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AVIAN/WIND TURBINE INTERACTION: A SHORT SUMMARY OF RESEARCH RESULTS AND REMAINING QUESTIONS

Fact Sheet

INTRODUCTION

The NWCC Avian Subcommittee (see below for list) was formed in 1994 to provide a forum and dialogue among researchers, environmentalists, wind industry representatives, and federal, state, and local officials to better understand avian wind interaction issues. After conducting four national research meetings, producing a document guiding research: *Metrics and Methods for Determining or Monitoring Potential Impacts on Birds at Existing and Proposed Wind Energy Sites, 1999,* and another paper, *Avian Collisions with Wind Turbines: A Summary of Existing Studies and Comparisons to Other Sources of Avian Collision Mortality in the United States, 2001,* the subcommittee recognized a need to summarize in a short fact sheet what is known about avian-wind interaction and what questions remain.

This fact sheet attempts to summarize in lay terms the result of extensive discussion about avian-wind interaction on land. This fact sheet does not address research conducted on offshore development. This fact sheet is not intended as a conclusion on the subject; rather, it is a summary as of Fall/Winter 2002. The Avian Subcommittee intends to revisit the fact sheet periodically as more is learned. Additional resources are available on the NWCC website, (www.nationalwind.org). Questions can also be directed to the NWCC staff at 1-888-764-WIND.

Wind energy has attracted attention in recent years as a means of generating electricity without air pollution or greenhouse gas emissions.[1] In very simple terms, as the wind spins a turbine's rotor, a generator connected to the rotor generates electricity. Large wind turbines generate electricity more cheaply than small ones, because an increase in rotor blade length means a larger increase in rotor swept area, and swept area is the key to productivity. Early turbines were mounted on towers 60 to 80 feet in height and had rotors 50 to 60 feet in diameter which turned at rates of 60 to 80 revolutions per minute. Today's wind machines are mounted on towers 200 to 260 feet in height and have rotors ranging from 150 to 225 feet in diameter which turn at rates of 11 to 20 rpm. Still larger turbines may be developed in the future.

The impact of wind plants on birds has been raised as an issue. This fact sheet very briefly summarizes the results of wind/avian research to date and lists the questions that remain. The information presented here pertains only to land-based installations using wind turbines of 50 kW or larger capacity. Some findings may need to be revisited for wind farms with tower heights in excess of 300 feet.

[1] "Electricity from Wind." *Power* Scorecard: Rating the Environmental Impact of Electricity Products. Pace University. Pace Law School Energy Project. White Plains, NY. 9/27/02. http://www.powerscorecard.org/tech_detail.cfm?resource_id=11

What Current Studies Have Shown

- Birds and bats sometimes die in wind farms as a result of collisions with wind turbines and meteorological towers (and their supporting guy wires).
- Studies have demonstrated that wind farms with low avian usage have few avian fatalities.
- At those wind resource areas where studies have been conducted, an average of one to two bird kills per turbine per year is at the high end of the range of fatalities recorded during studies of operating wind farms. For some wind farms studied, no bird fatalities have been recorded. The frequency of raptor deaths at Altamont Pass, a large wind development area in northern California, has focused public attention on wind energy's impact on birds. Altamont is the only wind farm location with high, year-round use by raptors, a substantial prey base, and thousands of densely packed, early-generation turbines. The frequency of raptor deaths there is much higher than at other wind farm sites where monitoring of fatalities has been conducted.
- An initial avian site evaluation conducted in tandem with the assessment of the wind resource of a potential wind plant can identify whether wind power development at a particular site is likely to cause a significant number of bird fatalities.

What Current Studies Imply

- Although the fact that birds are present at a site does not necessarily mean that wind power development there would put them at risk, the weight of evidence to date indicates that locations with high bird use, especially by raptors or protected species, are not suitable for wind farm development.
- Compared with other avian species, raptors appear to be disproportionately vulnerable to collisions with wind turbines. The reasons for this are not fully understood. However, in the Altamont Pass, the specific location of individual turbines in relation to terrain features (for example, the positioning of turbines on the edge of hills, or at points within wind farms that intersect common bird flight paths) and the existence of a large prey base within the wind farm appear to be factors.
- To date, the only known U.S. wind-development location that has experienced significant avian mortality is California's Altamont Pass.
- Evidence to date indicates that wind turbines are unlikely to present a local or regional population threat to migrating birds. Most migratory flights are conducted at levels above today's typical turbine heights, except during inclement weather conditions with poor or zero visibility. However, as turbine heights increase and aviation lighting requirements evolve, migratory-bird impacts need to be carefully monitored.

What Is Unknown

Whether larger wind turbines will reduce avian collisions and mortality: It has been speculated that larger turbines may cause more avian collisions than smaller turbines because their rotor blades are physically larger. Conversely, it has been speculated that larger turbines may cause fewer avian collisions because their blades rotate more slowly and are more visible; and because there are fewer machines, more widely spaced, in any given area. Some studies indicate that newer wind projects, with larger turbines, are experiencing lower avian mortality. However, it is not clear to what degree this is due to the larger turbines or to other factors.

Impacts of lighting requirements: Questions remain about the impact of lighting requirements on night migration of songbirds and other lower-flying species, particularly during poor weather conditions. Lighting needs are still being assessed and studied by the Federal Aviation Administration (FAA).

The degree to which the type of wind turbine tower design matters: Wind turbines are built on "lattice" (built of interlocking steel members, like "Erector set" pieces) or tubular (built of large sections of steel pipe) towers. Lattice towers and tubular towers with external ladders or platforms provide an opportunity for perching. However, raptors and other birds cannot perch on modern tubular towers. Raptor fatalities in the Altamont may be exacerbated by the "perchability" of the older towers. Because very few raptor fatalities have been found at modern wind plants at which tubular towers are used, researchers suspect--but have not determined--that tower design is a risk factor for collision fatalities.

Population impacts in Altamont, California: The degree to which wind turbines at Altamont Pass are affecting the population of Golden Eagles that either visit or reside in the area is not yet known. A population of 'floater' eagles (adults without mates that do not breed, but that become part of breeding pairs if one partner dies) appears to be providing a buffer against eagle population decline. Research needs to continue to assess impacts at the population level, determine which turbine designs are most bird-friendly, and reduce predator-prey contacts, especially those of California ground squirrels.

The impacts of wind turbines on bats: In assessing avian mortality at wind turbine sites around the country, most researchers also collect data on bat mortality, although the data may not necessarily be published or be made publicly available. Research currently indicates that bats suffer small levels of mortality, although this question may be complicated by scavenging at some sites. Continuing research and analysis are needed to further assess wind turbine impacts on bats, to compile and publish existing information, and to determine whether there are impacts on threatened and endangered species.

The impacts of wind turbines on passerines: The full impact of wind turbines on passerines (also known as songbirds) is not clear. Although passerine kills have been recorded as part of wind avian studies since the first studies were performed in the early 1980's, there are questions about whether many of those surveys were carried out with sufficient rigor to fully account for passerine mortality. As with bats, reported kills are few in number and scavenging is common.

Impact of weather events on avian deaths: Other than raptors, avian deaths at wind farms may occur as "events". The relation between weather and avian deaths at wind facilities needs to be studied.

AREAS WHERE STUDIES ARE ONGOING OR WHERE NEW INSIGHTS MAY EMERGE

- Research is continuing in Altamont Pass to better understand the issues there and determine what, if any, turbine-design and wind-farm-layout features may contribute to avian mortality.
- Many older, smaller turbines in Altamont Pass may soon be replaced by newer, larger machines. As Altamont is the only wind-power-development area experiencing significant avian mortality, this "repowering" offers the potential to evaluate the difference between early-generation and modern wind turbines with respect to avian issues. However, such a

comparison may be clouded by the tendency of project owners to avoid siting new turbines in locations that have historically been dangerous for raptors. In addition, mitigation measures are being developed, deployed, and tested for effectiveness on existing turbine models.

- Basic research is also continuing on raptor vision, hearing, and other issues that may yield information on how to reduce wind plant risk to birds.
- Avian and bat monitoring programs are being carried out at several other large wind farm sites around the U.S.
- Wind developers routinely carry out site evaluations for birds and other flora and fauna to identify potential problems before seeking permission from regulators to build a wind plant. These evaluations may offer important new insights.

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