predicted sound levels as well as the residences IRI identified.

Methods

Standard acoustical engineering methods were used in this model. The sound propagation factors used in this analysis have been adopted from ISO 9613-2, *Acoustics – Sound Attenuation During Propagation Outdoors, Part 2: General Method of Calculation* (ISO, 1993) and VDI 2714, *Outdoor Sound Propagation* (VDI, 1988). Atmospheric absorption for conditions of 10°C and 70 percent relative humidity (conditions that favor propagation) was computed in accordance with ISO 9613-1, *Acoustics – Sound Attenuation During Propagation Outdoors, Part 1: Calculation of the Absorption of Sound by the Atmosphere (ISO, 1993)*. Each Gamesa wind turbine is expected to have an overall maximum sound power level of 106.4 dBA. Each turbine was modeled on an octave band basis for the nine standard octave bands from 31.5 to 8000 Hz with an overall level of 108.4 dBA. This includes a +2 dBA adjustment to account for typical vendor warranty, uncertainty or declared sound power levels

Inherent in the ISO 9613 and IEC61400-11 standards are downwind conditions. That is, the turbine sound power levels and modeling methods are representative of when the wind is blowing from the turbine to the receptor. The maximum sound power levels used in this analysis are generally realized at wind speeds of 6 m/s (13.4 mph) or greater which is referenced to 10-meter (32.8 feet) height in accordance with the IEC 61400-11 standard. Lower sound levels would be expected under lower wind speed or upwind from the turbine. As shown in Figure 1, the project sound level is not expected to exceed 55 dBA at any identified non-participating occupied building or residence.

References

International Electrotechnical Commission (IEC) 61400-11. 2006. *Wind Turbine Generator Systems – Part 11: Acoustic Noise Measurement Techniques – Amendment 1*. Geneva, Switzerland.

International Organization for Standardization (ISO). 1993. *Acoustics – Sound Attenuation During Propagation Outdoors*. Part 1: Calculation of the Absorption of Sound by the Atmosphere, 1993. Part 2: General Method of Calculation. ISO 9613. Switzerland.

Mark Bastasch, P.E., I.N.C.E.

Acoustical Engineer

Distinguishing Qualifications

- Has prepared acoustical analysis for more than 15,000 megawatts (MW) from gas-fired facilities and more than 5,000 MW from wind generation facilities
- Specializes in industrial noise measurements, modeling and control for power, industrial and transportation clients
- Routinely consulted by the American Wind Energy Association on acoustical matters, including establishment of multidisciplinary scientific advisory panel comprising Medical Doctors, Audiologists, and acoustical professionals to conduct a review of current literature available on the issue of perceived health effects of wind turbines

Relevant Experience

Mr. Bastasch is a registered acoustical engineer with more than 10 years experience conducting acoustical studies. Mr. Bastasch's acoustical experience includes preliminary siting studies, regulatory development and assessments, ambient noise measurements, industrial measurements for model development and compliance purposes, mitigation analysis, and modeling of industrial and transportation noise.

Representative Projects

Mr. Bastasch has supported IBR (as well as PPM Energy) with analysis of numerous projects nationwide including **Elm Creek II (MN), Otter Creek (IL), South Cayuga Ridge (IL), Leaning Juniper II Amendment (OR), Hay Canyon (OR), Helix (OR), Horse Creek (NY), Hardscrabble (NY), Barton (IA)** and **Winnebago (IA).**

Acoustical Technical Lead, Wild Horse Wind Energy Project, Kittitas County, Washington. Acoustical technical lead for Horizon Wind Energy (formally Zilkha Renewable Energy) application to the Washington ESFEC for the 140-turbine project.

Acoustical Technical Lead, Kittitas Valley, Central Washington. Acoustical technical lead for Horizon Wind Energy (formally Zilkha Renewable Energy) successful filing of an application to the Washington Energy Facility Siting Evaluation Council (EFSEC) for a 121-turbine wind energy project.

Klondike Wind, Northwestern Wind Power, Oregon and Washington. Northwestern Wind was looking at several sites in three counties in Washington and Oregon. Provided preliminary acoustical modeling and permit assistance at the local and state levels.

Stateline Wind Project, Oregon and Washington. Acoustical technical lead for the first wind turbine project to be permitted through Oregon EFSC, a 263-MW wind farm in northeast Oregon (Umatilla County) and southeast Washington (Walla Walla County). Tasks included monitoring at existing Vestas wind turbines and proposed turbine locations, authoring a noise impact evaluation, and preparing environmental documentation to comply with both Oregon and Washington standards.

MEGS, Modesto Irrigation District, Ripon, California. Acoustical technical lead for a LM6000 (Norway package) power plant. Tasks included evaluating and measuring background noise levels; coordinating measurements of operating Norway Package with General Electric, development of detailed noise model, comparison of expected noise levels with the City of Ripon, County of Stanislaus, and the California Energy Commission's (CEC) noise guidelines; preparing Application for Certification and subsequent amendments submitted to the CEC; regulatory negotiation; and review of Conditions of Certification, testimony at CEC evidentiary hearings.

Walnut Energy Center, Turlock Irrigation District, Turlock, California. Acoustical technical lead for a combined cycle power plant. Tasks included evaluating and measuring background noise levels; development of detailed noise model, comparison of expected noise levels with the City of Turlock, County of Stanislaus, and the California Energy Commission's (CEC) noise guidelines; preparing Application for Certification and subsequent amendments submitted to the CEC; regulatory negotiation; and review of Conditions of Certification. Additional tasks included development assistance with acoustical bid and guarantee specifications and independent analysis of manufacturer steam turbine generator enclosure.

Pacific Gas & Electric, Humboldt Bay Repowering Project, Humboldt, California. The proposed facility will be a load following power plant consisting of 10 natural gas-fired Wärtsilä 18V50DF 16.3 megawatt (MW) reciprocating engine-generator sets and associated equipment with a combined nominal generating capacity of 163 MW. As acoustical permitting lead for this facility, tasks included evaluating and measuring background noise levels to determine and evaluate risk associated with potential CEC permit limits; preparation of Application for Certification to the CEC, conducting site tour with CEC's acoustical staff and review of existing EPC commitments.

Education

M.S., Rice University
B.S. (cum laude), Cal Poly San Luis Obispo

Professional Registrations and Societies

Registered Acoustical Engineer: Oregon
Registered Environmental Engineer: Oregon
Registered Civil Engineer: Oregon
Institute of Noise Control Engineering
Acoustical Society of America

Representative Publications & Presentations

"Wind Turbine Noise – An Overview" Bastasch, M. et al. Journal of the Canadian Acoustical Association. June 2006. Vol 34 No. 2.

"Regulation of Noise in the United States " Technical Considerations in Siting Wind Developments. National Wind Coordinating Committee (NWCC) Research Meeting December, 2005 . Washington, D.C.

"Technical Issues in Developing Wind Projects: Noise", American Wind Energy Association Wind Power Project Siting Workshop, Wind Project Siting: Emerging Issues and Technologies, Portland, Oregon, October, 2004.